

LINKING CLASSROOM ENVIRONMENT WITH AT-RISK ENGAGEMENT IN SCIENCE:

A MIXED METHOD APPROACH

by

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ABSTRACT

This explanatory sequential mixed-method study analyzed how the teacher created learning environment links to student engagement for students at-risk across five science classroom settings. The learning environment includes instructional strategies, differentiated instruction, positive learning environment, and an academically challenging environment. Quantitative and qualitative data were gathered in the form of self-reporting surveys and a follow-up interview. The researcher aimed to use the qualitative results to explain the quantitative data. The general research question was “What are the factors of the teacher-created learning environment that were best suited to maximize engagement of students at-risk?” Specifically explaining, (1) How do the measured level of teacher created learning environment link to the engagement level of students at-risk in science class? and (2) What relationship exists between the student perception of the science classroom environment and the level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?

This study took place within a large school system with more than 20 high schools, most having 2000-3000 students. Participating students were sent to a panel hearing that determined them unfit for the regular educational setting, and were given the option of attending one of the two alternative schools within the county. Students in this alternative school were considered at-risk due to the fact that 98% received free and reduced lunch, 97% were minority population, and all have been suspended from the regular educational setting.

Pairwise comparisons of the SPS questions between teachers using t-test from 107 students at-risk and 40 interviews suggest that each category of the learning environment affects the level of behavioral, cognitive, emotional, and social engagement in science class for students at-risk in an alternative school setting. Teachers with higher student perceptions of learning environment showed increased levels of all types of engagement over the teachers with a lower perception of learning environment. Qualitative data suggested that teachers who created a more positive learning environment had increased student engagement in their class. Follow-up questions also revealed that teachers who incorporated a wider variety of classroom instructional strategies increased behavioral engagement of students at-risk in science class.

DEDICATION

This dissertation is dedicated to my gorgeous wife, Nicki, who supported me and passionately prodded when I thought I could go on no longer. Further, I dedicate this dissertation to my children who had to be hushed many times while I grappled with the story I had to tell. Finally, this dissertation is dedicated to all the “misfit” students out there struggling to survive. It is your plight with which I identify; and it is your voice that I will strive to broadcast nation-wide.

LIST OF ABBREVIATIONS AND SYMBOLS

<i>df</i>	Degrees of freedom: number of values free to vary after certain restrictions have been placed on the data
<u><i>M</i></u>	Mean: the sum of a set of measurements divided by the number of measurements in the set
t	Computed value of t test
p	p value or probability
<	Less than
=	Equal to

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CHAPTER 1

INTRODUCTION

American schools face a significant challenge to the ideal of an equal education for all. The problem lies in the failure, in many schools, to fully engage a sizable group of students in the learning process, those we have come to refer to as "students at-risk." Engagement, in this context, is related to the level of attention, interest, desire, and confidence students demonstrate when they are in the classroom and includes the level of motivation to continue their learning. Students at-risk are identified as a minority, attend inner-city schools, come from low-income families, or are from homes where English is the secondary language spoken. Students at-risk are disengaged at higher rates, perform much worse on standardized testing, and drop out more frequently than students who do not carry that label (Lehr et al., 2009).

Students at-risk currently do not arrive at school seeking to learn; they do not enter the classroom engaged (Finn, 1989, 1993). Teachers need to respond to this particular population with specific strategies of engagement aligned to their unique needs. Teachers also need to consider the construct of student engagement which consists of four facets: behavioral engagement, cognitive engagement, emotional engagement, and social engagement (Fredricks et al., 2004; Finn & Zimmer, 2012). Each form of engagement has unique characteristics and is necessary to meet the needs of all students. Engagement is malleable, or shaped by experience, and is influenced by an effective learning environment. This teacher created learning environment includes teacher-directed instructional strategies, differentiated instruction, positive

learning environment, and an academically challenging environment (Fredricks et al., 2016; Willms, 2003).

This study targets the population of students at-risk. Specifically, the current lack of all types of engagement for these students in American classrooms. This study further seeks to determine strategies to engage students at-risk by identifying the ideally suited teacher created learning environment.

Overview

Some students at-risk attend school for no other reason than the compulsory attendance laws that force them. However, these students at-risk are disengaged as demonstrated by their level of behavioral, emotional, cognitive, and social commitment. This lack of engagement affects the ability of students to learn effectively (Finn, 1993; Fraser-Abder, Atwater, & Lee, 2006). Even though education is compulsory until age 16 in most states and up to 18 in a few, Mosher and MacGowan (1985) report that “While engagement cannot be legislated, attendance (physical presence) can be” (p. 17). In order for students at-risk to engage fully, educational needs must be met while concurrently holding the interest and motivation of these students. This can only occur when teachers consider all facets of the learning environment and all forms of engagement.

Student Engagement Construct

Student engagement is an issue of concern for school systems across the country (Appleton, Christenson, & Furlong, 2008). Historically, “schooling is characterized as using a ‘transmission model’ where teaching is telling, and learning is absorption” (Tatto, 1997, p. 405). Teacher-centered models do not serve the population of students at-risk very well, especially when the level of student engagement is considered. While engagement is necessary for

academic performance, research shows the number of disengaged learners is at least 25% and as much as 66% in many American classrooms (Harris, 2008; Willms, 2003). In addition to being more passive learners, disengaged at-risk learners also report being jaded, uninterested, anxious, or even angry about having to attend class (Kaplan, Peck, & Kaplan, 1997).

The research into engagement, beginning in the late 1980's, brought about "little consensus in definitions and contained substantial variations in how engagement is operationalized and measured" (Appleton et al., 2008, p. 370). Historically, student engagement has been understood to have at least two components. Many researchers included a behavioral and an emotional or affective subtype (Appleton et al., 2008; Fredricks, Blumenfeld, & Paris, 2004; Klem & Connell, 2004). Later, the concept of cognitive engagement (e.g., self-regulation, learning goals, and investment in learning) was included in the construct (Appleton et al., 2008; Fredricks et al., 2004). The current conceptualization in the academic literature is that engagement has three distinct intertwined dimensions including behavioral, emotional, and cognitive engagement (Fredricks et al., 2004; Appleton et al., 2008). Student engagement as a multidimensional construct has become the accepted model even though there have been inconsistencies in the variations of definitions and numbers of indicators in each dimension (Appleton et al., 2008; Fredricks et al., 2004).

While many researchers agreed conceptually on behavioral, cognitive, and emotional types of engagement some scholars, such as Fredricks et al. (2016), more recently have added a social component to these conceptualizations of engagement. Finn and Zimmer (2012) embraced the concept of social engagement as prosocial behavior inside the classroom which extended the quality of interactions with other students in the setting of instructional content delivery. Additionally, The Common Core State Standards Initiative in Mathematics and the

Framework for Science Education included a greater emphasis on the social aspects of the classroom environment (Finn & Zimmer, 2012; Fredricks et al., 2016). Group work, complex problem solving, quantitative data analysis, abstract reasoning, argumentation, and communication occur in the social function of the learning environment (Finn & Zimmer, 2012; Fredricks et al., 2016), making the social facet of engagement relevant and important to overall engagement of current learners. Specific to science learners, there is limited research on the conceptualization and instrumentation of engagement for math and science class, the addition of the social aspect to the construct is, therefore, of particular importance in the current study (Fredricks et al., 2016).

Students At-Risk

The term “at-risk” is used to describe individual circumstances or general conditions that are present in a large population of students (Finn, 1993). Lehr, Tan, and Ysseldyke (2009) detail students at-risk as those with “higher rates of substance abuse, suicide attempts, sexual activity, pregnancy, [and those] more likely to have been physically or sexually abused or to have witnessed abuse within their families” (p. 20). Finn and Rock (1997) further identify at-risk factors that contribute to school failure and included minority students attending inner-city schools, coming from a low-income family, or coming from homes where English is not the primary language spoken.

Other at-risk factors include: low SES neighborhood, low grades, and low school attendance. More obvious at-risk factors include: multiple suspensions, expulsion from regular school, teen pregnancy, physical, verbal, or sexual abuse, and bullying (Finn, 1989,1993; Finn & Rock, 1997). While these factors are challenging, researchers agree that no single risk factor is more significant than any other (Lucio, Hunt, & Bornovalova, 2012; Masten & Coatsworth,

1998; Rutter, 1987). However, research further indicates that when students experience two or more of these risk factors, they are at-risk for academic failure (Finn & Rock, 1997; Lucio, et al., 2012).

Engagement is vital to this population to give students at-risk the opportunity to have academic success (Finn, 1989; Lucio et al., 2012). In fact, Klem and Connell (2004) pointed out that many students at-risk escape the academic setting mentally or physically, and will avoid or delay the activity as long as possible when encountered in the future. Hence, many students at-risk are less likely to engage in academics and more likely to avoid school altogether.

Students at-risk have lower engagement levels and, therefore, limited academic success compared to their mainstream counterparts, especially in standardized science assessments (Finn, 1993; Fraser-Abder, Atwater, & Lee, 2006). Students, identified as low SES individuals, scored much lower than those students not in this category. The National Assessment of Educational Progress (NAEP) provided the nation with the only data sample survey of student achievement in core subject areas. O'Sullivan et al., (2003) reported comparisons of 1996 and 2000 NAEP science assessment results, revealing students who qualified for free/reduced lunch performed 25-29 points lower than those who did not qualify for free/reduced lunch.

Finn (1993) also reports that 66% of students at-risk fell in the unsuccessful achievement group, scoring more than one-half deviation below the mean compared to 38% of students who were not at-risk. Regardless of the type of at-risk factor, these students cope with stressful situations differently from those who were not at-risk. At-risk populations tend to overreact to seemingly minor irritation, make poor choices, or experience uncontrollable factors that shaped the coping mechanisms of these students, often resulting in a cyclical pattern of disruptive and sometimes violent behavior (Fredricks et al., 2004; Skinner, Wellborn, & Connel, 1990). This

pattern often results in isolation, suspension, expulsion, and a high dropout rate (Belfanz, Herzog, & Mac Iver, 2007).

Alternative Schools

The number of alternative schools rose sharply over the last twenty years as students found need for educational interventions not available in regular schools (Raywid, 1994). Students at-risk are served at much higher rates in alternative schools and suffer more at-risk factors than students in regular educational settings (Lehr et al., 2009; Riele, 2007). Also, there are more minority students at-risk and low socioeconomic status (SES) students in alternative school settings than any other population (Lehr, Moreau, Lange, & Lanners, 2004).

In spite of catering to a different clientele, alternative schools are required to perform and function as a regular school; they are required to produce the same level of academic success in their student population. The Elementary and Secondary Education Act (NESE) was passed in 1965 and emphasized equal access to education while establishing high standards and accountability. In response, the alternative schools have become mainstream in public education with support of government funding.

In response to extensive study of alternative schools, Raywid (1994) groups alternative schools into three types. Type I alternatives are schools of choice, sometimes resembling magnet schools, based on themes with an emphasis on innovative programs or strategies to attract students. Type II alternatives are “last chance” schools where students are sentenced as a last step before expulsion. The emphasis of Type II schools is typically on behavior modification or remediation. Type III alternatives are designed with a remedial focus on academic or social-emotional issues. Type I and Type III are positive in direction and affect students differently than the regular classroom setting.

Although the public education system developed alternative education to prevent the educational neglect of students at-risk, they have evolved into something contrary to their design and are growing in number at an astounding rate. Instead of Type I schools, meeting the needs of specialized learners, most alternative schools have become punitive in nature as Type II schools; they have become dumping grounds for students not wanted in the regular educational setting (Lehr et al., 2009). These “alternative” programs, which on the surface are meant to offer and provide an equal and meaningful education to disengaged, alienated, disadvantaged, and minority students, have become daytime detention centers. Lehr et al. (2009) contends that “Meeting the needs of students disenfranchised from the traditional education system is becoming more and more important as we are faced with a growing population of students for whom status quo education is not successful” (p. 19).

Science Learning

Best practice science teaching and learning includes strategies that focus on creating an environment that caters to the needs of the individual student. Treagust (2008) gives a comprehensive historical list of instructional methods and strategies used in science education, ranging from more teacher-centered to primarily student-centered. Treagust includes itemization of effective strategies: “demonstrations, classroom explanations, questioning, forms of representations, cooperative learning, and the learning cycle” (p. 373). Demonstrations are used for motivation to learn the science content, especially when the teacher combines the demonstration with teacher classroom explanation (Ogborn, Kress, Martin, & McGillicuddy, 1996). Another effective strategy involves using computer technology through online simulations. This strategy enhances demonstrations, and allowed for interactive Predict, Observe, and Explain (POE) activities, producing student learning (Treagust, 2007).

According to Treagust and Harrison (1999), classroom explanations are necessary for science learning since they "draw creative word pictures that both appeal to and inform a diverse group like a class of students" (p. 28). Further, researchers find that using written language in classroom explanations is essential for understanding science content (Yore, Bisanz, & Hand, 2003). Higher-level questioning and classroom comments elicit conversation and communication of scientific ideas (Treagust, 2007).

In review of cooperative learning methods, Lazarowitz and Hertz-Lazarowitz's (1998) found several strategies in use for science education: (1) Learning Together and Alone; (2) Jigsaw Classroom; (3) Student Teams and Achievement Divisions; (4) Group Investigation; and (5) Peer Tutoring in Small Investigative Group. Lazarowitz and Hertz-Lazarowitz found that junior and senior high school students improved their learning. This improvement was confirmed by higher cognitive achievement, more positive attitudes, greater self-esteem, more engagement on tasks, and increased motivation and enjoyment in science class.

Abraham (1998) recalls that the Learning Cycle originated from the work of Robert Karplus and Chester Lawson around the 1950's and 1960's, but recently narrows it to three phases: inform, verify, and practice. The phases of the Learning Cycle "in a sequence are the *identification* of a concept, *demonstration* of a concept, and *application* of the concept" (Treagust, 2007, p. 385). The most critical conclusion based on research for the Learning Cycle reveals that it provides students with hands-on experiences with the concept to be learned. These experiences allow students to practice the skill of constructing knowledge from their personal experience, aiding them in solving new and unique problems (Abraham, 1998).

While the strategies mentioned above are widely used to direct teachers in their science instruction, many reformers and researchers believe that the creation of a personalized learning

environment, that promotes engagement on all levels, and a caring student-teacher relationship are missing from reform strategies (Rascoe & Atwater, 2005). Developing such an environment begins within the classroom, but also requires that an entire school culture of expectations, norms, values, and organizational design is encouraged and sustained by healthy teacher-student relationships (Wang, Haertel, & Walbert, 1998).

Teacher Created Learning Environment

An effective learning environment is one where all students can learn to the best of their ability. This learning environment is teacher created and dependent on both the strategies employed by the teacher and the student response to these strategies within the curriculum (Fredricks et al., 2016; Willms, 2003). An effective teacher created learning environment has an enormous impact on student participation. Fredricks et al. (2016) contends that engagement is malleable and controlled by the teacher. Walberg (1984) analyzed the academic success in the United States and found that teachers' classroom instruction is a significant variable that has a substantial effect on student cognitive, behavioral, and emotional outcomes. In fact, "focusing on the learning environment and its effect on student engagement illuminates the 'black box' between teacher behaviors and student outcomes" (Shernoff, Ruzek, & Sinha, 2016, p. 2).

The positive learning environment is characterized by Barge (2012) as an environment where "The teacher provides well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all" (p. 43). To create this positive learning environment, an engaging and enriching environment for students to learn, teachers must observe guidelines for expected behavior, on-task students, respect for relationships within the classroom, use of humor, and emit care for the students (Barge, 2012). Further, research by Fraser and Fisher (1982)

found that a positive learning environment shapes student outcomes in behavioral, cognitive, emotional, and motivational domains.

The Academically Challenging Environment is defined by Barge (2012) as one in which “The teacher creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners” (p. 53). Teachers working with students at-risk often have low expectations in response to prevalent student engagement in the classroom. However, Miller-Cribbs, Cronen, Davis, and Johnson (2002) found that African-American students are engaged more with their learning when high expectations are placed on them by teachers. Miller-Cribbs et al. (2002) found that these students at-risk believe that being in school will help them create new challenges, do something positive in their lives, and prepare them for life in college, in response to high expectations.

Special Population

Within the school system where the study took place, there were over 20 high schools, most having 2000-3000 students. Students who were sent to a panel hearing that determined them unfit for the regular educational setting, who were given the option of attending a Type II alternative school within the county. The school site served paneled students from more than 150,000 students within the county. Students at the alternative school exhibited characteristics that made them at-risk for academic failure and sensitive to the classroom culture (Sheffler, 2009). All of the students at-risk in the study presented one or more of the following three factors; urban minority, low (SES), or language minority. These three at-risk factors often coincide with many other at-risk factors in these students.

Problem and Purpose

Fraser-Abder et al. (2006) underscore that “The goal of “science for all” continues to be unattainable, particularly in the urban setting where science achievement gaps exist between some groups of African American, Latino, Native American, and Asian American students and their white counterparts” (p. 599). This at-risk population demonstrates disengagement at a higher rate compared to regular education students as evidenced by their low performance in standardized testing, behavior in the classroom, attendance, and poor social skills (Finn, 1993; Klem & Connell, 2004). This disengagement hinders progress in academic learning and performance on standardized exams for at-risk populations. Science education suffers particularly compared to other subjects for students at-risk when comparing standardized test scores (Atwater & Lee, 2006; Finn, 1993; Fraser-Abder).

Students at-risk are particularly sensitive to their learning environment (Sheffler, 2009). Research shows that engagement levels are malleable (Finn, 1997; Appleton et.al., 2008; Fredricks et al., 2016). The learning environment fosters or stifles engagement, in turn minimizing or maximizing learning. Therefore, a better understanding of the factors within a teacher created learning environment which maximizes engagement with students at-risk is needed. A better understanding of these environmental factors of the teacher created learning from a student perspective helps to establish strategies for increasing student academic, behavioral, cognitive, and social engagement levels. This understanding is pivotal to engage at-risk learners. In turn, knowledge of these specific strategies is instrumental in delineating effective interventions for students at-risk in high school science.

Research Questions

The main research question for this research project is: “What are the factors of the teacher created learning environment that are best suited to maximize engagement of students at-risk?” With the two sub-questions:

1. How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?
2. What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?

Research Design

An explanatory sequential mixed methods design was used in this study and involved collecting quantitative data first and then explaining the quantitative results with in-depth qualitative data. For the 2016-2017 school year, five science teachers and their students from an alternative school in a large school district were invited to participate in three phases. Initial permissions of assent and consent forms from students, parents, and teachers were gathered. County and local school level approval was also obtained. Phase One involved gathering the quantitative data using two surveys; the Science Engagement Measure (SEM) and the Student Perception Survey (SPS). The SEM measured the level of student engagement within the separate classrooms and the SPS measured the effectiveness of the teacher created learning environment. Phase Two involved gathering qualitative data from the follow-up interviews with students and the coding of this data to align with categories of the SPS survey. Phase Three is the integration of the quantitative and qualitative data into a complete explanation of the

connection between the teacher created learning environment and the level of engagement for students at-risk in science class.

Assumptions

The literature shows strong empirical support for the connection of engagement, achievement, and behavior across all levels of social and economic advantage and disadvantage (Appleton et al., 2008; Fredricks et. al., 2004; Klem & Connell, 2004; Wang et al., 2016). Engaged students earn higher grades, perform better on standardized tests, perceive a more positive experience, and drop out of school at lower rates (Christenson et al., 2012; Fredricks et.al., 2004; Klem & Connell, 2004; Reyes, Brackett, Rivers, White, & Salovey, 2012). Students at-risk perform worse on standardized tests and are less engaged at a higher rate than those not at-risk of failing (Finn, 1993; Klem & Connell, 2004).

Students at-risk are being served at much higher rates in alternative schools. They suffer more at-risk factors than students in regular educational settings (Lehr et al., 2009; Riele, 2007). More minorities and low SES students are served in alternative school settings than other populations (Lehr et al., 2000).

In addition to the assumptions established by the literature on engagement for students at-risk, this study incorporates two assumptions. The first assumption is that interventions that include instructional strategies, differentiated instruction, positive learning environment, and academically challenging environment are pivotal to the level of engagement for students at-risk. Second, the impetus for this research evolved over reflection on personal action research on engagement with students at-risk. The teacher-researcher made purposeful changes designed to establish a low-stress learning environment for students at-risk. In response, the teacher-researcher saw significant growth in engagement in the science classroom. Specifically, data

from Student Perception Surveys (SPS) indicated considerably increased scores regarding the teacher created learning environment in the student perceived learning environment. This informal action research pilot study morphed from a study with one teacher-researcher into the current study, examining science teachers of students at-risk on a wider scale to include all science teachers in the alternative school site.

Significance of Study

This study is significant in that it contributes to literature regarding engagement with the at-risk population. Findings from this study specifically contribute to understanding the role that teacher created learning environment have on engagement for students at-risk in the science classroom. Findings further indicate the type of engagement (behavioral, cognitive, emotional, or social) within the learning environment that contributes to engagement for students at-risk. This study attempts to reveal the linkage between classroom learning environment and the various types of student engagement specific to secondary at-risk science students. This research helps teachers understand the student perception of the classroom environment and its effects on the engagement for students at-risk in science class. Further, the study aids administrators and other stakeholders in evaluating the importance of the teacher created learning environment as a potential template for increasing engagement for students at-risk within all classrooms.

This study focuses on the aspects of the state evaluation system that uses student self-reporting data regarding the teacher created learning environment as it relates to the level of engagement for students at-risk. The four areas of the teacher created learning environment that

are assessed using the Student Perception Survey include Instructional Strategies, Differentiated Instruction, Positive Learning Environment, and Academically Challenging Environment.

These areas of teacher created learning environment shed light on what it is that teachers do within their classrooms that increases behavioral, cognitive, emotional, and social student engagement. The data gathered concerning these areas elaborate on what students perceive is occurring in the classroom. This knowledge may be used to establish strategies designed to increase the motivation for students at-risk to engage fully with the curriculum in science class.

Definition of Terms

Affective Filter. A complex of attitudinal factors influenced by emotional variables that can prevent learning by interfering with reception and processing of comprehensible input. Such factors may include self-consciousness, anxiety, stress, boredom, alienation, and others that impede the learner from acquiring new knowledge (Krashen, 1982).

At-risk. Students. Those experiencing multiple at-risk factors in combinations of two or more. These factors can range from low SES, English Language Learners, EBD (emotional and behavioral disorder), Special Education, expelled students, family breakdown, poor choices, unengaged learners, and other at-risk factors.

Domains of Engagement. There are four main domains of engagement, emotional, behavioral, cognitive, and social.

Behavioral Engagement. Regarding participation, effort, attention, persistence, positive conduct, and the absence of disruptive behavior (Fredricks et al., 2004).

Cognitive Engagement. The student's level of investment in learning: being thoughtful, strategic, and willing to exert the necessary effort for the comprehension of complex ideas or mastery of difficult skills (Fredricks et al., 2004).

Emotional Engagement. The extent of positive or negative reactions to teachers, classmates, academics, or school as well as identification of the school or subject domains which make up emotional engagement (Finn, 1993).

Social Engagement. A student's prosocial behavior in classrooms and the quality of interactions with peers around instructional content.

Level of Engagement. The degree that student engages in the four domains of academic engagement (Behavioral, Cognitive, Emotional, and Social). Quantitative and qualitative measures determine the level of engagement.

Science Engagement Measure (SEM). A quantitative measuring instrument that measures student levels of behavioral, cognitive, emotional, and social engagement that is measured using a five-point Likert scale which was adapted from the Math and Science Engagement Measure (MSEM) developed by (Fredricks, et al., 2016) adapted to indicate science class only.

Student Perception Survey (SPS). A quantitative measuring instrument that establishes a teacher score for the average student perception of the Teacher Created Learning Environment and established for each teacher county-wide, which uses a questionnaire and scored on a four-point Likert scale.

Teacher Created Learning Environment (TCLE)- The teacher created learning environment for this study includes all of the teacher-directed instructional strategies, differentiated instruction, positive learning environment, and an academically challenging environment that exists within the classroom.

Limitations of the Study

The behavioral, cognitive, emotional, and social engagement factors were examined in a multidimensional way across the student population at an alternative school to understand how the classroom environment affects the engagement level of students at-risk in science class. The research site was composed of a higher percentage of students who were experiencing multiple at-risk factors compared to regular education schools. Some of the factors included low SES school, expulsion from regular school, Title I designation, a majority of students were minority populations, and ninety percent of the population participation in free or reduced lunch programs.

For the above-stated reasons, the findings are not generalizable to most other school populations. The results only apply to specific populations that have a higher percentage of students at-risk. More research is needed to support the generalizability of the study to regular education schools.

Philosophical Assumptions

Ontological Assumptions

Creswell (2013) described ontology as, "...the nature of reality and its characteristics" (p.20). The research done here was with the assistance of multiple realities found through the eyes of the teacher and the population of students at-risk. The perceptions of engagement were diverse between researchers and individual students at-risk. Through interviews and surveys, themes discovered distinguished the level of engagement for students at-risk in response to the TCLE. These themes created structure in reporting of research data.

Epistemological Assumptions

According to Creswell, (2013), the question asked by epistemology was, “What counts as knowledge?” and wants to know, “What is the relationship between the researcher and that being researched?” (p. 21). The researcher used quotations from interviews and interactions as the primary source of data from the perspective of a trusted “insider” (Creswell). Through teacher and student interview questions and surveys, the researcher identified the connections between the classroom environment and student behavioral, cognitive, emotional, and social engagement in the at-risk population in science class.

Axiological Assumptions

Creswell noted that axiological assumptions, "Center on the role of values" (Creswell, 2013, p. 20). It was easier to elicit data when the researcher identified with the subjects. How one deals with their current plight varied in response and illumination to the experience of others in the group. Students were honest and forthcoming with their discussions and feelings about student engagement in response to the classroom environment.

Methodological Assumptions

The at-risk population in the ninth, tenth, eleventh, and twelfth grade levels of a local alternative high school was studied using an explanatory sequential mixed-methods approach. The procedures of the qualitative aspect of the research may, "...change in the middle of the study to reflect better the types of questions needed to understand the research problem" (Creswell, 2013, p. 22). The collected data from the research was built from the survey data, words, and phrases from interviews, surrounding the SPS survey. Shared experiences in the data arise. Conclusions from the coded results and overall themes appeared through the interview

process. In this way, a clearer picture regarding the link between the TCLE and engagement levels for students at-risk across the population in science class emerged.

Theoretical Framework

Stephen Krashen (1982) has formulated the Affective Filter Theory (AFT). Although termed a hypothesis in the literature, this theory functioned as a theoretical framework in this research. In Krashen's theory, the affective filter served as a mechanism that allowed and disallowed negative emotions and anxiety across its boundary. Scientifically speaking, a filter allowed certain objects or information to pass and blocks others, similar to an oil filter for an engine. Krashen, thus recommends a low affective filter for a productive learning environment. A low filter was used to allow as much communication to pass in a conversation or collaborative learning opportunity as possible. Therefore, the focus of strategies when using the affective filter allowed as much natural, uninhibited conversation to flow. Mistakes were "made light of" and external processing was encouraged. Secondly, the affective filter was used to block out negative emotions and motivational factors which may interfere with the reception and processing of comprehensible input (Bilash, 2009).

Hence, the affective filter served as an imaginary selectively permeable membrane between learner and learning environment. If the affective filter was on, the learner was blocking input. If the affective filter was low or off, then the student allowed information to flow. Therefore, a high filter resulted in response to boredom, tasks resulting in low success rates, and negative tone and body language. Teachers and then students following suit raised the affective filter in response to initial signs of this type of environment.

Krashen (1982) found that a low affective filter resulted from and contributed to highly engaging and varied teaching materials and styles, high success, confidence-building tasks,

appropriate error correction, as well as positive tone and body language. The filter turned on when anxiety was high, self-esteem was low, or when motivation was low. Thus, low anxiety was better for learning, and too much correction raised the affective filter as self-esteem dropped.

To maintain a low filter, a teacher set the tone and pattern for learning without penalty for mistakes. There were no growing pains, just encouragement and gentle redirection. All opinions are valid. Respect for all was mandated. Grading was downplayed to encourage the mistakes that came with real learning. Finally, a low affective filter minimized anxiety and stress and served to foster the spark of learning and pleasure of discovery in students.

Affective filter theory also applied to the traditional classroom at all levels of learning. Both high achievers and struggling learners needed opportunities to make mistakes and grow from their mistakes in a stress-free, non-judgmental environment. Students were encouraged to think broader, deeper, and outside of the box. They were encouraged to share their developing understandings without penalty of grading reproaches. Teachers communicated genuine caring and commitment to the student first and his or her learning second. The students responded to the conscious effort of the teacher to create the ideal learning environment, especially for students who struggled with at-risk factors that tend to impede engagement. A safe environment to learn in minimized the affective filter, increasing the learning of every participant in the classroom.

CHAPTER 2
LITERATURE REVIEW

Introduction

To understand the role of the TCLE and the importance of engagement for students at-risk, the researcher sought to identify the best-suited classroom environment for this student population. Engagement had three distinct dimensions: behavioral, emotional, and cognitive, that interwove to form a multifaceted construct (Appleton, Christenson, & Furlong, 2008; Fredricks, Blumenfeld, & Paris, 2004). Growing research revealed the need for subject-specific engagement measures that added social engagement as a fourth dimension in the construct. Social engagement stemmed from the increased emphasis on collaboration and cognitively challenging tasks in math and science classrooms (Blumenfeld et al., 1991; Fredricks et al., 2016).

Research also showed that there was a correlation between the level of student behavioral, cognitive, and emotional engagement with the TCLE (Barge, 2012; Dunn, Griggs, Olson, Beasley, & Gorman, 1995; Fraser & Fisher, 1982; Helme & Clarke, 2001; Miller-Cribbs, Cronen, Davis, & Johnson, 2002). This chapter reviewed the literature and was organized by the following sections: (1) student engagement construct, (2) students at-risk, (3) alternative schools, (4) science learning, and (5) the TCLE. Key studies are summarized in Table 1.

Student Engagement Construct

Fredricks et al. (2004) reported that for students at-risk “there was consistent association between the need for competence and behavioral, emotional, and cognitive engagement in the elementary, middle, and high school years” (p. 82). The literature on needs provided a theoretical perspective on why certain contextual factors promoted engagement (Fredricks et al., 2004). However, research about student engagement lacked a multifaceted design. Fredricks and colleagues examined 44 studies of student engagement using many different types of assessment tools and found evidence that the many forms of engagement separated into three categories (behavioral, cognitive, and emotional) noting some overlap in concepts. The fourth construct, social engagement, was instrumental to fully defining student engagement. Patrick, Ryan, & Kaplan (2007) termed social engagement as *task-related interaction*.

Behavioral Engagement

Most schools kept behavioral data on every student from their time of entry into the school system. Lee (2014) says, “The term behavioral engagement usually encompasses a broad range of behaviors at school, from merely showing up to actively participating in academic or nonacademic activities” (p. 177). Downer, Rimm-Kauffman, and Pianta (2007) defined behavioral engagement as “children’s observed involvement in a teacher-sanctioned academic activity designed to promote achievement within a school context” (p. 414). Fredricks et al. (2004) stated behavioral engagement characteristics include those that “entail positive conduct, behaviors ...involvement in learning and academic tasks a such as effort, persistence, concentration, attention, and asking questions” (p. 62). Because it is easy to observe the outward behavior of students, most of the research done on engagement has focused on behavioral engagement.

In a seminal study to investigate the link between behavioral engagement and academic achievement, Finn (1993) used a nationwide random sample of almost 6,000 eighth-grade student at-risk surveys from the U.S. Department of Education's National Educational Longitudinal Study of 1988. An analysis of variance revealed a strong association between behavioral engagement and academic achievement. Another finding by Finn (1993), was that students at-risk have a lower level of behavioral engagement compared to non- students at-risk. Finn (1993) pointed out the need to identify the aspects of the classroom and school protocol of the curriculum that could be manipulated to encourage student engagement. Also, Finn (1993) called for correlational evidence to support the relationship of classroom environment with student engagement and identification. The at-risk factors identified by Finn (1993) were evident in the majority of students that attended alternative schools. This research suggested the need to study how the school and classroom environmental factors affected all forms of engagement and student success for students at-risk.

Downer, Rimm-Kaufman, and Pianta, (2007) examined the way in which quality of classroom environment, instructional quality, and the students' risk for school problems combined to predict behavioral engagement. Using the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, Downer et al. studied observations on 955 children in 888 third-grade classrooms. Chi-Squared tests for independence were computed to investigate patterns of association between student engagement and instructional context. Results showed that students were more likely to be engaged in small group conditions rather than individual learning or large groupings. A second finding confirmed that students at-risk were less engaged under most classroom conditions.

In a consecutive three-year study, Archambault, Jonasz, Morizot, and Pagani, (2009) administered questionnaires for over 13,000 high school students to examine the relationships between the levels of behavioral, affective, and cognitive engagement and student drop-out rates. Archambault et al. (2009) used a multiple-process growth mixture model to identify subgroups of individuals on each aspect of student engagement. Findings suggested that youth live through multiple changes contributing to their level of engagement. Behavioral engagement dropped significantly after ages twelve and thirteen, especially within students identified as at-risk through special education placement, or past academic failures. Research suggested that school-based interventions that aim to promote high school completion should focus on individual differences within the school population, especially students at-risk. These research studies echo the call by Finn (1993) for research on the relationship of the school environment with student behavioral engagement. These studies further encouraged focus in the area of TCLE and its effect on behavioral engagement levels of students at-risk.

Cognitive Engagement

One form of engagement centered on the cognitive realm. Fredricks et al. (2004) described research findings on cognitive engagement which, stressed “investment in learning, and self-regulation, being strategic [or] a desire to go beyond the requirements, and a preference for challenge” (p. 63). Finn and Zimmer (2012) summarized newer research and described cognitive engagement as “the expenditure of thoughtful energy needed to comprehend complex ideas to go beyond the requirements” (location 4229).

In search of evidence of cognitive engagement, Helme and Clarke (2001) studied video recordings, and interview records of twenty-four students and the teacher of an eighth grade science and math class. The researchers focused mainly on linguistic markers of cognitive and

metacognitive activity such as verbalization of thinking, questions, explanations, and communication. This mixed-method study considered non-verbal indicators of cognitive engagement including eye contact, hand gestures, and body language. The methods of gathering data resulted in evidence that points to the importance of social settings to increase cognitive activity that is observable as a whole group and reinforced from individual responses during the interview process of the student participants. The study concluded that there were more instances of cognitive engagement in student to student interactions than when looking at the teacher to student interactions. Helme and Clarke found that novel connections to personal experience impacted cognitive engagement in a positive way. This study revealed the need to gather data from the student perspective to understand how the student perceived deliberate cognitive task specific thinking in the context of social learning and how it affected cognitive engagement.

Using a nationwide sample of 792 students in nine high-poverty elementary schools, Taylor, Pearson, Peterson, and Rodriguez (2003) analyzed mixed-method data from classroom observations and interviews. The authors examined the influence of teacher practices that encouraged cognitive engagement in literacy learning. Taylor et al. (2003) used hierarchical linear modeling, which computed regression at multiple levels, and descriptive analyses to elaborate the quantitative findings of the data. This study also revealed that higher-level questioning was an important strategy. Some findings showed that reading instruction that maximized students' cognitive engagement enhanced elementary students' growth in reading and writing. Higher-order questions allowed the students to connect character interpretations to their personal experience. This research reinforced the relationship between increasing cognitive engagement through higher-order questioning and improved academic performance.

Emotional Engagement

Emotional engagement was found to be difficult to measure compared to other forms of engagement. Belfanz, Herzog, & Mac Iver (2007) confessed that they failed to address the cognitive and emotional engagement domains based on the fact that, "school systems already routinely collected indicators of behavioral engagement but seldom directly measured other types [emotional or affective]" (p. 224). In other words, it is much harder to gather and analyze data concerned with the emotional domain of engagement due to the internal nature of emotional processes. Regardless, the emotional domain must be included in research when looking for links between the TCLE and the level of engagement for students at-risk (Finn, 1989).

Some researchers advocated that all three domains of engagement (cognitive, behavioral, and emotional) should be studied together (Appleton et al., 2008; Fredricks et al., 2004; Appleton et al., 2008). Fredricks et al. (2004) suggested that "the fusion of behavior, emotion, and cognition under the idea of engagement was valuable because it provided a richer characterization of children than [was] possible in research on single components" (p. 61). In the participation-identification model, Finn (1989) described how affect and behavior blend to increase the likelihood of academic success. Accordingly, some researchers concluded that affective engagement was a supporting factor in academic achievement.

Fredricks et al. (2004) described emotional engagement as a "students' affective reactions in the classroom, including interest, boredom, happiness, sadness, and anxiety" (p. 63). At-risk populations dealt with more stress than students not exposed to at-risk factors because the combined effect of at-risk factors and behaviors often lead to overwhelming academic barriers (Finn & Rock, 1997). More stress inevitably effected the way students at-risk responded to all forms of engagement at school. Lee (2014) noted that "Affective reactions toward tasks, school,

and people at school (e.g., teachers or peers) may include liking, disliking, being interested, being focused, being bored, being happy, being sad, or being anxious” (p. 178). Often, students at-risk experienced disengagement caused by the emotional strife in response to factors they had experienced outside of the school setting (Finn, 1989; Finn & Rock, 1997; Lehr et al., 2009; Lucio et.al., 2012).

The need for emotional engagement could take priority over behavioral and cognitive engagement, because at-risk populations are not able to engage in those domains until they commit to engage emotionally (Finn, 1989). A component of the participation-identification model (Finn) places importance on connecting to the school to navigate experiences at home or school and achieve academic success. For at-risk populations, negative at-risk factors compound the need for connecting with the school for any real engagement to occur (Finn, 1989). Understanding the emotional state of students at-risk was essential when considering their level of engagement in school because a sense of belonging arose from connections made on emotional levels (Finn).

Lowering the affective filter lead to positive emotional engagement and increased learning because students felt more connected to school (Krashen, 1982). Krashen's Affective Filter has mostly applied to English Learners since its inception in the 1980's. Lin (2007) used English songs, games, and videos that lowered the Affective Filter "in an attempt to update pedagogies based on Krashen's theories to enhance [Asian] learners studying English" (p. 115). Lin (2007) used a mixed-method approach to gather and analyze data concerning the effect of lowering the Affective Filter in her classroom. She used pretest and posttest averages from the Test of English as a Foreign Language reading test to gauge the results from lowering the Affective Filter with her students (Lin, 2007). Lin used the Affective Filter as the centerpiece for

her English class in a population of freshmen college students at the University of Taiwan for combating "negative emotions formed through the passive moods, including low motivation, low self-esteem, and debilitating anxiety" (p. 115). She found significant gains as students went from an average of 75% on the TOEFL reading test to an 83% after treatment consisting of lowering the Affective Filter through effective pedagogy aimed at increasing the affective engagement of her students (Lin).

Using a multimethod approach, Fredricks, Blumenfeld, Freidel, and Paris, (2002) studied third through fifth grade students in two Hispanic and African American low-income communities. Their purpose was to measure the influence of the social and academic context on student engagement in urban school settings. They conducted surveys and interviews with a longitudinal design. The authors also analyzed behavioral, emotional and cognitive engagement factors using regression analysis for the quantitative data and thematic analysis for the qualitative data. The main findings concluded that teacher support was associated with emotional and cognitive engagement. Also, work norms and academic task challenge were both correlated with behavioral, emotional, and cognitive engagement.

In an urban school system, Appleton, Christenson, Kim, and Reschly (2006) studied 1,931 students at-risk to validate a student engagement instrument that measured cognitive and psychological engagement. The self-reporting student survey was designed to measure the less visible, more internal indicators of cognitive and psychological aspects of engagement. Measuring internal indicators like feelings of identification or belonging, and relationships with teachers and peers were essential for improving the emotional engagement and learning outcomes for students at-risk. Appleton et al. (2006) used exploratory methods and found that their study examining the Student Engagement Instrument (SEI) was statistically supported by

positive correlations. These positive relationships suggested that each factor measured a sufficient degree of cognitive and psychological (emotional) engagement. This research supported the idea that the use of student self-reporting surveys was an accurate measure of less visible indicators of cognitive and emotional engagement for students at-risk when considering interventions targeting improvement of these subtypes of engagement.

Fredricks et al. (2002) additionally found that the students' perception of the academic task routine positively correlated with emotional, behavioral, and cognitive engagement. This finding suggested that classroom culture was a major factor concerning the increase in student engagement. These findings indicated that emotional engagement should be part of a multifaceted study of engagement with students at-risk. Social engagement was part of the multi-dimensional study of engagement due to increased focus on the social aspects of learning that were circulating in educational pedagogy (Blumenfeld et al., 1991; Fredricks et al., 2016).

Social Engagement

Specific engagement measures that included social engagement rose in response to increased emphasis on collaboration and cognitively challenging tasks in math and science classrooms (Blumenfeld et al., 1991; Fredricks et al., 2016). Patrick et al. (2007) termed social interactions as "task-related interaction" that denoted the day-to-day social interactions which students experienced with their peers linked to the instructional content.

In addition to the research on cognitive engagement discussed above, Helme and Clarke (2001) found that social setting offered more opportunity for demonstrating higher order cognitive engagement than teacher-centered interactions within whole-class and small group interactions. The researchers noted indicators of emotional involvement such as expressions of enthusiasm, enjoyment, and satisfaction. Researchers observed these indicators in the context of

the group setting. The social protocol evident in this classroom played a pivotal role in the procedure and appearance of cognitive engagement levels. This research established the need to add social engagement in the overall construct of student engagement, which was brought on by the educational push for more collaboration and cognitively challenging tasks in science class (Finn & Zimmer, 2012). This research indicated the need to gather qualitative data on high school students and to expose a complete picture of cognitive engagement in the student at-risk.

Patrick et al. (2007) examined how 602 fifth grade students' perceptions of certain aspects of the classroom social environment related to their engagement in math class. This research used surveys to better understand thirty-one elementary schools which were made up of predominantly European American students. Patrick and colleagues used a confirmatory factor analysis procedure to measure the assumptions regarding the factor structures of the various scales. Findings revealed that the classroom social environment was linked to engagement levels when students perceived emotional support, were encouraged to discuss their learning, and received academic support from classmates. The research stressed the prominence of students' perceptions of the social environment and the link to understanding how this TCLE influenced student engagement in science class. The use of student interviews qualitatively highlighted students' perception of the TCLE and the link to the quantitative data on student level of engagement in science class for students at-risk. Further findings by Patrick et al. (2007) reinforced arguments for applying a social learning perspective that linked the social context of the classroom to student engagement.

Anderson, Christenson, Sinclair, and Lehr (2004) examined whether or not increased student engagement was associated with the level of quality and closeness of relationships between intervention staff and students at-risk. Eighty at-risk elementary students (determined

by attendance rate) from eleven schools in the same urban district were chosen to participate in the study. The researchers examined the means and standard deviations for attendance, student risk, relationship survey, and teacher rated scale of intervention outcomes of their relationship, academic, and social engagement data. Anderson et al. (2004) found improved engagement in students who had closer, higher quality relationships with the intervention staff. Students with closer relationships with their intervention staff had higher ratings of social engagement than those who were below the sample average. This study was among the first to demonstrate a link concerning the quality of relationships between intervention staff and students at-risk with school outcomes such as attendance and teacher-perceived social and academic engagement.

Engagement is a robust predictor of educational outcomes and is malleable (Fredricks et al., 2016). Engagement is a multifaceted construct. It includes the behavioral, cognitive, emotional, and social facets to more fully understand how each domain combined to explain the larger construct of student engagement. All facets of engagement could be explored to better understand the construct of student engagement for students at-risk, struggling with disengagement at higher levels than students not at-risk.

Students At-Risk

At-risk populations often dealt with life situations or personal choices that insulated them from ordinary discourse in schools (Finn, 1993). They struggled with acceptance, self-worth, isolation, and physical issues that weigh on them drastically (Downer et al., 2007; Matheson & Shriver, 2005). For this reason, emotional engagement was the key to unlocking all other forms of engagement. Emotional engagement was the precursor to any engagement for students at-risk (Downer et al., 2007; Finn, 1989; Matheson & Shriver, 2005).

A list of common at-risk factors compiled by Finn and Zimmer (2015) included status risk factors, family (SES), race/ethnicity, English Learner status, and family structure that included early pregnancy/parenthood. Students with multiple at-risk factors had a more challenging task of engaging behaviorally, cognitively, emotionally, or socially in the curriculum of secondary science classrooms than their peers (Downer et al., 2007; Finn, 1989; Matheson & Shriver, 2005). Some other educational risk factors included low grades and test performance in early grades, in-grade retention, and student misbehaviors (Christenson, Reschly, & Wylie, 2012, location 4072).

Some researchers agreed that academic failure was not reliant on which predictors an individual experienced, but the number of predictors experienced (Lucio, Hunt, Bornovalova, 2012). The multiple at-risk factors weighed heavily on the person and created a higher level of stress for the student (Downer et al., 2007). Often, students misbehaved and disrupted the learning environment as a coping mechanism for dealing with the stresses from these situations (Downer et al., 2007; Matheson & Shriver, 2005).

Regardless of the type of at-risk factor, the at-risk population coped with stressful situations differently than those who did not experience multiple factors at once (Downer et al., 2007; Matheson & Shriver, 2005). Poor choices or uncontrollable family factors shape the coping mechanisms of these students that often caused a cyclical pattern of disruptive and sometimes violent behavior (Finn, 1989). This pattern frequently resulted in disengagement, peer isolation, suspension, expulsion, and a high rate of dropouts for the at-risk population (Finn et al., 1993).

Although the educational task for many students at-risk seemed monumental, engagement held the key to an important component of academic resilience that led to academic

success (Finn & Rock, 1997). Finn and Rock researched a large sample size of 1,803 eighth, tenth, and twelfth grade minority students from the U.S. Department of Education's National Educational Longitudinal Study of 1988 (NELS:88). They found academic engagement was a safeguard for individual students from difficulties that may accompany status risk factors (Finn & Rock, 1997). In this cross-sectional designed study, the analysis of variance revealed differences between the three groups of student classifications: resilient, non-resilient completers, and dropouts. Finn and Rock found that engagement could be an insulator for students at-risk from many risk factors and that positive reinforcement by the school staff could encourage many engagement behaviors. The researchers determined that elements of the school and classroom organization may have had an effect on student engagement levels. Small class sizes facilitated more engagement, supportive relationships, and warmer environment compared to larger schools (Finn & Rock).

These findings indicated that increasing student engagement for students at-risk influenced academic success, and small school settings were more beneficial for students at-risk and increased their level of student engagement. Fredricks et al. (2002) examined the impact of creating a challenging academic environment for students at-risk. These findings suggested the need for more research on the TCLE and the relationship between engagement of students at-risk in schools with high populations of students at-risk. Students at-risk often found it harder to engage with academic tasks or institutions. If engagement was pliable as researchers indicate (Appleton et al., 2006; Fredricks et al., 2008; Fredricks et al., 2016) the students at-risk stood an enhanced opportunity for academic success if best practices for science learning were employed.

Science Learning

Some of the following science learning methods were not only used in many alternative schools, but also have been shown to benefit regular schools. Lazarowitz and Hertz-Lazarowitz, (1998) reviewed cooperative learning methods and found several strategies in use for international science education from the 1970's through the late 1990's: (1) Learning Together and Alone; (2) Jigsaw Classroom; (3) Student Teams and Achievement Divisions; (4) Group Investigation; and (5) Peer Tutoring in Small Investigative Group. These strategies moved towards increased social learning in science class. Investigations, interaction, and interpretations were used to increase emphasis on collaboration and cognitively challenging tasks in science classrooms and student learning in the social context of the science classroom (Blumenfeld et al., 1991; Fredricks et al., 2016). Through their investigation of the literature concerning cooperative learning employed in science classes around the world, Lazarowitz and Hertz-Lazarowitz, (1998) found that junior and senior high school students improved their knowledge. Higher cognitive achievement, more positive attitudes, greater self-esteem, more engagement on tasks, and increased motivation and enjoyment in science class provided the evidence for growth.

The Learning Cycle took on a primary emphasis in science, and one application used these three phases: inform, verify, and practice. The phases of the Learning Cycle in sequence were the *identification* of a concept, *demonstration* of a concept, and *application* of the concept (Treagust, 2007). The most critical conclusion based on research for the Learning Cycle was that it provided students with hands-on experiences with the concept to be learned and the skill of constructing knowledge from their personal experience, which aided in application to help solve new and unique problems (Abraham, 1998).

While the above-mentioned strategies were widely used to direct teachers in their science instruction, many reformers and researchers believed that the creation of a personalized learning environment that promoted engagement on all levels and a caring student-teacher relationship were missing from the reform strategies (Rascoe & Atwater, 2005). Developing such environment began within the classroom, but also required that an entire school culture of expectations, norms, values, and organizational design encouraged and sustained a healthy teacher-student relationship (Wang, Haertel, & Walbert, 1998). Helme and Clarke (2001) found that the connection between emotional and motivational aspects of engagement was evident in their research. Helme and Clarke perceived that cognitive engagement in science and math class occurred within a complex interaction of particular aspects of the classroom environment, the academic task, and of the individual.

In a longitudinal study, Finn (1993) found that out of over 15,000 students from across the country, science was the most failed standardized test (62.7%) among students at-risk. The increasing diversity of the school-aged population, coupled with differential science performance among demographic groups, made the goal of "science for all" a challenge for most nations (Lee & Luykx, 2007). The number of students at-risk who were academically unsuccessful and disengaged in school demanded that science teachers reconsider how they approach the TCLE in the classrooms (Belfanz et al., 2007). Lee and Luykx (2007) suggested that teachers do not necessarily have to come from the same ethnic or racial background as their students, but must understand strategies appropriate to multicultural settings.

Alternative Schools

Lee and Luykx (2007) stated:

differing science outcomes may be as much a product of the ways in which policies and schools define, delimit, and manage student diversity as they are of diversity itself;

Regardless of the origin or nature of students' marginalization, academic success often depends on assimilation into mainstream norms. (p. 173)

However, students at-risk were not characteristically the same and did not fit the mainstream expectations.

Aron (2006) utilized the U.S. Department of Labor reports to gather this quantitative data on all school curriculum within the U.S. and offered a thorough overview of alternative schools nationwide. The data centered on community or district based programs that had a primary focus on re-engaging out-of-school youth in learning to prepare these children to attain high growth occupations and careers. Aron reported that 3.8 million young people were not in school, do not have a diploma, and were not working. Aron drew a clear distinction between the students most in need of re-engagement since more than one million youth aged 16-19 did not have a high school diploma (or GED) and were not enrolled in school. Half of all black students in the United States did not graduate from high school, and graduation rates among Hispanics, and Native Americans were as low as 48 and 47 percent respectively (Aron). Aron illuminated the gross failings of the U.S. educational systems to provide minority students an equitable education. Alternative schools aimed to offer students who do not fit in regular educational settings an opportunity to attain an education.

There were many different models of alternative schools during the 1960's through the 1980's. Therefore, Raywid (1994) grouped alternative schools into three types: Type I, Type II, and Type III. Type I alternatives were schools of choice (which resemble magnet schools) based on themes with an emphasis on programs or strategies to attract students and virtually always reflected organizational and administrative departures from the traditional, as well as institutional improvements. Type II alternatives were "last chance" schools where students are sentenced as a last step before expulsion. These were not schools of choice, and their emphasis was typically

on behavior modification or remediation. The Type II alternative schools were likened to "soft jails," and had nothing to do with options or choice. Type III alternatives were designed with a focus on social, emotional issues and remedial academic issues emphasizing effort on stimulating social and emotional growth. Type III alternative schools attempted to achieve this through emphasizing the school itself as a community.

Raywid (1994) used a literary review in gathering her data and creating the classifications for alternative schools. Raywid was the expert on typing alternative schools due to her extensive research and experience in this educational setting. Type I and Type III alternative schools were positive in direction and effect on students who chose these types of alternatives to the regular classroom setting. Type II was punitive in nature and approach, more rule oriented, and focused on academics. This alternative setting required students to go through metal detectors, a search line, and adherence to strict behavioral and dress code rules for attendance.

Teacher Created Learning Environment

The teacher created learning environment focused on effective instructional strategies, differentiated instruction, a positive learning environment, and an academically challenging environment (Barge, 2012; Dunn et al., 1995; Fraser & Fisher, 1982; Miller-Cribbs, Cronen, Davis, & Johnson, 2002). Teachers are the central agent of change in the classroom environment for many at-risk populations that include African Americans and other minorities (Fraser & Fisher, 1982; Miller-Cribbs et al., 2002).

Within the TCLE, instructional strategies, described by Barge, promote student growth by being "relevant to the content to engage students in active learning and...facilitate the students' acquisition of key knowledge and skills" (2012, p. 20).

One approach, Differentiated Instruction, is defined as education in which “The teacher challenges and supports each student’s learning by providing appropriate content and developing skills which address individual learning differences” (Barge, 2012, p. 28). Dunn, Griggs, Olson, Beasley, and Gorman (1995) examined 36 experimental studies on the effects of using student learning-style preferences through the lens of differentiated instruction, and found these interventions were statistically significant. Additionally, Dunn et al. (1995) extended this finding to include students at-risk. Dunn et al. found that achievement scores for students at-risk increased close to one standard deviation (from the 50th percentile to the 84th percentile) when teachers attended to individual student learning styles.

Lee (2014) wanted to find out if the relationship between student engagement and academic performance was myth or reality. This multilevel analysis of 3,268 15-year-old students in 121 U.S. schools using quantitative data, examined the relationship between student engagement and academic performance using the Program for International Student Assessment (PISA) 2000 data. Lee found that emotional engagement, defined as the sense of belonging, was a significant predictor of reading performance. This research emphasized emotional engagement as an important factor in academic success and suggested that policy makers, educators, and the research community focus on ways to improve student engagement (Lee).

Using quantitative longitudinal data sets collected by the Institute for Research and Reform in Education, Klem and Connell (2004) examined six urban elementary schools (1,846 students) and one urban middle school (2,430 students). A Student Performance and Commitment Index (SPCI) survey was used in conjunction with the Research Assessment Package for Schools (RAPS) to explain linkages among individual experience of the social context, patterns of behavior, and outcomes of performance. Klem and Connell found, "teacher

support is important to student engagement in school, engaged students pay more attention, are more persistent in the face of challenges than disengaged students, and were 75% more likely to do well on the attendance and achievement index" (p. 266). They found that well-structured learning environments with clear, fair and high expectations reported higher engagement (Klem & Connell). This research supported the idea that the teacher had a great impact on the classroom learning environment and encouraged higher levels of engagement, equating to higher attendance and higher test scores.

Fredricks et al. (2002) examined the impact of academically challenging environment, teacher support, and peer support on emotional, behavioral, and cognitive engagement. The authors found that student perceptions correlated with each type of engagement. The findings suggested that the TCLE was perceptible by the student at-risk and had an effect on the level of emotional, behavioral, cognitive, and social engagement. The research called for attention to the elements of TCLE since it affected the malleable nature of student engagement in the science curriculum.

Gap in the Research

After reviewing the key research studies summarized in Table 1, the researcher established a gap in the research. Specifically, there was a need for research exploring how the classroom environment is linked to the level of engagement of students at-risk (Klem & Connell, 2004). There was a limited number of subject-specific engagement studies, making it difficult to determine which aspects of engagement were deemed essential based on subject (Fredricks et al., 2016). Research was lacking within the at-risk population. More research was needed which included information about research methods for gathering data on the social and emotional types of engagement with students at-risk. Research specific to alternative schools

with a high population of students at-risk was necessary to inform best practice (Lehr, Tan, & Ysseldyke, 2009; Riele, 2007). Further study on how classroom characteristics affect short and long term engagement of students at-risk was needed (Finn, 1993).

Studies that include the social engagement were sparse and of primary concern for research, since new initiatives place social learning as a priority in giving students the skills necessary to communicate and solve problems as in a group setting (Blumenfeld et al., 1991; O'Donnell & Hmelo-Silver, 2013). Data on the social indicators of engagement were especially needed since aspects of the new instructional emphases from the Common Core State Standard Initiative in math and Framework for Science Education focused on small group work, complex problem solving, argumentation, and justifying your reasoning to others (Fredricks et al., 2016).

Table 1

Key Literature Review Research

Topic	Author	Type of Research	Sample	Findings
Student Engagement in Urban Schools	Fredricks, Blumenfeld, & Paris, 2004	Mixed Methods Longitudinal Design	3rd through 5 th grade students in two Hispanic and African American low-income communities	<ul style="list-style-type: none"> Teacher support was associated with emotional and cognitive engagement Work norms and academic task challenge were both correlated with behavioral, emotional, and cognitive engagement.
Students At-Risk and Types of Student Engagement	Fredricks et al., 2004	Literature Review on Student Engagement	44 studies of student engagement	<ul style="list-style-type: none"> Consistent association between the need for competence and behavioral, emotional, and cognitive engagement in the elementary, middle, and high school years Added 4th category of social engagement
Student Engagement	Finn, 1993	Analysis of Variance of the link between behavioral engagement and academic achievement	6000 eighth-grade student at-risk surveys from the U.S. Department of Education's National Educational Longitudinal Study of 1988	<ul style="list-style-type: none"> Revealed a strong association between behavioral engagement and academic achievement Students at-risk have a lower level of behavioral engagement compared to non-students at-risk Need to identify the aspects of the classroom and school protocol of the curriculum that could be manipulated to encourage student engagement
Students At-Risk and Behavioral Engagement	Downer, Rimm-Kaufman, and Pianta, 2007	Chi-Squared tests for independence were computed to investigate patterns of association between student engagement and instructional context questionnaires	955 children in 888 third-grade classrooms	<ul style="list-style-type: none"> Students were more likely to be engaged in small group conditions rather than individual learning or large groupings Students at-risk were less engaged under most classroom conditions
Student Engagement and Drop Out Rates	Archambault, Jonasz, Morizot, and Pagani, 2009	multiple-process growth mixture model	13,000 high school students	<ul style="list-style-type: none"> Youth live through multiple changes contributing to their level of engagement Behavioral engagement dropped significantly after ages twelve and thirteen
Student Engagement and Increased Cognitive Activity	Helme and Clarke, 2001	Mixed-Method Study	24 students and the teacher of an eighth grade science and math class	<ul style="list-style-type: none"> Evidence that points to the importance of social settings to increase cognitive activity Novel connections to personal experience impacted cognitive engagement in a positive way Need to gather data from the student perspective
Student Engagement in Literature Learning	Taylor, Pearson, Peterson, and Rodriguez, 2003	Mixed-Method hierarchical linear modeling, which computed regression at multiple levels, and descriptive analyses	nationwide sample of 792 students in nine high-poverty elementary schools	<ul style="list-style-type: none"> Higher-order questions allowed the students to connect character interpretations to their personal experience
Affective Filter	Lin, 2007		English class in a population of freshmen college students at the University of Taiwan	<ul style="list-style-type: none"> Students went from an average of 75% on the TOEFL reading test to an 83% after treatment
Student Engagement Survey	Appleton, Christenson, Kim, and Reschly, 2006	Exploratory Mixed Methods	1,931 students at-risk	<ul style="list-style-type: none"> Measuring internal indicators like feelings of identification or belonging, and relationships with teachers and peers were essential for improving the emotional engagement and learning outcomes for students at-risk

Table 1 continued

Topic	Author	Type of Research	Sample	Findings
Student Engagement	Patrick et al., 2007	Surveys and confirmatory factor analysis mixed methods	602 fifth grade students' perceptions thirty-one elementary schools	<ul style="list-style-type: none"> • Classroom social environment linked to engagement levels when students perceived emotional support, were encouraged to discuss their learning, and received academic support from classmates. • Social learning perspective linked social context of the classroom to student engagement
Student Engagement and Relationships	Anderson, Christenson, Sinclair, and Lehr, 2004	Means and Standard Deviations for attendance, student risk, relationship survey, and teacher rated scale	Eighty at-risk elementary students	<ul style="list-style-type: none"> • Students with closer relationships with their intervention staff had higher rates of social engagement.
Student Engagement and Staff Behavior	Finn & Rock, 1997	cross-sectional designed study, the analysis of variance	1,803 eighth, tenth, and twelfth grade minority students	<ul style="list-style-type: none"> • Academic engagement was a safeguard for individual students from difficulties that may accompany status risk factors. • Engagement could be an insulator for students at-risk. • Positive reinforcement by the school staff could encourage many engagement behaviors.
Alternative Schools	Aron, 2006	Quantitative Data Analysis	U.S. Department of Labor reports to gather this quantitative data on all school curriculum within the U.S	<ul style="list-style-type: none"> • 3.8 million young people were not in school, do not have a diploma, and were not working. • Found gross failings of the U.S. educational systems to provide minority students an equitable education.
Alternative Schools	Raywid, 1994	Literary Review		<ul style="list-style-type: none"> • Alternative schools vary in purpose and outcome • Types of Alternative Schools
Student Engagement and Academic Performance	Lee, 2014	Multilevel Analysis	3,268 15-year-old students in 121 U.S. schools	<ul style="list-style-type: none"> • Emotional engagement was a significant predictor of reading performance • Emotional engagement as an important factor in academic success
Student Engagement	Klem and Connell, 2004	Student Performance and Commitment Index (SPCI) survey was used in conjunction with the Research Assessment Package for Schools (RAPS) to explain linkages	6 urban elementary schools (1,846 students) and 1 urban middle school (2,430 students)	<ul style="list-style-type: none"> • 75% more likely to do well on the attendance and achievement index • Well-structured learning environments with clear, fair, and high expectations yield higher engagement

Conclusion

To underpin the role of the TCLE and magnitude of student engagement for students at-risk in science, identifying the best-suited classroom environment for the assurance of academic success for this student population was necessary. The behavioral, cognitive, emotional, and social aspects of engagement needed to be addressed as a multi-faceted construct by the teacher when considering the optimal classroom environment for the at-risk population. There was a correlation between the level of student behavioral, cognitive, and emotional engagement with the TCLE (Barge, 2012; Dunn et al., 1995; Fraser & Fisher, 1982; Helme & Clarke, 2001; Miller-Cribbs et al., 2002). The increased emphasis on collaboration and cognitively challenging tasks in math and science classrooms prompted research about the need for subject-specific engagement measures that included social engagement, as well as behavioral, cognitive, and emotional engagement (Blumenfeld et al., 1991; Fredricks et al., 2016).

Three significant findings of the literature review focused on: 1) the need to study engagement as a multi-faceted construct, 2) engagement existed in a malleable state and was a robust predictor of academic success, and 3) attention to the elements of the TCLE increased student engagement for students at-risk. In reviewing the literature, the researcher was led to discover what correlation or link exists between the student perceived notion of the TCLE and the level of engagement for the student at-risk.

CHAPTER 3
METHODOLOGY

Introduction

Science teachers needed to fully understand the impact of the environment they have the power to create in the classroom and its effect on engagement for students at-risk. In an effort to shed light on the impact of the TCLE on engagement for students at-risk in science class, survey and interview data from the students' perspective were gathered and analyzed in 5 classrooms. The researcher measured engagement for students at-risk in science class in response to the TCLE centering on the following aspects: instructional strategies, differentiated instruction, positive learning environment, and academically challenging environment.

The purpose of this explanatory sequential mixed–method study was to examine student perceptions of teacher effectiveness in creating an environment that was conducive to engagement for students at-risk within 5 high school science classrooms in a large suburban school system in the southeastern United States. Additionally, the researcher identified the characteristics of the TCLE that increased engagement for students at-risk with the science curriculum.

The overarching question framing the research study was: “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” The two sub-questions: “How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?” and “What

relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?” The social engagement domain was added to this study because there had been a recent push to include the social aspects of learning in “both math and science classrooms on small group work, argumentation, and justifying your reasoning to others” (Fredricks et al., 2016, p. 8). The authors of the Math and Science Engagement Measure (MSEM) revealed that the scale used in the MSEM differed from previous measures of social engagement by including items that reflected social-affective elements and social-cognitive engagement aspects (Fredricks et al., 2016).

Within the context of this explanatory sequential mixed-method approach, six high school science teacher classrooms were studied through student surveys and interviews. Teachers were chosen on the basis that they taught at least four sections of science content per day. Classroom one was a 9th grade biology class. Classroom two was a 10th grade chemistry class. Classroom three was an 11th grade physics class. Since all county students are required to take a fourth year of science, classroom four was an elective class where online classes of environmental science, forensics, or other science electives were offered. The remaining two teacher classrooms were a combination of biology, chemistry, or physics depending on demand from student population. Sometimes, students from different grade levels were mixed in to help them receive instruction for classes they failed in other settings.

This explanatory sequential mixed methods research study is itemized into three phases as seen in Figure 1. These phases include Phase 1: Quantitative; Phase 2: Qualitative; Phase 3: Explanation. The third phase serves to paint a more vibrant picture of the overall findings of mixed methods by using the qualitative data to best explain the quantitative data.

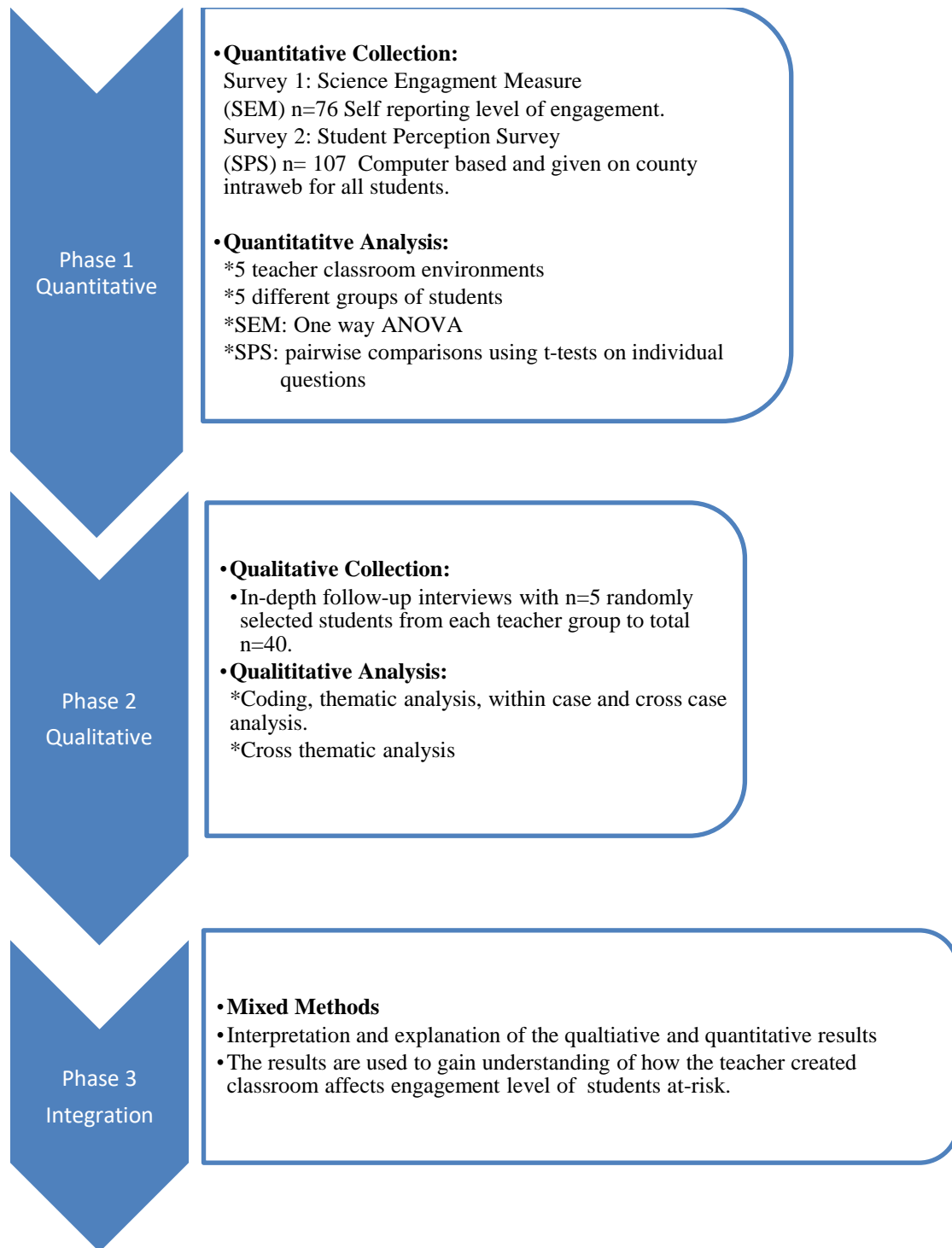


Figure 1. Explanatory Sequential Research Phases.

Figure 1 shows the three phases involved in this explanatory sequential mixed methods research study.

Quantitative data stemming from the student perception surveys were validated through qualitative interviews. After all data were compiled, the researcher interpreted to what degree and in what ways the qualitative results explained and added understanding to the quantitative results. The researcher further assessed what overall understandings were learned in light of the research questions.

Methodology

This research methodology was an explanatory sequential mixed method design. The overall purpose of this design was to use a qualitative strand of data to explain and expand the meaning from the initial quantitative survey results. This method worked well as the researcher wanted to use quantitative data to identify a grouping and qualitative data to follow up and get a clearer picture of research implications (Creswell & Clark, 2013). The explanatory design began with a post-positivism orientation, as it began with quantitative data. The explanatory design then moved to a constructivist approach, as the qualitative phase, which valued multiple perspectives and in-depth description (Creswell & Clark). Further, Creswell and Clark contended that qualitative data were to be both inductive and deductive to establish patterns that were reasoned to be themes arising from the surveys. Explanatory sequential mixed method was used to first establish what the implications of research were and then to explain why or how they were relevant.

Method

Due to the nature of the qualitative data to be gathered, minor modifications occurred in response to data gathering and a need for exploring in different ways. These changes included modifications to the interview questions and length of the interview. Additionally, the survey collection participants for the SEM was diminished due to the transient and volatile nature of the

alternative school population. In fact, the population of the school changed dramatically from week to week due to inconsistent attendance, suspension, student drop-out, expulsion, incarceration, or other reasons. Twenty-one percent of the original population chose not to participate in the survey or thought it was too difficult for them and aborted the survey. Fifteen of the 87 initial surveys were thrown out due to completion time violations (students who took under four minutes to complete the 38 survey questions or were observed to have randomly bubbled in the responses without reading the questions). There were 72 total SEM surveys completed by participants and considered useable data for purposes of this study.

In an effort to better understand the effect of the TCLE on the engagement level of engagement for students at-risk in science class, the researcher sought the common meaning of their classroom experiences by collecting quantitative data first and then explaining the quantitative results with in-depth qualitative data. In analyzing the data on engagement levels for these students at-risk through a self-reporting survey and student interviews, the researcher proposed to “develop a composite description of the essence of the experience for all of the individuals” as described by Creswell (2013, p. 76).

Population and Sample

Adult Participants

The participants were solicited in the pre-planning days of August 2016 in response to the newly published teaching schedule for the 2016/2017 school year. After inviting science teachers to participate through casual discussions during pre-planning, emails were sent to all interested teachers with details of the research. All the teachers were broad-field certified (i.e. have passed a content test that shows proficiency at a cursory level in many areas of science). All teachers, therefore, had a general understanding of all types of science as reflected by the

state certification test. Teachers were not required to have certification in alternative school practice or environmental conditions present in alternative schools. Each science teacher invited to participate in the research project were scheduled to teach at least five sections of science with contents of biology, chemistry, physics, forensics, or environmental science.

The IRB approval (Appendix G) was obtained for the research. In addition, the high school principal approved (Appendix H) the research project to include as many interested science teachers at the local school site. After the participant teachers had been selected, they met with the principal investigator who explained the research plan. Those who committed to see the project out to the end were considered participants for the purpose of this study.

Participants were surveyed to obtain teaching experience, educational experience, and science teaching experience demographics as portrayed in Table 2. In the daily science content planning, participant teachers, along with the principal researcher, planned for the student surveys and interviews around important curricular events as to not interfere with the instructional calendar schedule.

Table 2

Educational Levels and History of Teachers

Adult Participants	Years of Experience	Educational Level	Classes Taught
Teacher 1	24	Bachelor	Chemistry, Biology
Teacher 2	18	Bachelor	Chemistry
Teacher 3	6	Bachelor	Ecology, Biology
Teacher 4	26	Specialist	Chemistry, Forensics
Teacher 5	17	Specialist	Biology

Student Population

The students for this research project attended one of two alternative schools located in a very large district in a southeastern state. Within this school system that served more than 150,000 students, there were over 20 high schools, most having 2000-3000 students. Participating students, ranging in age from 15-19, were sent to a panel hearing in response to significant behavioral misconduct referrals that deemed them unfit for the regular educational setting. Reasons for a panel hearing may have included numerous office referrals, drugs, weapons, gang activity, fighting, or chronic disruption of the classroom environment. The paneled students were given the option of attending one of the two alternative schools within the county. Consequently, the site population was composed of a 100% at-risk population facing multiple factors that include: low (SES) schools, expulsion from regular school, Title I designation, 95% minority populations, 96% free or reduced lunch program qualification and participation, and a large English Learner (EL) population.

School Demographics

This alternative high school employed 42 full time teachers with five full time science teachers. The school further employed six administrators that included one principal and five assistant principals. There was a main building composed of administrative offices, gym, cafeteria, and media center. The classrooms consisted of a series of trailers lined in rows of three trailers to equal 20 classrooms, three of which contain science labs.

Positionality Statement

The researcher had been teaching science in the district for thirteen years. During that time, he was involved with analyzing standards for the district, evaluating district assessment

items, presenting technology usage professional development at the school level, as well as developing a mentor program for students at-risk in the regular educational setting.

The teacher had been working in the at-risk school for seven years and studying the dynamic of learners at-risk for six years. The teacher served as content leader for biology during which time he developed an eCLASS internet platform, focusing on increasing all levels of student engagement in the science classroom.

Data Collection

Self-Reporting Student Surveys

The Science Engagement Measure (SEM as seen in Appendix) was adapted from the Math and Science Engagement Measure (MSEM) to indicate Science only was used to give a subject specific measure of engagement in science class. The MSEM, created by Fredricks and colleagues in 2016, was validated “student report measures of student engagement in math and science for the fields and research and practice” (Wang, Fredricks, Ye, Hofkens, & Linn, 2016, p. 1). The sample for the MSEM consisted of ethnically and socioeconomically diverse middle and high school students. Consistency throughout the implementation of the MSEM across the sample points to the reliability of the instrument. Wang et al., 2016, also found “empirical evidence supporting measurement invariance and predictive validity” (p. 1). This reporting ensured reliability and validity for the SEM in the current research study, which was adapted from the MSEM to reflect science only.

This survey was given during week eight and was analyzed to discover relationships between the level of science engagement after exposure to the TCLE in science classrooms. After exposure to the current TCLE, students took the self-reported SEM survey to measure current engagement in science class. Finally, nearing the end of the fall semester, students

participated in a self-reporting survey that measured teacher effectiveness in the TCLE via the Student Perception Surveys (SPS). This electronic survey was developed by the Georgia Department of Education and was given to all enrolled students via internet access.

In the SPS portion of the data collection, students answered questions that addressed teacher performance standards to which they could respond from personal experience in the classroom. These surveys are aligned to Instructional Strategies, Differentiated Instruction, Positive Learning Environment and Academically Challenging Environment. Questions are designed to assess the learning environment teachers create for their students.

Concerning the reliability and validity of the SPS used in this study, the Georgia Department of Education published The Teacher Keys Effectiveness System describing the SPS survey as part of “a common evaluation system designed for building teacher effectiveness and ensuring consistency and comparability throughout the state” (Barge, 2012, p. 2). The Georgia Department of Education published fact sheets in 2012 concerning the evaluation of the TCLE using observation data, growth in student achievement, and Student Perception Surveys (SPS) to determine a teacher’s effectiveness (Barge, 2012). This fact sheet also pointed out that “students’ ratings were the best predictor of student achievement, thus demonstrating that students provide valid feedback on teacher performance” (Barge, 2012, p. 82).

Interviews

The principal researcher conducted student interviews after the level of student engagement surveys to obtain as much quantitative information about the students’ experience in science class as possible. Questions were guiding and served as a foundation for interviewing, but questioning criteria was open-ended and flexible to most effectively respond to and aid participants’ input (as seen in Appendix E). Interview questions were refined in order to follow

the quantitative results of the engagement survey. The researcher then recorded the student interviews and transcribed them into a two-column format to best code responses.

Themes were aligned with the four facets of the TCLE. These themes were valuable in providing a rich description of differences of thoughts, patterns, and feelings from the student's view about engagement. The student perspective was valuable since that firsthand knowledge, when shared, could be used to increase the understanding of how the relationship between the classroom environment and engagement interact.

Timeframe and the instruments used for data collections are detailed below in Table 3.

Table 3

Research Plan

Research Questions	Stage & Instrument(s)	Timeline Week 1= August 8 th	Data/Variable Results
IRB Approval, School and County Approval, Teacher selection, student consent, and parent assent forms.	Prior to Data Collection	Prior to week 1	Approval from all parties with documentation.
How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?	Phase 1 Science Engagement Measure (SEM)	Week 8 Measured on a five point Likert scale.	Quantitative Measures student level of behavioral, cognitive, emotional, and social engagement.
What relationship exists between the level of engagement for students at-risk and perception of the science classroom environment?	Phase 1 Student Perception Surveys (SPS)	Week 10 Measured on a 4 point Likert scale.	Quantitative Establishes a teacher score for each teacher. Link score to teacher to get an average student perception of the teacher created learning environment.
What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?	Phase 2 Teacher - Directed Student Interviews	Weeks 10-12	Qualitative Creates links between the teacher created learning environment and the levels of engagement in science class.
Interpretation and explanation of the quantitative results using the qualitative results.	Phase 3 Qualitative data coded to align with quantitative	Weeks 12-until complete	Quantitative and Qualitative data results are used to gain understanding of how the learning environment affects engagement of students at-risk.

Prior to Data Collection

All science teachers who taught at least five sections of any science content area (biology, chemistry, physics, etc.) were selected to participate in the study. Students were on the role of one of the selected teachers for the research project. Participant teachers, students, and parents were given consent forms according to Internal Review Board (IRB) mandates (Teachers-Appendix A). Students and parents were also given consent forms to participate and audio tape student responses to the interview questions (Students-Appendix B; parents Appendix C). Participants for this research study included teachers with signed consent forms and students with signed assent and parental consent forms will be participants. Students who did not give assent or parents who did not consent to student participation in data collection did not participate in data collection.

Phase One

As seen in Figure 1, Phase One of the study involved the quantitative data collection. The Science Engagement Measure (SEM) (Appendix D) was administered to the participating students during the eighth week to gather quantitative data on the engagement level in science class for each student. County published scores for participating teachers came from the Student Perception Survey Data (SPS, Appendix E) given during the tenth week. This survey was given to measure the students' perception of teacher effectiveness in creating the classroom environment. The classroom environment score was documented by the students' perception of the following TCLE domains: positive learning environment, instructional strategies, differentiated instruction, and academically challenging environment. The TCLE score is derived from the results of the Student Perception Survey (SPS).

Phase Two

As seen in Figure 1, Phase Two of the data collection is the qualitative stage. Specifically, 40 (five from each teacher group) random follow-up interviews (Appendix F) were conducted with students during the tenth through the twelfth week to gather qualitative data in order to clarify relationships between the TCLE classroom environment and engagement for students at-risk in science class.

Phase Three

As seen in Figure 1, Phase Three of the research involved using the qualitative data gathered in Phase Two to better understand the quantitative data gathered in Phase One. The researcher compiled the data, coded the data, and established connections related to the research questions. The qualitative data were coded to align with quantitative data categories of behavioral engagement, cognitive engagement, emotional engagement, and social engagement, before data analysis commenced.

Research Instruments

The three instruments which were used to gather data were a student self-reporting Science Engagement Measure (SEM), a self-reporting Student Perception Survey (SPS), and the follow-up student interview. These instruments aligned with the research questions as seen in Table 3.

Surveys

The student (SEM) self-report Likert survey (see Appendix B) developed by Fredricks et al. (2016) but adapted to indicate science only. Most engagement measures up to this point have focused on the academic, behavioral, and cognitive aspects of engagement only (Fredricks et al.). This engagement measure was specifically designed for science from a student perspective and

uses a five point Likert scale. Fredricks and colleagues stated that their “goal was to develop a theoretically grounded measure of math and science engagement that reflect[ed] a multidimensional construct” (p. 7). Further, Fredricks et al. noted that “It is important to develop domain-specific measures because of changes in instruction, the types of tasks, and increased emphasis on collaboration and cognitively challenging tasks in math and science classrooms can shape and interact with how students engage behaviorally, emotionally, and cognitively” (p. 2).

In addition to a subject specific engagement measure, the (SEM) was unique because it included the social aspect in the measure. “These social indicators are a key aspect of the new instructional emphases in both math and science classrooms on small group work, argumentation, and justifying your reasoning to others” (Fredricks et al., 2016, p. 8). The SEM was given after eight weeks of exposure to the TCLE.

The second instrument was a self-reporting Student Perception Survey (SPS). Students answered questions that addressed teacher performance standards to which they responded from personal experience in the classroom. The SPS used a four point Likert scale to measure the TCLE from the students’ perspective in four domains: Instructional Strategies, Differentiated Instruction, Positive Learning Environment, and Academically Challenging Environment.

The SPS was given by the county to every student enrolled in its system using a web-based platform generated and accessed through the county website. The SPS sought to measure the learning environment created by the teacher according to twenty statements organized by the four domains of the TCLE (e.g. “My teacher encourages me to participate in class”) for instructional strategies, (e.g. “My teacher gives me opportunity to opportunities to use what I learned in creative ways”) for differentiated instruction, (e.g., “My teacher cares about my

learning”) for positive learning environment, and (e.g., “The work assigned in class challenges me”) for academically challenging environment. This assessment tool was used to determine a ranking score for all teachers for the TCLE.

Interviews

The follow-up student interviews (see Appendix C) were the final tool used to gather the qualitative data from five randomly selected participants for each teacher chosen for the qualitative phase of the project. This research tool fulfilled the call for a multidimensional approach to studying the level of engagement of the at-risk population in a science specific classroom. Interviews were coded, and a consensus was drawn from the results. Overall themes that arose throughout the interview process were analyzed and compiled. The researcher was able to deduce the meaning behind the comments to each of the open ended questions on the follow-up interview. The mixing of the qualitative data was useful in getting clearer picture of the at-risk learning environment. Further, this approach added a better understanding of the effects of the TCLE on engagement for students at-risk in the science classroom.

Ethical Issues

The Internal Review Board at the University of Alabama gave approval (Appendix G) and the school district and principal (Appendix H) approved the project as well. Further, due to the participant-researchers’ involvement in the study and the relationships with the participants, bias may emerge. However, the researcher took necessary precautions to preserve the reliability of the gathered data and upheld the ethical interpretation of that data. In the case of the participant researcher, surveys were collected and interviews were conducted by a co-teacher to avoid bias. These precautions included efforts to maintain a low-stress atmosphere while

collecting survey data from students, audio-taping to facilitate accurate interview responses, and interview coding to refine and confirm student perceptions.

In order to preserve confidentiality of the data, all data were stored under two locks and key in the researcher's classroom file cabinet. Surveys and interview data were transported in such a manner as to reasonably ensure confidentiality of the data and anonymity of the teachers and students participating. Ethical issues of human treatment during research was adhered to the highest level. The researcher has taken all reasonable steps to avoid harming participants in any way and minimize the possibility of misleading or skewed results.

Data Analysis

The gathering of quantitative and qualitative data revealed patterns and constructs between the TCLE and the level of academic engagement for students at-risk in science class. The data were then analyzed to uncover links between the TCLE for students at-risk and the engagement level throughout the semester in science class. A one-way ANOVA was conducted to identify variations in engagement level results from the SEM surveys. The anonymous nature of the SPS did not allow a multi regression analysis. Therefore, individual t -tests were run on the subscale scores for the SPS in order to discover statistically significant differences for each learning environment. Additionally, a Bonferroni adjustment was implemented in order to counteract the problem of multiple t test being run.

Student interviews were administered to record follow-up qualitative data and beliefs about science engagement after exposure to the TCLE in science class. The purpose was to explore how the TCLE influenced engagement for students at-risk in science class. The researcher analyzed the coded data in a series of analyses and interpreted these findings with an overall picture of the connections between the TCLE and level of engagement for students at-risk

in science class. Student interviews with coded phrases or comments that were shared were analyzed and compiled to present a written product of the research in an effort to understand how the TCLE affects engagement of students at-risk in high school science class.

Summary

This research study investigated how students at-risk perceive the teacher created learning environment. Further, how this created learning environment affected at-risk engagement in science class was sought. The overarching research questions used to frame the research are “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” With the two sub-questions: “How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?” and “What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?” as seen in Table 3.

The researcher examined the quantitative data from students at-risk self-reporting surveys to gauge the level of engagement in science class. Six science teachers and their students from one of the two alternative schools for a large county in the southeastern United States participated in the explanatory sequential mixed method study.

Forms of quantitative data were gathered with the Science Engagement Measure (SEM), and the Student Perception Surveys (SPS). This quantitative data was used to identify the perceptions of the teacher created learning environment by the students at-risk and its effect on the level of student behavioral, emotional, cognitive, and social engagement. This survey culminated in a TCLE score for each science teacher.

Qualitative data were obtained by follow-up student interviews that assessed the level of engagement after exposure to the TCLE in science classes for students at-risk. The researcher then interpreted to what extent and in what ways the qualitative results explained and added insight to the quantitative results. Using qualitative data to further interpret the meaning of the quantitative data gave the researcher a better understanding of how finely tuned interventions focusing on the TCLE affected the engagement level for the at-risk population in science class. The research shed light on which of the multidimensional areas of student engagement is more essential for the at-risk population for academic success and how these students at-risk felt about their educational experience in the science classroom.

Research proceeded according to the schedule of Table 4.

Table 4

Timeline Schedule of Events

Stage 1: Prior to Week 1 (August 11, 2016)

- Proposal submitted and defended
- IRB approval request
- IRB approval acquired
- Calendar made to reflect potential teacher participation in the project due to teaching assignments for the school year.
- Collection of student consent and parental assent

Stage 2: Week 8

- Science Engagement Measure (SEM)

Stage 3: Week 10-12

- Student Perception Surveys (SPS) analysis
- Follow-up interviews
- Study data collection ends

Stage 4: Week 12 until complete

- Data analysis and conclusions
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CHAPTER 4

RESULTS

Introduction

During science department meetings during the previous school year, a team of science teachers met to discuss possible reasons for the low levels of student engagement in the classroom. Through these discussions about engagement, the teachers in the department agreed to participate in research in regards to the learning environment in each classroom from the students' perspective. Future discussions about survey data from the county, Student Perception Survey (SPS), led the teachers to wonder if the differences in student perception between the different classrooms affected the level of student engagement.

This study was conducted in order to investigate how the Teacher Created Learning Environment (TCLE) linked to the engagement level of students at-risk in five alternative school science classrooms. The entire high school science department team included five teachers from one of two alternative high schools located in a large southeastern state suburban county school district. This mixed method study used quantitative and qualitative data to explain the link between the TCLE and the level of student engagement in science classrooms.

The population in this alternative school site was composed of 148 students in grades nine through twelve with 98% classified as low SES, minority, and students at-risk who were given the option to attend this alternative school as the result of expulsion from the regular educational setting. Participants were 110 students at-risk in five classrooms ranging from grades nine through twelve. The instruments used to collect the data were from the student

perspective. This unique student perspective of these students at-risk in an alternative school was valuable. This perspective revealed firsthand knowledge of lived experience of students at-risk in an alternative school environment. More could be learned about the actual TCLE that was used as interventions to increase engagement. This would add understanding of how the relationship between the classroom environment and engagement for students at-risk interacts.

Findings presented in this chapter reflect how the TCLE affected the engagement level of students at-risk in science class. Other specific questions to be answered were: “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” With the two sub-questions being “How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?” and “What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?”

Quantitative Data

The two instruments used to gather the quantitative data considered in this research project were the Student Perception Survey (SPS) and the Science Engagement Survey (SES). The Science Engagement Measure (SEM) survey asked students to report on their level of engagement in science class. The SEM survey was only modified from its original version to exclude the word “Math” from the survey to make it relevant to the experience of students at-risk in science. The SEM was modified from the validated test created by (Fredricks et al., 2016). Students were asked to use a five point Likert scale to measure their level of engagement in four domains of engagement: behavioral, cognitive, emotional, and social.

For the first, quantitative, phase, a one-way ANOVA was conducted using the survey scores from the Science Engagement Measure (SEM) for each teacher group to determine if the engagement level was significantly different between teacher groups. Pseudonyms for the teacher names were assigned by the researcher according to characteristics of the teacher name or personality. Participants were classified into five groups: Smith ($n=9$), Davis ($n=10$), Cook ($n=19$), Hunt ($n=17$), and D ($n=20$). There were no outliers in the data, as assessed by inspection of a boxplot; data was normally distributed for each group, as assessed by Shapiro-Wilk's test ($p > .05$); and there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .552$).

The mean engagement level score increased from Davis ($n = 10, M = .22, SD = .83$), to Smith ($n = 9, M = .25, SD = 0.47$), to Cook ($n = 19, M = .45, SD = .68$), to Hunt ($n = 17, M = .57, SD = 0.70$), to Taylor ($n = 20, M = .62, SD = .61$) teacher groups, in that order as depicted in a box plot in Figure 2. Since $p > .05$, there were no statistically significant differences in SEM scores among the five teacher groups, $F(4,70) = .934, p = .449$.

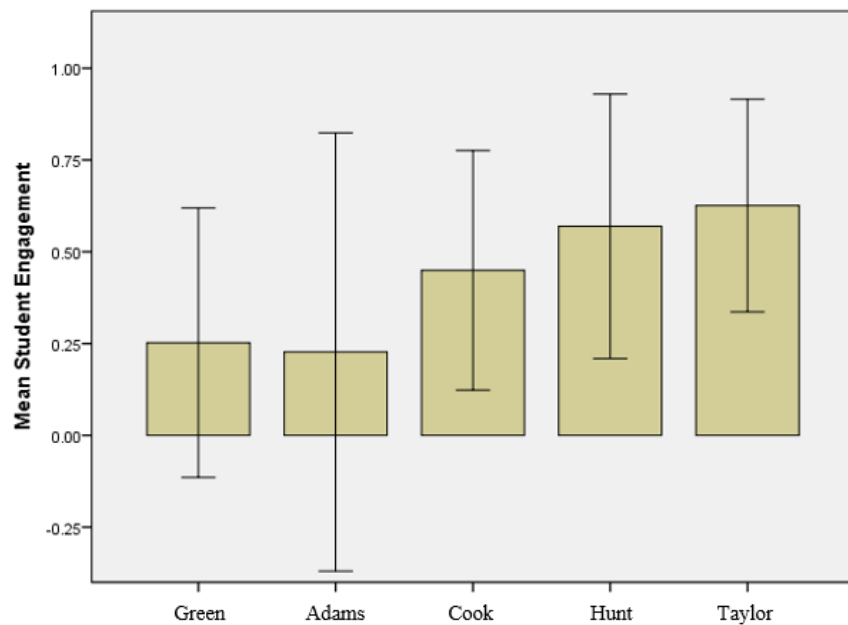


Figure 2. Mean Engagement Level.

For the second, quantitative phase, results from the Student Perception Surveys (SPS) were analyzed to address the second research question, “What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?” The researcher hoped to learn if there were correlations between the TCLE from the SPS score and the level of student engagement from the SEM results.

The researcher analyzed the data by looking first at the SPS mean score for each teacher. Results show that the mean SPS score increased from Smith ($M = 2.6$), to Davis ($M = 2.89$), to Hunt ($M = 3.22$), to Cook ($M = 3.25$), to Taylor ($M = 3.52$) teacher groups, in that order. These mean scores were for the teacher created learning environment (TCLE).

Mean TCLE rankings from the SPS scores are shown below in Figure 3.

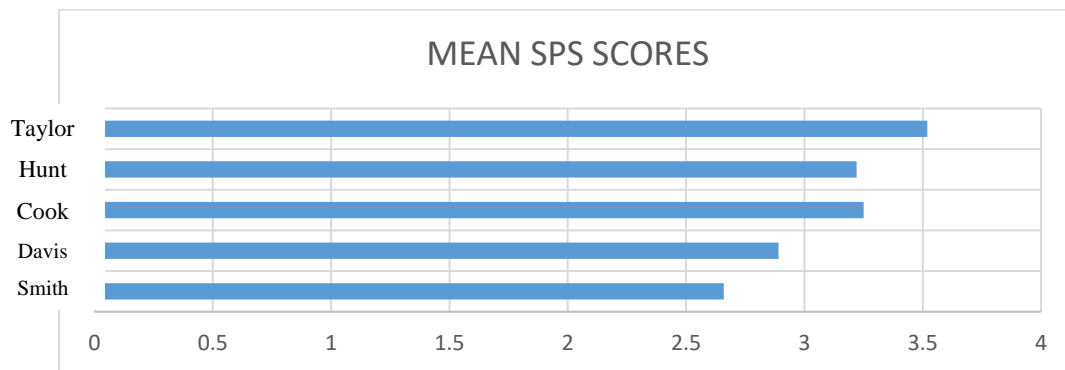


Figure 3. Mean SPS Scores for TCLE Rankings for each science teacher illustrated.

There were twenty questions on the SPS, which were subdivided into four sub-categories: Instructional Strategies (questions 1-5), Positive Learning Environment (questions 6-10), Differentiated Instructional (questions 11-15), and Challenging Academic Environment (questions 16-20). The mean SPS score for each of the subcategories that make up the Teacher Created Learning Environment (TCLE) are shown below in Figure 3:

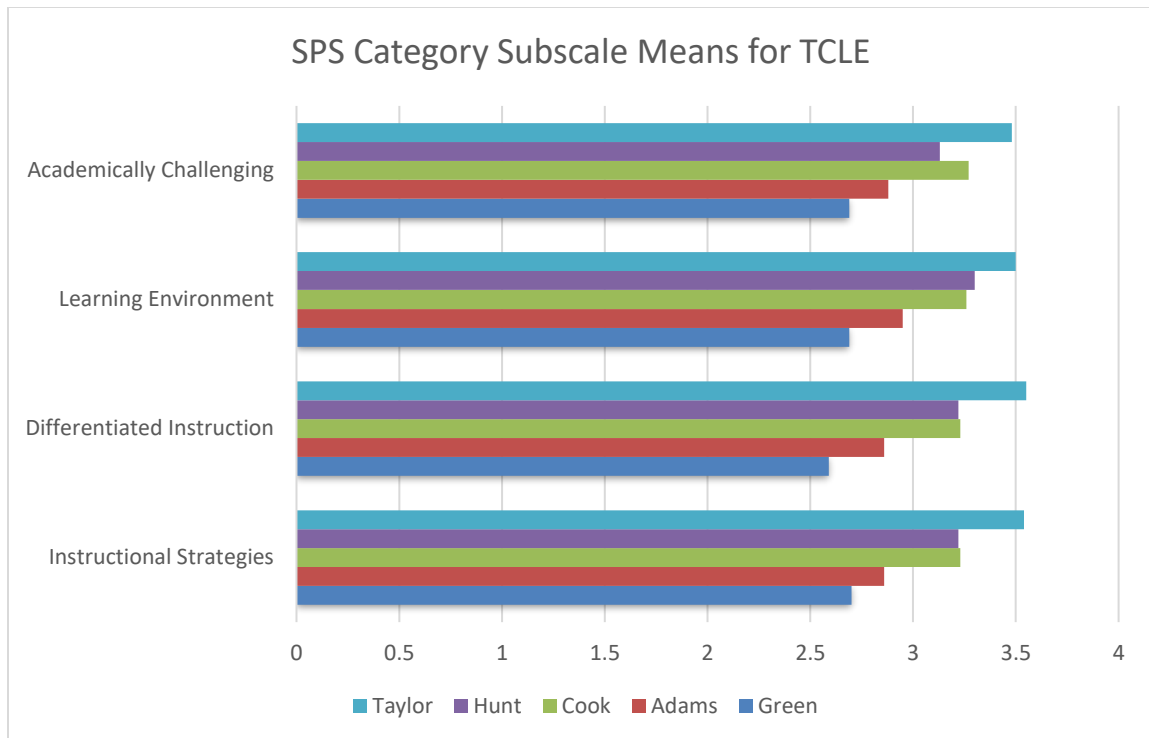


Figure 4. SPS Category Subscale Means for TCLE subcategories are illustrated.

All five teachers who participated in the research project submitted the county generated report for the SPS scores to the researcher. The report included the mean, standard deviation, and number of valid responses for each question on the survey. The individual scores of the SPS student surveys were not available to teachers or the researcher due to the anonymous nature of the survey. This presented a problem when trying to run a multivariate analysis. Therefore, the teacher means for the subscales were compared and each question was compared separately using t tests. In order to counteract the problem of multiple t test being run on the SPS data, the researcher implemented a Bonferroni adjustment. Therefore, based on the number of items in each subscale on the SPS, the alpha was corrected to .01. Instances where p values were less than .01 were considered significantly different. The teacher pairwise SPS category subscale comparisons that showed a significant difference are listed below in tables.

Questions one through five were categorized as Instructional Strategies. These questions related to the student perception of the instructional strategies employed by the teacher to encourage behavioral engagement in the classroom environment. They focused on whether the student perceived that the teacher encouraged them to participate in class, frequent checks on understanding, summarizing, and connecting assignments with several different sources. Pairwise comparisons, in Table 5, showed that Taylor was ranked higher than Smith on all five questions for the Instructional Strategies subscale category and were statistically significant. Pairwise comparisons in Table 6 showed that Taylor was ranked higher than Davis on questions 1, 3, and 5 for the Instructional Strategies subscale category and were statistically significant.

Table 5

SPS t-test: Smith v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t value	p value	Df
	Smith	v. Taylor				
1	2.74	3.62	.82	3.94	.000	26
2	2.66	3.62	.86	4.10	.000	26
3	2.66	3.48	.87	3.46	.002	26
4	2.70	3.48	.86	3.33	.003	26
5	2.77	3.48	.87	3.00	.005	26

Table 6

SPS t-test: Davis v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t value	p value	Df
	Davis	v. Taylor				
1	2.97	3.62	.82	2.87	.009	21
3	2.86	3.48	.87	3.40	.000	21
5	2.70	3.48	.87	3.18	.004	21

Questions six through ten were categorized as Differentiated Instruction, which focus the ways a teacher challenges and supports each student's learning by providing appropriate content and developing skills which address individual learning differences. Questions six through ten

center on the student perception of activities that are based on individual student needs, individual attention, clarification of content, and appropriate levels of assignments.

Pairwise comparisons, in Table 7, showed that Taylor was ranked higher than Smith in all five questions for the Differentiated Instruction subscale category and were statistically significant. In addition, pairwise comparisons, as displayed in Table 8, showed that Taylor was ranked higher than Davis on questions eight and nine for the Differentiated Instruction subscale category and were statistically significant.

Table 7

SPS t-test: Smith v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t	P	df
	Smith	v. Taylor				
6	2.51	3.51	.88	4.18	.000	26
7	2.59	3.55	.88	4.01	.000	26
8	2.48	3.62	.88	4.76	.000	26
9	2.81	3.51	.83	3.10	.004	26
10	2.59	3.55	.87	4.05	.000	26

Table 8

SPS t-test: Davis v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t value	p value	df
	Davis	v. Taylor				
8	2.86	3.62	.88	3.10	.005	21
9	2.88	3.51	.83	2.68	.000	21

Questions 11-15 were categorized as Positive Learning Environment and solicited the student perception of the emotional engagement methods instituted by the teacher to generate a positive learning environment. Questions 11-15 focused on an environment where the student feels comfortable asking the teacher questions, care, expectations for students, and respect for all shown by the teacher. Pairwise comparisons, as seen in Table 9, showed that Taylor was ranked

higher than Smith in all five questions for the Positive Learning Environment subscale category and were statistically significant.

Table 9

SPS t-test: Smith v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t value	p value	df
	Smith	v. Taylor				
11	2.77	3.62	.87	3.59	.001	26
12	2.74	3.48	.88	3.09	.005	26
13	2.81	3.51	.86	2.99	.006	26
14	2.48	3.51	.89	4.25	.000	26
15	2.59	3.40	.89	3.34	.002	26

Questions 16 through 20 were categorized as Academically Challenging Environment and garnered the student perception of social engagement strategies established by the teacher to inspire an academically challenging environment. The subset questions focused on the teacher use of challenging assignments, teacher influence, and teacher encouragement for exploring new learning situations. Pairwise comparisons showed that Taylor was ranked higher than Smith on all questions for the Academically Challenging Environment subscale category except for number 17, as seen in Table 10, and were statistically significant.

Table 10

SPS t-test: Smith v. Taylor Teacher Pairwise Comparison

Question #	Mean		SD	t value	p value	df
	Smith	v. Taylor				
16	2.74	3.48	.87	3.12	.004	26
18	2.62	3.40	.92	3.12	.004	26
19	2.59	3.40	.92	3.23	.003	26
20	2.59	3.48	.91	3.59	.001	26

The quantitative data showed that the only statistically significant pairwise comparison for all but one of the twenty questions for the SPS was between the highest ranked teacher

(Taylor) and the lowest ranked teacher (Smith). This finding indicates that there are few statistically different quantitative differences found between the five different Teacher Created Learning Environments (TCLE). The qualitative data should reveal how the students perceived the characteristics that distinguished each teacher as a result of the TCLE.

The mean scores of the SPS were compared to the mean score from the SEM. The results show that teachers with the higher SPS scores also had the higher SEM scores. In other words, teachers who attended to the learning environment specifically created for students at-risk experienced higher levels of engagement from their students at-risk in science class. This supports the notion that the TCLE is linked to the level of engagement for students at-risk. The SPS and the SEM score were positively correlated as noted below in Figure 5 with SEM score increased by one magnitude in order to visually compare.

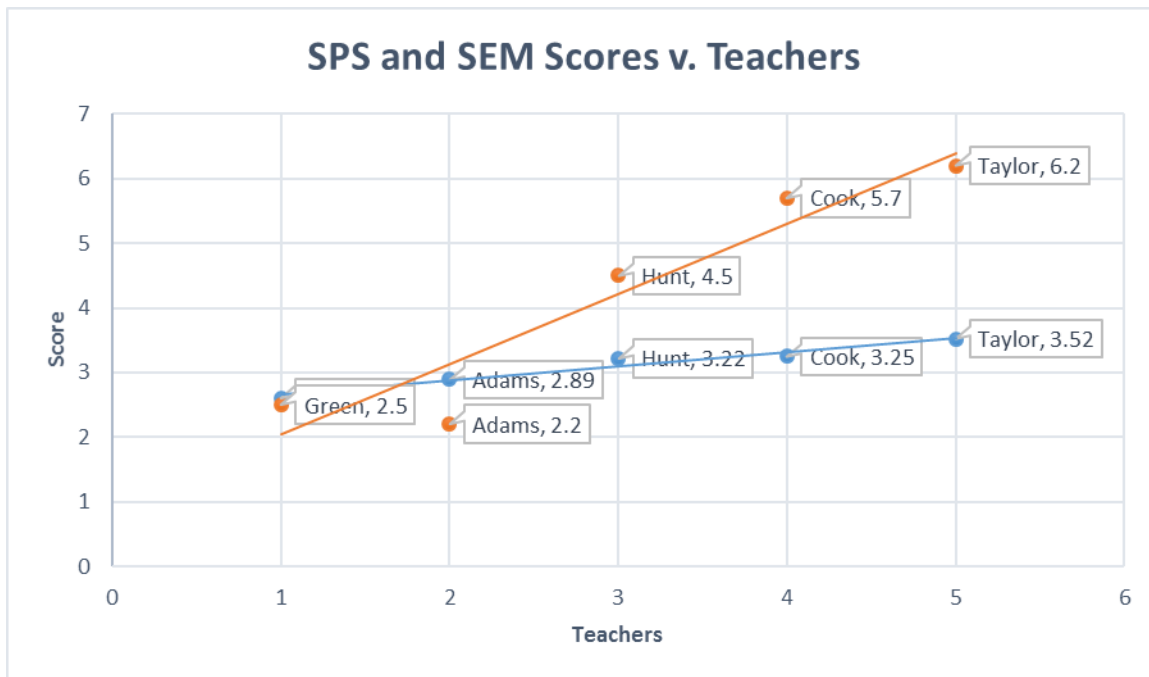


Figure 5. SPS and SEM Scores v. Teachers shows visual correlation.

Qualitative Data

In order to describe the relationship that existed between the student perception of the science classroom environment and the level of engagement, follow-up interviews were conducted. Sequential explanatory method requires that the qualitative data be shaped from the results of the quantitative results. Creswell and Clark (2013) recommended this method when a researcher wanted to use quantitative data to identify a grouping and qualitative data to follow up and get a clearer picture of research implications. Therefore, follow-up questions were formed with the concept that each question would elicit data concerning the “why” or “how” of student engagement related to the TCLE.

Although the questions were aligned with the different aspects of engagement represented in the SEM along with the corresponding learning environment sub-divisions found in the SPS, I did not address the validity of the interview questions. However, the follow-up interview questions were structured and exploratory in nature which was a useful function of the explanatory sequential mixed method used in this study in order to gather reliable data from students at-risk.

To clarify the link between behavioral engagement and instructional strategies, follow-up interview questions evolved from the results of the quantitative data. An example question “What kind of activities does your teacher use that encourages you to participate?” was asked to explain the relationship between the TCLE and behavioral engagement. To further explain the link between cognitive engagement and differentiated instruction, an example question “How does your teacher use different ways of teaching the same thing to others in class?” was asked. To make clear the link between emotional engagement and positive learning environment, an example question “How do you know your teacher cares about your learning specifically?” was

asked. To understand the link between social engagement and academically challenging environment, an example question “How does your teacher expect you to communicate science content to other students?” was asked. A complete list of follow-up interview questions is itemized in Appendix F.

All teacher classroom groups were chosen to participate in the follow-up interview in order to gather qualitative data on the student perceptions of the TCLEs and student engagement levels as determined by quantitative results from the SES and the SPS. The researcher utilized Microsoft Excel to produce random student numbers to be interviewed for each of the teacher groups. Pseudonyms were then put in place of actual student names in order to maintain anonymity between the reported data by student participants and the teachers.

The interviews were audiotaped and transcribed verbatim according to the research plan. The follow-up interview process was halted when the principal researcher completed eight randomly selected student interviews for each of the teachers for this portion of data analysis. The qualitative data was analyzed with an ongoing emergent design according to Saldonia’s (2013) two cycle approach to coding. The analysis included holistic coding strategies to identify themes from the interview data and in vivo coding to better explain the themes in reflection of the research questions. Specifically, “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” was the target for qualitative data.

When the forty interviews were completed, in vivo coding was performed to support emergent themes with specific strong evidence from participants’ experiences in participants’ words. The themes with their supports were categorized appropriately into clusters or groups with one overarching theme category. Overarching themes were aligned with the research

question to provide further insight. Data was coded and analyzed to obtain new understanding of how the SPS and SEM teacher scores were related to the student engagement level in each of the teacher created learning environments. Finally, in reflection of the new understandings obtained through the data organized using coding methods, the researcher synthesized a rich description of the perception of the participant students.

The categories for the qualitative data were coded according to the types of data elicited from the SES and the SPS. Each category heading is listed with an explanation to its rationale:

- **Instructional Strategies/Behavioral Engagement** - the student perception of the instructional strategies employed by the teacher to encourage behavioral engagement in the classroom environment.
- **Differentiated Instruction/Cognitive Engagement** - the student perception of the differentiated instructional strategies in place by the teacher to encourage cognitive engagement.
- **Positive Learning Environment/Emotional Engagement** - the student perception of the emotional engagement methods instituted by the teacher to generate a positive learning environment.
- **Academically Challenging Environment/Social Engagement** - the student perception of social engagement strategies established by the teacher to inspire an academically challenging environment.

Behavioral Engagement/Instructional Strategies

In this category, behavioral engagement refers to participation, effort, attention, persistence, positive conduct, and the absence of disruptive behavior (Fredricks et al., 2004). Instructional strategies described by Barge (2012) promote student learning by “using research-based instructional strategies relevant to the content to engage students in active learning and to facilitate the students’ acquisition of key knowledge and skills” (p. 20). The follow-up interview questions were asked to further explain how the students perceived their level of engagement via the teachers’ use of effective instructional strategies.

Taylor. Students reported that the TCLE produced by Taylor was exciting via effective instructional strategies that facilitated active learning. Students reported that they were engaged

in science class in part due to the variety of ways that Taylor delivered the content. These students at-risk explained that the variety of instructional strategies created an environment of active engagement by the variety of academic activities that met different interests. Particularly, students recalled the use of varied methods of hands-on activities. Carlos explained, “Taylor’s class is more hands-on, so I don’t just go to sleep anymore because I might miss something cool.” Maria added, “Taylor actually teaches us and doesn’t just give us a worksheet and say ‘do it’. Taylor “does lots of different things, not just take notes.” Julio expounded:

The egg experiment was cool because we were taking data every day and we could actually see how the egg was acting like a membrane. It would get big, then get small the next day. Some things went into the egg cell and some things would come out of the cell. It was really cool.

Experiments and the use of computers often increased student interest and engagement as well as student learning. Angel stated, “When we do labs, they are interesting. There are fewer people in class, so everyone gets a turn to do something, not just watch others do it.” Jill added, “Hands-on activities were nasty sometimes, but I think they’re are awesome!” Tom expanded:

I love anything to do with projects; actually seeing the changes over time are helpful to understand the process. Like when we did the experiment on food coloring in warm and cold water. Seeing the differences helped me get diffusion better.

Taylor demonstrated consistent use of the school-wide Positive Behavior Intervention Support (PBIS), which attributed to student persistence, positive conduct, and the absence of disruptive behavior. The PBIS system gave students incentive to earn “GIVE Bucks” for following classroom expectations such as completing assignments in a timely manner or staying in dress code. Over a semester, students are given rewards from the PBIS committee that range from a candy bar, shoe game day, or quarterly celebration that included a video game bus, pizza party, cook out, and a movie.

GIVE Bucks were accumulated through the week and given to the students on Friday in Taylor's class. Then the GIVE Bucks were put in the "bank" to credit the students' account.

Julio stated, "My other school never did stuff like that (quarterly celebrations), but I like it a lot.

The game bus is my favorite." Carlos explained:

I like the "pay day" at the end of the week, because you know, if you do your work during the week, you know you're going to get rewarded for it. So, I feel like that pushes us to do the work more.

Angel agreed:

I like pay day, because I got to wear my new Jordan's to school one time on a Friday. I earned a lot of bucks in science class so far. I want to go to the celebration too. My friend won last time and said the burgers are the best.

Hunt. Hunt's class was computer based due to the fact that Hunt's roster was composed of different grade levels and courses (e.g. physics, biology, environmental science) at the same time. However, participants in Hunt's class also reported enthusiastic levels of behavioral engagement due to the use of effective instructional strategies. Students discussed how Hunt recognized the individual needs presented by the students in class, but was able to meet those needs through the level of attention paid to each individual student. Hugo stated, "Hunt recognized that I was not in the same place as some other students. Hunt started me off with simpler stuff and then moved on to harder stuff." Ellen added, "I'm doing credit recovery; and Hunt keeps me on track to finish the assignments and labs I need in order to move on to the next unit."

Participants testified that Hunt used several ways to explain content to the students, since there were always students working on different subjects in the classroom. Tay elaborated, "We get 'one-on-one' attention and have a lot of different activities, like readers' theatre, and all the different labs. We hardly did those at my other school 'cause there were so many kids."

Cook. Cook used a variety of strategies to connect her students to the academic tasks. Cook used computer simulations, online science games, and interactive labs to encourage behavioral engagement throughout her classroom setting. Students added that Cook typically used one way to deliver the material during her class, but noted that Cook was still exciting. They explained that the one strategy Cook chose to deliver the content was varied enough throughout the semester to meet the individual needs of the students.

Engaging role play was one specific method of engagement mentioned in several student responses. Students assumed roles of an investigator team at a crime scene and argued their findings to others. Shan elaborated, “Labs are fun. Electricity labs, and forensics labs are the best. Looking at bullets through magnifying glass got my interest.” Joe said, “Computer simulations are awesome! Quiziz (online question/ answer competitions) is my favorite review game.” Jane proclaimed, “Labs like the electrical circuits helped me understand the way electricity moves.”

There was a mixed response for Cook when participants were asked about how they felt when they realized science class was next. However, most students felt that Cook made sure to demonstrate her concern for each individual learner. Participants noted the dichotomy of individual and group work that persisted in Cook’s class. In conclusion, they noted that group work was popular at the beginning of the semester, but waned as the semester progressed.

Davis. Participants reported that Davis had difficulty getting them to engage cognitively in class due to her choice of content delivery and energy level. Students stated that Davis struggled with finding ways to deliver the content and primarily relied on teacher-centered activities that failed to keep their engagement level high during class. Further, some responses were blunt when students in Davis class was asked their feelings when they realized science

class was next. When asked about the teacher encouraging students to learn in science class, students reported that there was little active engagement in the classroom environment.

Ultimately, participants struggled to express the social engagement aspect of Davis's class portraying the idea that there was little to report about this essential factor within the classroom.

Smith. Participants were reserved in their response concerning the instructional strategies and behavioral engagement of her classroom. Many of the students really did not want to talk about how they felt about Smith's classroom environment. Tammy exclaimed:

Smith doesn't seem to care if we are having a tough day. Like zero sympathy. If we get stuck on something, Smith doesn't help us most times and when we ask her for help, Smith just says 'we went over that already several times last week.'

Scott added, "Smith is just here to get her job done...the way Smith just gives us the assignment and Smith is done." Amy agreed, "Smith seems uptight a lot. We don't usually talk much to her because Smith gets so mad and says 'Are you serious right now!' So, we just keep conversations as short as possible."

Differentiated Instruction/Cognitive Engagement

Differentiated instruction was defined as instruction in which "The teacher challenges and supports each student's learning by providing appropriate content and developing skills which address individual learning differences" (Barge, 2012, p. 28). The follow-up interview questions were asked to further explain how the students perceived their level of engagement via the teacher's use of differentiated instructional strategies.

Taylor. Participants reported that Taylor used a variety of instructional methods to provide the content prescribed by the county and allowed students to demonstrate their learning. Carlos stated, "Sometimes we get to choose how we want to learn. We can choose the video lesson, PowerPoint notes, or use our text book. It is nice to pick what I feel like that day." Jill

said, “I like that we can decide how to complete our projects. I can create a My Story video, poster, or essay.” Angel agreed, “It’s better to have a choice on the way I turn in my work. I like making posters since I want to be an artist one day.”

Taylor also ranked first in differentiated instruction according to the results of the SPS. Participants noted the reasons for their persistence, positive conduct, and the absence of disruptive behavior were related to the strong use of differentiated instruction. Students especially valued that they were allowed to demonstrate their learning in various ways. Angel exclaimed, “It’s better to have a choice on the way I turn in my work. I like making posters since I want to be an artist one day.” When students were engaged in a variety of ways, behavior became less of a concern to the teacher as the absence of negative behavior prevailed

Hunt. Participants reported that Hunt used several ways to explain content to the students, since there were always students working on different subjects in the classroom. Hunt was deliberate about helping each student complete the unit that they were working on in order to receive credit for the class. Paul replied, “Sometimes, there would be labs set up for some students, a video playing on the board, and several students working on the computer.” Susie said:

Hunt always found ways to make the lesson interesting to me. One day, we walked around the school yard and picked up as many different kinds of organisms we could find. Then we went back to class and talked about how they depended on each other.

Susan reiterated, “If I didn’t understand the book, Hunt would point me to a video on eCLASS that was easier for me to get.”

Students also expressed appreciation to the differentiated instruction used in Hunt’s class. Hunt was ranked third by a thin margin in this sub-category of TCLE as noted in Figure 3. A positive learning environment was paramount to Hunt as students responded to the fact that Hunt

had the ability to guide them with on-task activity, even in this multi-level classroom. For example, Ellen said, “I’m doing credit recovery; and Hunt keeps me on track to finish the assignments and labs I need in order to move on to the next unit.” Tay elaborated, “We get one-on-one attention and have a lot of different activities.” Clearly, students were engaged with academic activities aimed at helping them move forward. Hunt made sure that the academic needs of each student was met.

Cook. Students reported that Cook typically used one way to deliver the material during her class; however, Cook was still exciting. They explained that the main strategy Cook chose to deliver the content was varied enough throughout the semester to meet the individual needs of the students. One example came up frequently of how the class contacted a local lawyer and had a mock trial in which students argued evidence they had processed in class labs. Ariel said, “Cook taught the same way to all of us, but Cook switched her style a lot. One day we were role playing at a crime scene, and the next we were analyzing DNA reports.” Mandy confirmed, “We all did the same thing, but it was interesting because I liked to figure out the crime scenes and argue our findings with the lawyer. She was awesome.” Nick replied, “The real thing is not like the TV shows. The details at the crime scene were like telling a story.”

Several of the students expressed interest in the field of criminal investigation because of the effectiveness of Cook’s classroom proceedings. The opportunity to bring the field of criminology to her students was valuable. Nick said, “The trial of that one murder scene was something that made me very interested in becoming a CSI agent.” Shan went further:

I want to know how much CSI investigators earn around here. I kind of got a rush when we were live on cameras with the lawyer talking about the weapons used at the crime scene. I could see myself as a crime scene investigator.

Davis. Students reported that Davis struggled with finding ways to deliver the content and primarily relied on teacher-centered activities that failed to keep their engagement level high during class. Todd replied, “A little bit of variety. Davis puts on a movie once in a while. Mostly we do PowerPoints and fill in notes. Gets kinda old, but at least we get to use the computer a lot.” Susanne disagreed:

No. It’s boring. And all we do is take notes. At times, I don’t want to pay attention; because it’s the same thing over and over. Sometimes, put my head down or I just doodle and wait for the bell to ring.

Participants also reported that Davis had difficulty getting them to engage cognitively in class due to her choice of content delivery and energy level. Scott said, “Davis is very calm, chill, and a little boring.” Todd added, “Davis stays quiet. Davis always says, ‘be quiet and do your work all the time.’” Scarla explained, “Almost every day, we have worksheets to do. Notes, notes, notes.” Tabetha reiterated, “We still haven’t done any projects yet.” Albert disagreed though, “We know exactly what to do. We come in and write down our EQ and get to work, I like it that way”.

Smith. Participants seemed timid about discussing the differentiated instruction in Smith’s class. Tammy said, “Basically, Smith teaches one way to us all. Smith may write it on the board or tell us to get our computer.” James agreed, “Mostly we just take notes a lot. If it’s not notes, we work on the computer.” Oren expounded:

If you ask questions, Smith just says, ‘It’s on eCLASS’, that’s it. We have to figure out what’s going on by our self or ask another student. I’d rather have someone tell me how to do it than figure it out on a computer.

Steve chimed in, “Once Smith explains it to the class the first time, Smith doesn’t explain it again. Plus, I try to sleep a lot in there, cause it’s boring, Smith plays ----- music all the time and it gets me in sleepy mode.” Amy further states:

Smith's class is a working class. We come in and get our computer and do our work. We do some labs like solutes and all that stuff, but mostly we just take notes a lot. If it's not notes, we work on the computer.

Davis. Participants ranked Davis as the fourth most effective learning environment according to the SPS results shown in Figure 4. Davis had difficulty getting students cognitively engaged in her class due to the lack of variety in her content delivery and energy level. Students stated that Davis relied on teacher-centered activities, which kept their engagement level the lowest of all teachers as seen in the SEM results in Figure 2.

Positive Learning Environment/Emotional Engagement

The Positive Learning Environment was characterized by Barge (2012) as an environment where "The teacher provides [a] well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all" (p. 43). To create an engaging and enriching environment for students to learn, positive learning environment teachers included guidelines for expected behavior, on-task students, respect for relationships within the classroom, use of humor, and showed concern for their students (Barge, 2012).

Taylor. Students expressed appreciation to the positive learning environment created in Taylor's class when asked about their anticipation of science class. Julio said that when he knows he is about to go to science, he feels "good, cause I have a teacher who actually teaches us and doesn't just give us a worksheet and say 'do it'." Another student, Maria, added, "It makes me feel like I start my day off right. I love science class, it has more energy than any other and it makes me want to actually do something." Jill added "I get excited because it's a class I like and don't have a problem with." Overall, students were in agreement that they looked forward to science class and enjoyed the environment. Jill expounded:

When working on projects the teacher doesn't get mad when we don't get the instructions the first time. Most teachers just get mad and don't want to tell us again, but if we don't

understand Taylor just goes over it in different ways so that we can know what to do. I don't feel worried about asking [him] questions.

When asked "How do you know your teacher cares about your learning specifically?"

students reported that Taylor had a way of expressing concern for each student. Jill explained, "If we ask him to help us, Taylor ends up helping with the entire thing. Some teachers just help as little as possible." Tom added, the teacher "motivates me to get started and continue until I finish my assignment. If the teacher didn't care, Taylor wouldn't check on me so much. Taylor is so enthusiastic about science. I like it better because I've learned a lot of new things." Will showed his enthusiasm:

If Taylor sees us struggling, Taylor offers to help without us asking and makes sure everyone is awake and paying attention. I like the jokes and stories about life to get us interested in what we are doing.

Angel exhibited appreciation for the care demonstrated by Taylor:

The teacher actually helps you when you need it here because there are not too many students trying to get the teacher's attention. Last year, they would just get mad. The teacher actually listens to us and doesn't get mad for asking a question. The teacher is more approachable here. It's a more relaxed environment and I feel better about asking the teacher or other students if I don't understand something we are learning.

Hunt. Students reported a "larger than life" Hunt in the classroom due to an easy-going nature. When students were asked, "How do you feel when you realize science class is next?" participants agreed that Hunt created an exceptional learning environment. Susan replied, "Great! It's really easy the way Hunt puts things. Hunt talks to me on a personal level and wants me to continue doing my work". Paul said, "Hunt makes me like science even more because of the way Hunt runs the class."

Making a personal connection was evident by the response to the question "How do you know your teacher cares about your learning specifically?" Jesse replied, "I love science class. When I first got here, Hunt spent extra time helping me get used to the way things work here at

this school. I could tell Hunt was trying to help me since I was new.” Paul explained, “If I am having a bad day, Hunt comes up to me and encourages me to try to finish up my work so I won’t get further behind.” Tay made a comment about how Hunt puts a focus on recognizing positive behavior instead of harping on the negative, “At my home school, they don’t reward you for good behavior like Hunt does, but punish you for bad behavior. I like that they look for the positive instead of always looking for negative things here”. Susan expounded:

Even though we got here for being bad, my teacher tries to help me do better. I might even graduate since I’m doing well now that Hunt is helping me keep focused on my credit recovery. I might even be able to graduate early since I am moving so fast right now. It gives me hope.

Jaylen also said:

Hunt can see when I don’t feel like doing the work, Hunt comes over and talks to me about life in general. Like, Hunt was telling me about personal struggles, but reminds me that life is hard, but you have to keep going in order to be successful. Hunt is my favorite teacher.

Cook. There was a mixed response for Cook when participants were asked about how they felt when they realized science class was next. Shane exclaimed, “I love it!” Mandy replied, “Not the worst class, that’s for sure.” Joe responded, “Next class up.” However, most students felt that Cook made sure that care about each individual learner was present. Jane replied, “If I don’t get it, Cook will sit down with me and help me understand.” Austin said, “If you fall asleep, Cook wakes you up and makes sure you do your work.” Nick and Shan agreed, “Cook keeps me up with my work” and “makes me stay caught up.”

Davis. Some responses were blunt when students in Davis’s class was asked their feelings when they realized science class is next. Scott said, “I don’t know, I don’t want to go.” Susie was more to the point, “I can’t learn anything with her in my ear. If I’m doing something, Davis just interrupts me all the time.” Other students were more favorable in their response.

Todd replied, "I like her class." Albert added, "Davis's class is easy, just do what's on the board and don't bother anyone else."

When asked about the teacher encouraging students to learn in science class, students reported that there was little active engagement in the classroom environment. Alan replied, "Davis just puts the work on the board, and talks about it for a few minutes and then makes us work on the laptop. We only did like one experiment." James reiterated, "Davis doesn't. Davis just gives us our work, shows us our notes, and tells us to stop talking. It's like library time or something. It makes me want to fall asleep or do something else." JT sheepishly admitted, "It's so quiet in there most of the time. I always fall asleep."

Students had little to say when asked if they felt like their teacher cared about their learning specifically. Albert said, "Davis asks me how I'm doing sometimes." Scott added, "Davis only helps when someone asks. Davis walks around and looks to see what we are doing, but doesn't offer help unless we ask." JT concluded, "Davis doesn't talk about personal stuff to me, that's for sure."

Smith. Participants struggled to find positive things to say about Smith's emotional environment in her classroom. When asked about how they felt when they realized science class was next, students replied harshly. James said, "You don't feel like going. Smith surprises you with things like tests and stuff we don't know is going on. It's like Smith is a robot sometimes." When asked about the encouragement to learn science, Amy added, "Smith's music always puts me to sleep." Billy was not as reserved, "Smith plays ----- music all the time, it sucks. Smith just says 'I don't think so' when we ask if we can play something different. Seems selfish to me."

Academically Challenging Environment/Social Engagement

The Academically Challenging Environment was defined by Barge (2012) as one in which “The teacher creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners” (p. 53). Social engagement stems from the increased emphasis on collaboration and cognitively challenging tasks in science classrooms (Fredricks et al., 2016).

Taylor. Student responses portrayed a healthy social engagement network created by Taylor. Carlos replied, “Groups are more interesting to compare answers and ideas. Its better when the teacher can’t come to you as fast and I can just ask the other group members to see what they are thinking.” Angel added, “I like working with other people better because we can help each other if I don’t know what I’m doing.”

Other participants responded by admonishing the benefits of having both independent and social learning sessions. When asked about working in groups or alone, Carlos replied, “I like to work in groups, but I actually seem to get more work done when I work independently.” Julio said, “It’s not as boring when we mix it up and work in groups some days and by ourselves on other days.”

Jill expounded on the self-directing opportunities available in Taylor’s class:

Both, I like the variation of working with groups and by myself. The teacher lets us work in groups sometimes and other times we work on eCLASS on our laptops. I enjoy these sessions because I can work at my own pace on the topics that interest me the most.

Hunt. Participants were excited to tell about the details of Hunt’s academically challenging environment when asked to talk about the social aspects of this mixed-course classroom. Susan said, “Everyone is working on their own assignments. So, some are doing

experiments, some are reading or writing, and others may be in a small group working on a project.” Paul added:

Hunt juggles a lot of different activities because there are students working on different courses. I’m trying to finish biology, cause I failed it last year. It’s cool because Hunt knows how to set everyone up to get going on what they need to be successful in science.

Jesse talked about how Hunt, “Helps [her] be successful because Hunt talks to me about how to keep myself focused on getting all the assignments done in order to complete my forensics class.” Jaylen added, “Hunt keeps us focused on what each of us need to do in order to pass our class. It may be computer day for me or work on an experiment, but I know what I need to do.”

Cook. Participants noted the dichotomy of individual and group work that persisted in Cook’s class. They noted that group work was popular at the beginning of the semester, but waned as the semester progressed. Tellis reported, “We did that at the beginning of the year, but not so much lately.” Mandy added, “Group work slowed down after we did the crime scene and mock trial. We have been focusing on individual work lately so that we can focus on our own needs before the mid-term test.” Others had differing opinions. Ariel noted, “We sit at tables, so we are in groups already if we need to ask a peer about something.” Shan added, “We did argue our evidence to the class and the lawyer in that one unit, but we haven’t presented to like just the students.”

Davis. Participants struggled to express the social engagement aspect of Davis’s class. When asked about group work, students replied sparingly. Scott exclaims, “Once in a while. Davis puts us in groups and tells us to do our work.” Todd adds, “Not in my class. Davis tells us to work with the person next to us. If we aren’t sitting beside someone, we do it by ourselves, which is fine with me.” When asked about communicating science to others, Susanne blurted out, “We don’t talk to other students about what we are learning very much.” When asked about

whether or not Davis challenges them to learn about science, little enthusiasm followed in their responses. Albert replied, “Once in a while we do labs.” Scott bluntly said, “Not really.”

Smith. Students also had little to say about Smith’s social engagement atmosphere. When asked about working in groups, Billy replied, “Only when we do labs.” James added, “Sometimes Smith will tell us to pair up. Smith doesn’t say who gets to group though.” Tammy expounded:

We work in groups sometimes, but some of us think it’s better to work individual, cause some people don’t know how to express themselves and it gets a little bit loud and crazy. So, we work alone on our computers most times. It works better.

When asked if they are challenged to learn new things, Amy replied, “We just follow the county pacing guide, that’s all Smith cares about doing. Regarding communication of science content to other students, James replied, “No. We don’t work like that. We just do our own work.”

Smith’s social engagement atmosphere fared no better from the students’ perspective on the SPS mean comparison and pairwise t-test analysis. Smith was ranked last place on the SPS and scored significantly worse than three other teachers on seven of the twenty questions related to academically challenging environment as seen in Tables 17 and 19. When discussing group work, Tammy reported, “it gets a little bit loud and crazy. So, we work alone on our computers most times. It works better.” Further James added, “We don’t work like that. We just do our own work.” Social learning is an important strategy for learning scientific concepts. Without it, students lost opportunity to learn from each other and to experience scientific dialogue as seen in the crime scene investigation and mock trial in Cook’s class.

Teacher Summary

Taylor. The mean score for Taylor on the SEM was .62 and was ranked number one in this survey that measured the perceived level of student engagement. Taylor also ranked number one with a score of 3.52 on the SPS, which measured the student perception of the TCLE. Follow-up interviews revealed specific reasons for this ranking. Looking at each subscale category, Taylor exhibited the ability to create a learning environment that was favorable for higher levels of engagement of students at-risk. Specific techniques included focusing on positive behavior, aspiring to lower the affective-filter, using humor, and showing personal concern for students.

Hunt. Students recounted a “larger than life” Hunt in the classroom due to an easy-going nature. In fact, Hunt scored the second highest in the positive learning environment sub-category of the TCLE as noted on Figure 3. Students demonstrated that they were emotionally engaged with Hunt’s class when students were asked, “How do you feel when you realize science class is next?” Participants agreed that Hunt created an exceptional learning environment. Paul explained, “If I am having a bad day, Hunt comes up to me and encourages me to try to finish up my work so I won’t get further behind.” Jaylen shared, “Hunt was telling me about struggles, but reminds me that life is hard, but you have to keep going in order to be successful. Hunt is my favorite teacher.” Students did not often give out compliments to teachers. However, they did speak up when they were impacted by someone on a personal level. Participants were excited to tell about the details of Hunt’s TCLE and aspects of this mixed-course classroom.

Cook. Although Cook was ranked third in the positive learning environment by a small margin on the SPS as seen in Figure 4, Cook was still a top scorer for engagement of her students overall with a score of .47 on the SEM. Cook was the second highest mean score for the SPS

measure as well. Cook made sure that concern for each individual learner was demonstrated. Cook made it a point to make sure that each student felt that Cook was “in their corner.” Jane explained, “If I don’t get it, Cook will sit down with me and help me understand.” Shane further exclaimed, “I love it!” Those words were hardly ever spoken in the at-risk, alternative school. However, students responded to teachers who encouraged a positive learning environment when they were given the opportunity.

Cook ranked second on the SPS subscale category of academically challenging environment. The highly engaging project of crime-scene analysis and mock trial with a practicing lawyer inspired students to rank her so high. However, participants noted the dichotomy of individual and group work that persisted in Cook’s class. They noted that group work was popular at the beginning of the semester, but waned as the semester progressed. Tellis reported, “We did that at the beginning of the year, but not so much lately.” Mandy added, “Group work slowed down after we did the crime scene and mock trial. We’ve been focusing on individual work lately, so we can work on our weaker areas before the [mid-term] test.”

Davis. Students did not seem to connect with Davis on many levels in the TCLE. Not only were students engaged at the lowest level on the SEM, Davis was second to last on the SPS. Students complained about the lack of energy and enthusiasm for science. Other complaints focused on the fact that they only learned new material from a teacher-centered orientation. Some responses were very blunt when asked about their feelings about the learning environment overall in her class. Scott stated, “I don’t want to go.” Susie was more to the point, “I can’t learn anything with her in my ear. If I’m doing something, Davis just interrupts me all the time.” In fact, Davis scored the lowest of all teachers in the positive learning environment sub-category on the SPS (see Figure 4).

Smith. Participants were nervous about discussing Smith’s classroom learning environment. When they did comment, it was negative. Smith scored the lowest average student engagement score with a 2.6 on the SEM. Students self-reported the lowest level of engagement in her class. Smith also scored significantly lower more often than any other teacher when comparing t-test scores on all sub-category questions related to the TCLE. When responding to Smith’s instructional strategies, Tammy exclaimed, “Like zero sympathy. If we get stuck on something, Smith just says ‘we went over that already several times last week.’”

Students replied harshly when asked about how they felt when they realized science class was next. Students seemed detached to the learning environment employed by Smith in many ways. James said, “You don’t feel like going. Smith surprises you with things like tests and stuff we don’t know is going on. It’s like Smith is a robot sometimes.” Steve chimed, “I try to sleep a lot in there, cause it’s boring, Smith plays ----- music all the time and it gets me in sleepy mode.” Smith did not make connections to students on a personal level; in turn, her students did not engage in the science classroom.

Summary

The researcher used two surveys to gather quantitative data and a follow-up interview to compile qualitative data in this explanatory sequential mixed method study to address the following research questions: “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” With the two sub-questions:

1. How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?

2. What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?

This study was conducted in order to investigate how the teacher created Learning Environment (TCLE) linked to the engagement level of students at-risk in five alternative school science classrooms. The measure for the TCLE was taken from the Student Perception Survey (SPS), which was a county-wide electronic perception survey given anonymously to every student in the county. The quantitative measure for the level of student engagement was gathered through the administration of the Science Engagement Measure (SEM), which was also a student perception survey given to assenting students. The qualitative data were gathered via follow-up interviews with forty randomly selected students in order to gain more understanding of the relationship between the TCLE and engagement for students at-risk in science class. This qualitative data was then coded both holistically and using in vivo coding. Qualitative data was then used to explain the findings of the quantitative data per the explanatory sequential mixed methods approach, using the research questions as a guide.

Responses to the follow-up interviews revealed that the level of enthusiasm towards the teacher followed the pattern found in the quantitative results. Mainly, more positive and revealing comments were made in correlation to the higher ranking teachers on the SEM and SPS measures. Less enthusiastic and negative comments followed for teachers scoring lower on the SEM and SPS measures.

CHAPTER 5

DISCUSSION

Introduction

The aim of this mixed methods sequential explanatory study was to answer the research questions: “What are the factors of the teacher created learning environment that were best suited to maximize engagement for students at-risk?” With the two sub-questions:

1. How do the measured levels of teacher created learning environment relate to the level of engagement for students at-risk in science class?
2. What relationship exists between the student perception of the science classroom environment and the measured level of behavioral, cognitive, emotional, and social engagement for students at-risk in science class?

Quantitative data was collected to determine the student perception of the teacher created environment and the level of student engagement in science class. Qualitative follow-up interviews provided the data needed to explain the results of the quantitative data.

This study attempted to explain the link between the learning environment and the engagement of students at-risk in alternative school science class. The study pursued the student perception of the environment that teachers create for students at-risk. It also sought to emphasize the most effective interventions for students at-risk who face multiple risk factors concurrently.

The quantitative questions of the Student Engagement Measure (SEM) did not relate fully to the actual engagement level of students at-risk and yielded no statistically significant difference between teacher groups. The quantitative data from the Student Perception Survey (SPS) did report statistically significant differences between Taylor (highest ranking) and Smith and Davis (the two lowest ranking teachers) on the SPS only after t tests were run using the subgroup questions and a Bonferroni adjustment of the p value to $< .01$. Therefore, the weak quantitative correlation found in the t test suggests that student perceptions are not related to the level of engagement and the learning environment. However, the qualitative data revealed that teacher strategies used by Taylor, Hunt, and Cook are related to increasing engagement of students at-risk. In fact, significant differences between the top three scoring teachers and the bottom two teachers in terms of engagement and the Teacher Created Learning Environment (TCLE) were identified.

Through the words and phrases of the students from the follow-up interview, the qualitative data revealed that the top teachers used strategies that were effective for increasing engagement for students at-risk. Mainly, the employment of effective instructional strategies, differentiated instruction, a positive learning environment, and an academically challenging learning environment were used to increase levels of engagement for students at-risk.

The Gap in Research

Authors from the literature review noted that more research specific to alternative schools with a high population of students at-risk was needed to inform best practice (Lehr, Tan, & Ysseldyke, 2009; Riele, 2007). Specifically, there was a need for research exploring how the classroom environment is linked to the level of engagement of students at-risk (Klem & Connell, 2004), lack of subject-specific studies (Fredricks et al., 2016), and lacking studies

within the at-risk population. Additionally, studies that included the social engagement were sparse and of primary concern for research, since new initiatives place social learning as a priority (Blumenfeld et al., 1991; O'Donnell & Hmelo-Silver, 2013).

Filling the Gap

This study addressed many of the gaps identified in previous literature. One of the benefits of completing research in an alternative school was that it helped fill the gap on specific findings in relationship to engagement and learners at-risk. This study took place in an alternative school which had a population that was 100% at-risk. This study addressed the lack of research linking the level of engagement as to classroom environment, added research on the social and emotional facet of engagement, and most importantly, sought to explain how engagement of students at-risk could be measured more thoroughly using qualitative data and quantitative data combined. Finally, this study emphasized the importance of qualitative data when eliciting true perceptions of how the learning environment affects engagement with students at-risk.

Blended Explanation of Findings

A prominent feature of the mixed method explanatory sequential study was employing qualitative data to explain the results of the quantitative data. The SEM and SPS measures were used to indicate how the TCLE effected the level of engagement for students at-risk in science class. A surprise finding was that the quantitative data from the SEM was not effective at identifying the differences between the engagement level of students at-risk in the different TCLEs. The only statistically significant findings from the quantitative data came from pairwise comparisons of the SPS score between Taylor (highest ranked) and Smith and Davis (lowest ranked). The qualitative data helped to explain the difference in the TCLE more effectively than

the quantitative data. In other words, when studying students at-risk, researchers must consider the qualitative data as the foundation for understanding teacher strategies aimed at increasing engagement. The qualitative data further solidifies the finding that students at-risk first become engaged emotionally with the teacher; this engagement extends socially to the classroom, and engagement then peaks with the content.

One premise of this research indicates that differences in engagement levels of students at-risk in science class is related to differences in the strategies used by certain teachers. The qualitative interviews give a more accurate understanding of these differences than do the quantitative results of the SEM and SPS. The blended explanation supports this premise as noted below.

Relationship to Research

The relationship of this mixed method explanatory sequential research project to the literature was significant in many ways. Among the most notable relationships were: 1) the specific needs of at-risk learners in an alternative school setting, 2) the best suited environment for students at-risk, 3) Krashen's Affective Filter, and 4) the correlation between the TCLE and the level of engagement of students at-risk attending alternative school.

Alternative Students At-Risk Needs

In this study, the researcher found that attending to the emotional state of students at-risk was essential to increasing levels of engagement. In addition, a sense of hope and determination arose in students from connections made on emotional levels as students reported that Hunt, Cook, and Taylor were effective at increasing engagement for students at-risk by creating an emotionally engaging environment. Both quantitative data and qualitative data from the follow-up interviews were consistent with previous research conducted by Finn in 1989. Finn (1989)

found that the need for emotional engagement took priority over behavioral and cognitive engagement, because at-risk populations were not able to engage in those higher order domains until they engaged emotionally or felt cared for by the teacher.

The researcher in this study also concluded that the qualitative data and scores on the SPS indicated that students' behavioral engagement was lower due to ineffective instructional strategies employed by Smith and Davis. Students revealed in the qualitative data that these teachers were boring and that they took notes most of the time. The strategies used by Smith and Davis negatively affected the student level of engagement in science class evidenced by their low ranking on the SPS and SEM surveys and comments from the interview. These findings were comparable to previous research by Archambault, Jonasz, Morizot, and Pagani, (2009) in which they conducted a consecutive three-year study using questionnaires with over 13,000 high school students to examine the relationships between the levels of engagement and student drop-out rates.

Archambault et al. (2009) found that behavioral engagement dropped significantly after ages twelve and thirteen, especially within students identified as at-risk through special education placement, or past academic failures. Archambault et al. (2009) also found that school-based interventions aiming to increase engagement with education should focus on individual differences and needs within the school population, especially the needs of students at-risk.

Best Suited Environment for Students At-Risk

The researcher in this study concluded that the evidence from the SEM and SPS scores combined with the qualitative follow-up interviews, reinforced the premise found in previous research concerning the most effective environment for students at-risk. The researcher in this

current study also found that similar strategies used by the top scoring teachers on the SPS and SEM resulted in higher levels of engagement for students at-risk. Qualitative data revealed that quality relationships between staff and students, small class size, and recognizing positive behavior were paramount for these students at-risk. These findings are similar to what other researchers have found (Anderson, Christenson, Sinclair, & Lehr, 2004; Finn & Rock, 1997).

Anderson and colleagues (2004) examined whether or not increased student engagement was associated with the level of quality and closeness of relationships between intervention staff and 80 students at-risk from eleven schools in the same urban district. Anderson et al. (2004) found improved engagement in students who had closer, higher quality relationships with the intervention staff. These findings were similar to those found in the current research study. Specifically, the researcher found higher quality relationships and student engagement were evident by comments made about the higher scoring teachers on the SPS and SEM. For example, Jaylen said “Hunt reminds me that life is hard, but you have to keep going in order to be successful. Hunt is my favorite teacher.” Students were more engaged when teachers purposefully cultivated quality relationships and shared relevant, personal connections with their students.

The current researcher found that Positive Behavior Intervention Support was paramount for increasing engagement in Taylor’s classroom. For example, Tay exclaimed, “At my home school, they don’t reward you for good behavior like Hunt does, but punish you for bad behavior. I like that they look for the positive instead of always looking for negative things here.” Other students commented how much they appreciated the rewards that came with positive behavior. These findings coincide with Finn and Rock (1997) who found that positive reinforcement by the school staff could encourage many engagement behaviors.

Comments and data from the current research showed increased social and emotional engagement in response to class organization and supportive environment. Specifically, smaller class size, more one-on-one attention and concern from the teacher were also held in high esteem as evident in the data. Angel mentioned that, “There are fewer people in class, so everyone gets a turn to do something, not just watch others do it;” and Tay added, “We hardly did those at my other school cause there were so many kids.” These results were in line with previous findings by Finn and Rock (1997), who found that elements of the classroom organization had a positive effect on student engagement levels. Specifically, small class sizes facilitated more engagement, supportive relationships, and warmer environment compared to larger schools.

Affective Filter Application for Students At-risk

The current researcher found that the teachers who communicated genuine caring and commitment to the students at-risk first and his or her learning second produced higher levels of engagement. The current researcher also found in this study that students responded to the conscious effort of the teacher to create the ideal learning environment, especially for students who struggled with at-risk factors that tended to impede engagement. Many students found hope and were encouraged to continue with their study because Taylor, Cook, and Hunt provided low anxiety classroom learning environments and communicated concern for students. One specific comment Susan made captures this theme:

Even though we got here for being bad, my teacher tries to help me do better. I might even graduate since I’m doing well now that Hunt is helping me keep focused on my credit recovery. I might even be able to graduate early since I am moving so fast right now. It gives me hope.

These results are similar to what Krashen (1982) found; that a low affective filter minimized anxiety and stress and served to foster the spark of learning and pleasure of discovery in students.

Taylor exhibited the ability to create a learning environment where the affective filter remained low and that was favorable to higher levels of engagement of students at-risk. Specific techniques included focusing on positive behavior, aspiring to lower the affective-filter, using humor, and showing personal concern for students. Further, the current researcher found that the concept of a “high affective filter” negatively affected the level of engagement of students at-risk, as many students implicated a “high affective filter” environment in Smith and Davis’s classrooms. Comments about boring instructional strategies and non-caring responses to student requests for help indicated that there was a barrier to learning and engagement.

These findings are similar to what Krashen (1982) found. Krashen reported that the affective filter served as an imaginary selectively permeable membrane between learner and learning environment and recommended a low affective filter for a productive learning environment. Additionally, Bilash (2009) found that boredom, tasks resulting in low success rates, and negative tone and body language were student responses to a high affective filter. Krashen also found that when anxiety was high, motivation was low. Thus, low anxiety was better for learning, and too much correction raised the affective filter as self-esteem dropped. The current researcher also found similar results. Students proclaiming, they “did not want to go to class” or “just wanted to go to sleep” because of the high stress environment that Smith and Davis produced mirrored the findings of Krashen closely.

Learning Environment Linked to At-Risk Engagement

The researcher further concluded that the TCLE was perceptible by students at-risk and had a positive effect on the level of engagement for these students. For example, the researcher found that teachers with the highest academically challenging environment also had the highest levels of engagement. These findings are consistent with previous research. Fredricks et al.

(2002) examined the impact of academically challenging environment, teacher support, and peer support on emotional, behavioral, and cognitive engagement. Fredricks et al. (2002) called for attention to the elements of TCLE since it affected the malleable aspects of student engagement in the science curriculum.

Limitations

This study was primarily focused on the student perception of the classroom environment and its effect on engagement for students at-risk. The findings were restricted to the means of gathering quantitative and qualitative data from the perspective of students at-risk. This population had challenges to overcome concerning their willingness to express their perceptions in a meaningful way. The sample size for the Science Engagement Measure (SEM) did not produce a sufficient number of responses due to a variety of reasons related to student attendance, release, suspension, or expulsion. One factor that may have contributed to differences among teacher scores on the SPS that was not looked at in this study was the effect of gender of the teacher or students and how that may have contributed to the differences in the perception of the ratings for the TCLE.

Problems

Perhaps the biggest problem that arose in this study centered on the fact that quantitative data collection was not as effective for identifying the measured level of engagement for students at-risk. The SEM did address the need for a subject specific study, but was not able to identify statistically significant differences whereas the qualitative data was able to establish significant differences between the TCLEs. In other words, qualitative data was more valuable than quantitative data in this instance for determining the level of engagement for students at-risk.

Further, the transient and volatile nature of the alternative school population resulted in fewer numbers of valid responses to the SEM, which resulted in diminished findings due to a reduction of power. Additionally, comments like, “I’m not doing this...there’s too many questions” were heard frequently during administration of the survey. Students were observed “Christmas treeing” the answers, or gave up on the task due to length, which resulted in fewer completed surveys. Further, some students refused to answer the follow-up survey questions due to the nature of questioning. A few students responded by saying, “I don’t want to talk down about my teacher” or “I don’t feel right talking about it.”

Implications for Practice

This study shows that students don’t care how much you want them to know until they know how much you care about them as a person. This study appears to support previous arguments for attention to the facets of the teacher created learning environment that increase engagement for students at-risk. The study provides evidence for a necessary change in teaching strategies and would suggest that the teacher is the principal instrument in creating an ideal learning environment for students at-risk. This entails implementation of effective instructional strategies which increase behavioral engagement differentiated instruction which increases cognitive engagement, a positive learning environment which increases social engagement, and an academically challenging learning environment which increases social engagement.

Effective instructional strategies include academic activities that promote student growth by being “relevant to the content to engage students in active learning and...facilitate the students’ acquisition of key knowledge and skills” (Barge, 2012, p. 20). Specifically, students at-risk mentioned experiments, hands-on manipulatives, and small group conversation were most helpful to increasing engagement. Differentiated instruction included in the qualitative data

centered on methods where the “teacher challenges and supports each student’s learning by providing appropriate content and developing skills which address individual learning differences” (Barge, 2012, p. 28). Students at-risk talked about the flexibility in the alternative school classroom that increased engagement with individual academic activities with different methods of delivery, but still have the support of the teacher if needed. Differentiated instruction was closely related to the academically challenging environment described by Barge (2012) as one in which “The teacher creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners” (p. 28). Students at-risk commented that they were more engaged due to the opportunities to move forward provided by the alternative school. For example, Susan exclaimed “I might even be able to graduate early since I am moving so fast right now. It gives me hope”. To create this positive learning environment, an engaging and enriching environment for students to learn, teachers must observe guidelines for expected behavior, on-task students, respect for relationships within the classroom, use of humor, and emit care for the students (Barge, 2012). Students at-risk also described how the positive learning environment increased social engagement. Angel exclaimed, “The teacher is more approachable here. It’s a more relaxed environment and I feel better about asking the teacher or other students if I don’t understand something we are learning.”

This research helps teachers in the alternative school environment understand the student perception of the classroom environment and its effects on engagement for students at-risk in science class. Further, the study could aid administrators and other stakeholders in evaluating the importance of the TCLE and provide a potential template for increasing student engagement within the population of students at-risk. The results, supported by evidence, expose what it is that alternative school teachers do within their classrooms that result in higher rates of

engagement for students at-risk. The data gathered concerning these areas explain what students perceive is occurring in the classroom. Finally, the results provide evidence for establishing appropriate strategies designed to increase the motivation for students at-risk to engage fully with the curriculum in science class.

Recommendations

Future research into the learning environment and its effect on the engagement level of students at-risk should examine pairwise comparisons concerning the number of office discipline referrals given. This would be relevant to the research concerning how the TCLE specifically affects the rate of discipline referrals for students at-risk. Additionally, this research may illuminate the possible effects of discipline referrals to the engagement level for students at-risk.

The researcher also recommends that the study be duplicated to include larger populations across the alternative school setting. This new research would increase power for the data analysis and give a broader sense of how the learning environment affects larger segments of the alternative school venue. This approach may identify effective approaches to this special population of “misfit” students in our school systems across the country.

Contribution to Research

While much research has been conducted concerning engagement for students at-risk, the alternative school, and the classroom learning environment, these facets were joined here by a single, distinguishing viewpoint: student perception through quantitative and qualitative means. This mixed method explanatory sequential research project, based in an alternative school with a high percentage of students at-risk, contributes greatly to the research from this student perspective. Quantitative and qualitative data collected in this research project utilized the voice of students who are often marginalized or huddled into mediocre schools with environments that

stigmatize and often suppress meaningful attempts at education in order to protect the “regular” educational setting. Doing so isolates large groups of students and propagates the label of “misfit” students. This research offers evidence to understand how students at-risk perceive the TCLE and its effect on the entire spectrum of engagement. This student perception distinguishes this research project from the multitude of previous studies while adding significantly to the understanding of the link between the TCLE and level of engagement with students at-risk.

Conclusion

The quantitative methods used in an attempt to measure at-risk engagement levels are less effective than the evidence from qualitative data. Students at-risk have characteristics that prevent quantitative data from fully measuring the link between the learning environment and level of engagement. For instance, disengaged at-risk learners also report being jaded, uninterested, anxious, or even angry about having to attend class (Kaplan, Peck, & Kaplan, 1997). Many students involved in this study also demonstrated characteristics that exhibited their unwillingness to participate with the Likert scale surveys pertaining to their experience at this alternative school. Fortunately, there were many students who were willing to participate in the follow-up interview. This setting gave them a chance to have their “own voice” heard above questions on the survey that seemed irrelevant to them. This cooperation led to a fuller understanding of how they viewed the link between the learning environment and engagement.

Therefore, in order to fully measure or understand the dynamic between the TCLE and the engagement levels of students at-risk, one must primarily use qualitative data as a foundation; not an addition to quantitative data. Qualitative data more completely describes the link between engagement with students at-risk and the teacher created learning environment.

Students at-risk have characteristics that often ostracize them in school settings. Many have been traumatized by personal choices or factors beyond their control. For example, Lehr, Tan, and Ysseldyke (2009) detail students at-risk as those with “higher rates of substance abuse, suicide attempts, sexual activity, pregnancy, [and those] more likely to have been physically or sexually abused or to have witnessed abuse within their families” (p. 20). While these factors can weigh heavy on anyone, they have devastating effects for high school students. However, engagement can be a shield of protection since it is malleable and influenced by the teacher created learning environment (Fredricks et al., 2016). Ultimately, students at-risk must first become emotionally engaged with the teacher in order to move to the other domains of behavioral, cognitive, and social engagement (Downer et al., 2007; Finn, 1989; Matheson & Shriver, 2005).

The instructional strategies, differentiated instruction, positive learning environment, and an academically challenging environment that teachers create in the classroom are all related to increasing engagement with students at-risk. Specific techniques for students at-risk that increase engagement focus on positive behavior, varying the academic tasks, use hands-on experiments, aspire to lower the affective-filter, use humor, and show personal concern for students. Teachers who are effective at creating an emotionally engaging environment, quality relationships between staff and students, and recognize positive behavior increase engagement with students at-risk.

Final Words

The underlying premise of this research project has led the researcher to conclude that regardless of the preparation a pre-service teacher undergoes, the at-risk population in an alternative school setting demands that teachers constantly reflect and adapt their delivery of

effective interventions to include a focus on the emotional connection to each student at-risk.

These unfairly labeled “misfits” deserve an opportunity to reach their full potential regardless of risk factors that they either brought upon themselves or were thrust upon them. The evidence found during this study may help to bring a paradigm shift in effective education for alternative schools throughout the United States.

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APPENDIX A

Consent Form for Teachers

Informed Consent for a Non-Medical Study

UNIVERSITY OF ALABAMA HUMAN RESEARCH PROTECTION PROGRAM

Study title: *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach.*

Investigator's Name, Position, Faculty or Student Status: *Craig Collins, Biology Teacher, GIVE West High School; and Ed.D. degree candidate for University of Alabama*

You are being asked to take part in a research study.

This study is called *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach*. The study is being done by Craig Collins, who is a graduate student at the University of Alabama. Mr. Collins is being supervised by Dr. Dennis Sunal who is a professor of Mr. Collins at the University of Alabama.

Is the researcher being paid for this study? No

What is this study about? What is the investigator trying to learn?

This study will help teachers create a better learning environment at GIVE West.

What data will be gathered?

Interviews, SPS (student perception surveys), and SMES (Science and Math Engagement Surveys) along with follow-up interviews conducted with teachers and students to clarify student and teacher interactions.

Why is this study important or useful?

The researcher seeks to identify characteristics of appropriate instructional strategies, and characteristics of the teacher created learning environment that will increase engagement for students at-risk with school curriculum.

Why have I been asked to be in this study?

You are a teacher at GIVE West, where there is a high percentage of students at-risk within the population.

How many people will be in this study?

Approximately 6 teachers will be in this study.

What will I be asked to do in this study?

You will be asked to spend time discussing student engagement and your experiences with students at GIVE West. You will be asked to allow a 20 minute follow-up interview of yourself, and discuss your experience with the researcher and other participants as well as share data concerning student engagement.

How much time will I spend being in this study?

It will require less than an hour for an interview about strategies used in creating student learning environment.

Will being in this study cost me anything?

The only cost to you is your time.

Will I be compensated for being in this study?

You will not be compensated for being in this study.

What are the risks (dangers or harms) to me if I am in this study?

No risk is foreseen.

What are the benefits (good things) that may happen if I am in this study?

This study should result in a clearer understanding of teacher created learning environment classroom environment that is specifically beneficial for and aligned for students at-risk and could prove to be instructive for teachers who serve this population.

What are the benefits to science or society?

The study should help researchers identify the link between classroom environment can be associated with increased student engagement.

How will my privacy be protected?

No names will be used at any time in either data gathering or data reporting. Furthermore, all answers are optional.

How will my confidentiality be protected?

All data will be kept confidential by separating signed consent forms from data collected, locking all data by either lock and key or by password-protected computer file.

What are the alternatives to being in this study? Do I have other choices?

The alternative to being in this study is not to participate.

What are my rights as a participant in this study?

Taking part in this study is voluntary. It is your free choice. You can refuse to be in it at all. If you start the study, you can stop at any time. There will be no effect on your professional position or evaluation as a teacher.

The University of Alabama Institutional Review Board (“the IRB”) is the committee that protects the rights of people in research studies. The IRB may review study records from time to

time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?

If you have questions about the study right now, please ask them. If you have questions about the study later on, please email Craig Collins at Craig_S_Collins@gwinnett.k12.ga.us or the faculty advisor, Dr. Dennis Sunal at 205-348-7010.

If you have questions, concerns, or complaints about your rights as a person in a research study, call Ms. Tanta Myles, the Research Compliance Officer of the University of Alabama, at 205-348-8461 or toll-free at 1-877-820-3066.

You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or email the Research Compliance Office at participantoutreach@bama.ua.edu.

After you participate, you are encouraged to complete the survey for research participants that is online at the outreach website or you may ask the investigator for a copy of it and mail it to the University Office for Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

I have read this consent form. I have had a chance to ask questions. I agree to take part in it. I will receive a copy of this consent form to keep.

Signature of Research Participant Date

Signature of Investigator Date

Audio Taping Consent

As mentioned above, the individual qualitative interview will be audio recorded for research purposes to gain understanding about teacher created learning environment. These tapes will be stored in a locked file cabinet in a locked room and only available to Mr. Collins. I will only keep these tapes for no more than two weeks and will destroy them after they have been transcribed.

I understand that part of my participation in this research study will be audiotaped and I give my permission to the research team to record the interview.

- Yes, my participation in _____ can be audiotaped.**
 No, I do not want my participation in _____ to be audiotaped.

APPENDIX B

Student Assent Form

Informed Assent for a Non-Medical Study

UNIVERSITY OF ALABAMA HUMAN RESEARCH PROTECTION PROGRAM

Study title: *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach.*

Investigator's Name, Position, Faculty or Student Status: *Craig Collins, Biology Teacher, GIVE West High School; and Ed.D. degree candidate for University of Alabama*

You are being asked to take part in a research study.

This study is called *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach*. The study is being done by Craig Collins, who is a graduate student at the University of Alabama. Mr. Collins is being supervised by Dr. Dennis Sunal who is a professor of Mr. Collins at the University of Alabama.

Is the researcher being paid for this study? No

What is this study about? What is the investigator trying to learn?

This study will help teachers create a better learning environment at GIVE West.

What data will be gathered?

As a student, you will be asked to take the SMES (Science and Math Engagement Surveys) to help me measure your level of engagement in science class. We will also have conversations that act as informal interviews that I will record so that I can use your words in my research about the topic of increasing student engagement within science class. An example question would be "What does your teacher do to peak your interest in the subject of science?".

Why is this study important or useful?

The researcher seeks to identify characteristics of appropriate instructional strategies, and characteristics of the teacher created learning environment learning that will increase engagement for students at-risk with school curriculum.

Why have I been asked to be in this study?

You are a student at GIVE West.

How many people will be in this study?

Approximately 6 science teachers their students will be in this study.

What will I be asked to do in this study?

You will be asked to take a short survey, allow a 30-minute follow-up interview of yourself, and discuss your experience with the researcher and other participants. The interview will ask questions related to the teacher created learning environment in your science classroom. For example, “Do you like working in small-groups or larger groups?”. The purpose of the questions is to determine what things teachers do to increase student engagement with science class.

How much time will I spend being in this study?

40 minutes for a survey and 30 minutes for a follow-up interview about the learning environment in the classroom.

Will being in this study cost me anything?

The only cost to you is effort and time to engage the surveys and follow up interview.

Will I be compensated for being in this study?

You will not be compensated for being in this study.

What are the risks (dangers or harms) to me if I am in this study?

No risk is foreseen.

What are the benefits (good things) that may happen if I am in this study?

This study should result in a clearer picture of teacher created learning environment classroom environment that is specifically beneficial for and aligned for students at-risk and could prove to be instructive for teachers who serve this population.

What are the benefits to science or society?

The study should help researchers identify the link between classroom environment and increased student engagement.

How will my privacy be protected?

No names will be used at any time in either data gathering or data reporting. Furthermore, all answers are optional.

How will my confidentiality be protected?

All data will be kept confidential by separating signed assent forms from data collected, locking all data by either lock and key or by password-protected computer file.

What are the alternatives to being in this study? Do I have other choices?

The alternative to being in this study is not to participate.

What are my rights as a participant in this study?

Taking part in this study is voluntary. It is your free choice. You can refuse to be in it at all. If you start the study, you can stop at any time. Your decision to participate or decline to participate in the study will have no impact on your grade or relationship with the school.

The University of Alabama Institutional Review Board (“the IRB”) is the committee that protects the rights of people in research studies. The IRB may review study records from time to time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?

If you have questions about the study right now, please ask them. If you have questions about the study later on, please email Craig Collins at Craig_S_Collins@gwinnett.k12.ga.us or the faculty advisor, Dr. Dennis Sunal at 205-348-7010.

If you have questions, concerns, or complaints about your rights as a person in a research study, call Ms. Tanta Myles, the Research Compliance Officer of the University of Alabama, at 205-348-8461 or toll-free at 1-877-820-3066.

You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or email the Research Compliance Office at participantoutreach@bama.ua.edu.

After you participate, you are encouraged to complete the survey for research participants that is online at the outreach website or you may ask the investigator for a copy of it and mail it to the University Office for Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

I have read this assent form. I have had a chance to ask questions. I agree to take part in it. I will receive a copy of this assent form to keep.

Signature of Research Participant

Date

Signature of Investigator

Date

Audio Taping Assent

mentioned above, the individual qualitative interview will be audio recorded for research purposes to gain understanding about teacher created learning environment. These tapes will be stored in a locked file cabinet in a locked room and only available to Mr. Collins. I will only keep these tapes for no more than sixty days and will destroy them after they have been transcribed. I understand that part of my participation in this research study will be audiotaped and I give my permission to the research team to record the interview.

Yes, my participation in _____ can be audiotaped.

No, I do not want my participation in _____ to be audiotaped.

APPENDIX C

Parental Consent

Parent Consent for a Non-Medical Study

UNIVERSITY OF ALABAMA HUMAN RESEARCH PROTECTION PROGRAM

Study title: *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach.*

Investigator's Name, Position, Faculty or Student Status: *Craig Collins, Biology Teacher, GIVE West High School; and Ed.D. degree candidate for University of Alabama*

As parent/guardian you are being asked to give permission for your minor child to take part in a research study.

This study is called *Linking Classroom Environment with At-Risk Student Engagement in Secondary Science: A Mixed Method Approach*. The study is being done by Craig Collins, who is a graduate student at the University of Alabama. Mr. Collins is being supervised by Dr. Dennis Sunal who is a professor of Mr. Collins at the University of Alabama.

Is the researcher being paid for this study? No

What is this study about? What is the investigator trying to learn?

This study will help teachers create a better learning environment at GIVE West.

What data will be gathered?

Your child will be asked to take the SMES (Science and Math Engagement Surveys) to help me measure your child's level of engagement in science class. I will also have conversations with your child that act as informal interviews that I will record so that I can use your child's words in my research.

Why is this study important or useful?

The researcher seeks to identify characteristics of appropriate instructional strategies, and characteristics of the teacher created learning environment that will increase engagement with school curriculum for students at-risk.

Why have I been asked to be in this study?

Your child is a student at GIVE West.

How many people will be in this study?

Approximately 6 science teachers their students will be in this study.

What will my child be asked to do in this study?

Your child will be asked to take a short survey and an interview by a teacher. The purpose of the interview is to give your child an opportunity to explain how their science teacher helps them be more engaged in science class. An example question, “What does your teacher do to encourage you to be an active participant in science class?” This information will be helpful in determining teacher practice for increasing student engagement in science class.

How much time will my child spend being in this study?

30 minutes for an interview and 40 minutes for a survey.

Will being in this study cost anything?

The only cost to you is your child’s effort.

Will my child be compensated for being in this study?

Your child will not be compensated for being in this study.

What are the risks (dangers or harms) to my child if in this study?

No risk is foreseen. No changes to

What are the benefits (good things) that may happen if my child is in this study?

This study should result in a clearer picture of teacher created learning environment classroom environment that is specifically beneficial for and aligned for students at-risk and could prove to be instructive for teachers who serve this population.

What are the benefits to science or society?

The study should help researchers identify the link between classroom environment and increased student engagement.

How will my child’s privacy be protected?

No names will be used at any time in either data gathering or data reporting. Furthermore, all answers are optional.

How will my child’s confidentiality be protected?

All data will be kept confidential by separating signed parent consent forms from data collected, locking all data by either lock and key or by password-protected computer file.

What are the alternatives to being in this study?

The alternative to your child being in this study is for your child not to participate.

What are my rights as a participant in this study?

Taking part in this study is voluntary. It is your free choice. Your child can refuse to be in it at all. If your child starts the study, your child can stop at any time. Your decision to have your child participate or decline to participate in the study will have no impact on their grade or relationship with the school.

The University of Alabama Institutional Review Board (“the IRB”) is the committee that protects the rights of people in research studies. The IRB may review study records from time to time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?

If you have questions about the study right now, please ask them. If you have questions about the study later on, please email Craig Collins at Craig_S_Collins@gwinnett.k12.ga.us or the faculty advisor, Dr. Dennis Sunal at 205-348-7010.

If you have questions, concerns, or complaints about your rights as a person in a research study, call Ms. Tanta Myles, the Research Compliance Officer of the University of Alabama, at 205-348-8461 or toll-free at 1-877-820-3066.

You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or email the Research Compliance Office at participantoutreach@bama.ua.edu.

After your child participates, you are encouraged to complete the survey for research participants that is online at the outreach website or you may ask the investigator for a copy of it and mail it to the University Office for Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

I have read this consent form. I have had a chance to ask questions. I agree to allow my child to take part in it. I will receive a copy of this consent form to keep.

Signature of Research Participant Date

Signature of Investigator Date

Audio Taping Consent

As mentioned above, the individual qualitative interview will be audio recorded for research purposes to gain understanding about teacher created learning environment. These tapes will be stored in a locked file cabinet in a locked room and only available to Mr. Collins. I will only keep these tapes for no more sixty days and will destroy them after they have been transcribed.

I understand that part of my participation in this research study will be audiotaped and I give my permission to the research team to record the interview.

- Yes, my child’s participation in this study can be audiotaped.**
- No, I do not want my participation in this study to be audiotaped**

APPENDIX D

Science Engagement Measure (SEM)

Self-reporting engagement tool using a five point Likert Scale developed by (Fredricks, et al., 2016) adapted to indicate science class only.

Behavioral Engagement

1. I stay focused.
2. I answer questions in class.
3. I put effort into learning.
4. I keep trying even if something is hard.
5. I ask questions in class.
6. I complete my homework on time.
7. I talk about math and science outside of class.
8. I try to learn more about the topics we cover in class.
9. I don't participate in class (Reverse coded).
10. I do other things when I am supposed to be paying attention (Reverse coded).
11. If I don't understand, I give up right away (Reverse coded).

Emotional Engagement

1. I often like to be challenged in math and science class.
2. I look forward to math and science class.
3. I enjoy learning new things in math and science class.
4. I want to understand what we are learning in class.
5. I feel good when I am in math and science class.
6. I often feel frustrated in math/science class (Reverse coded).
7. I think that math/science class is boring (Reverse coded).
8. I don't want to be in math/science class (Reverse coded).
9. I don't care about learning math/science (Reverse coded).
10. I often feel discouraged when I am in math/science class (Reverse coded).
11. I often get worried when I learn new things about math and science (Reverse coded).

Cognitive Engagement

1. I go through work that I do for class to try to make sure it is right.
2. I think about different ways to solve a problem.
3. I try to connect what I am learning to things I have learned before.
4. I try to understand my mistakes when I get something wrong.
5. When I am studying, I only review problems I have solved before.
6. I would rather be told the answer than have to figure it out myself (Reverse coded).
7. I don't think that hard when I am doing work for class (Reverse coded).

8. When work is hard, I only study the easy parts (Reverse coded).
9. I do just enough to get by (Reverse coded).

Social Engagement

1. I build on others' ideas.
2. I try to understand others peoples' ideas in math and science class.
3. I try to work with others who can help me in math/science.
4. I try to help others who are struggling in math/science.
5. I don't care about other peoples' ideas (Reverse coded).
6. When working with others, I don't share my ideas (Reverse coded).
7. I don't like working with my classmates (Reverse coded).

APPENDIX E

SPS Student Perception Surveys

Student perception survey using a four point Likert scale developed by TES (Teacher Effectiveness System, 2009).

Instructional Strategies

1. My teacher encourages me to participate in class, rather than just sitting and listening.
2. My teacher encourages me ask questions in class.
3. My teacher frequently checks to see if we understand what is being taught.
4. My teacher takes time each day to summarize what we have learned.
5. My teacher gives me assignments that require me to connect knowledge from several sources.

Differentiated Instruction

6. My teacher choses activities and assignments based on what students need to learn.
7. My teacher gives students as much individual attention as they need to be successful.
8. If I don't understand something, my teacher tries to figure out why I don't understand.
9. The work my teacher gives me is at the right level for me.
10. My teacher allows me to work with different groups of students depending on the activity we are doing.

Positive Learning Environment

11. I feel comfortable asking my teacher questions.
12. My teacher cares about my learning.
13. My teacher holds students responsible for their behavior.
14. My teacher explains the instructions if I don't understand them.
15. My teacher treats all students with respect.

Academically Challenging Environment

16. The work assigned in this class challenges me.
17. My teacher expects me to do my best.
18. When I am confused by something, my teacher will not give up until I understand.
19. Because of my teacher, I push myself to learn as much as I can.
20. My teacher encourages me to try new things, even if they are difficult for me.

APPENDIX F

Follow-Up Student Interview Questions

Behavioral engagement and Instructional Strategies

- 1) Do you ever find yourself distracted in class or doing work from other classes when you are supposed to be paying attention?
- 2) What kind of activities does your teacher use that encourages you to participate?

Cognitive engagement and Differentiated Instruction

- 1) Does your teacher use different ways of teaching the same thing to others in class? Explain?
- 2) How does the teacher help you connect in a deeper way to the lessons?
- 3) Does your teacher pay attention to all students who might need things explained to them differently?

Emotional engagement and Positive Learning Environment

- 1) When you realize science class is next, how does that make you feel?
- 2) What does your teacher do to encourage you to learn in science class? How?
- 3) How do you know your teacher cares about your learning specifically?

Social engagement and Academically Challenging Environment

- 1) How often do you work alone or in groups while in science class? Can you explain that?
- 2) Does your teacher push you to learn more about science content? How?
- 3) Does your teacher expect you to communicate science content to other students? How?

General Information

- 1) What does your teacher do that makes it more difficult to learn in science class?
- 2) Do you ever feel fearful or nervous in science class? Can you explain that?
- 3) Do the student learning groups assist you in understanding the content?
- 4) How do you feel overall about the learning environment in science class?

APPENDIX G

IRB Approval

IRB Project #:

UNIVERSITY OF ALABAMA
INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS
REQUEST FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS

I. Identifying information

	Principal Investigator	Second Investigator	Third Investigator
Names:	Stephen Craig Collins	Dr. Dennis Sunal	
Department:	Department of Curriculum and Instruction	Department of Curriculum and Instruction	
College:	College of Education	College of Education	
University:	University of Alabama	University of Alabama	
Address:	241 Durham Dr.	208A Graves Hall	
Telephone:	404-558-1472	205-348-7010	
FAX:			
E-mail:	Craig_S_Collins@gwinnett.k12.ga	dvsunal@ua.edu	

Title of Research Project: LINKING CLASSROOM ENVIRONMENT WITH AT-RISK STUDENT ENGAGEMENT IN SECONDARY SCIENCE: A MIXED METHOD APPROACH

Date Submitted: 05/11/16
Funding Source:

Type of Proposal New Revision Renewal Completed Exempt

Please attach a renewal modification form size

UA faculty or staff member signature _____

II. NOTIFICATION OF IRB ACTION (to be completed by IRB):

Type of Review: ___ Full board ___ Expedited

IRB Action:

___ Rejected Date: _____
 ___ Tabled Pending Revisions Date: _____
 ___ Approved Pending Revisions Date: _____
 ___ Approved-this proposal complies with University and federal regulations for the protection of human subjects.

Approval is effective until the following date:

Items approved: ___ Research protocol (dated _____)
 ___ Informed consent (dated _____)
 ___ Recruitment materials (dated _____)
 ___ Other (dated _____)

Approval signature _____ Date _____

APPENDIX H

Local School Research Approval



LOCAL SCHOOL RESEARCH REQUEST FORM

Name of School: GIVE West High School
 Name of Researcher: Stephen Craig Collins
 Position or Grade: 9th Grade Biology Teacher

A. Research Project

a. Title: LINKING CLASSROOM ENVIRONMENT WITH AT-RISK STUDENT ENGAGEMENT:
 A MIXED METHOD

b. Statement of Problem and research question: At-risk students are disengaged at a much higher rate than other populations. What teacher practices contribute to building an environment conducive to increasing at-risk student engagement?

c. Subjects or population for the study: Teachers and students at GIVE West
Teachers and students at GIVE West

d. Reason for doing this research:

- Graduate Study at The University of Alabama University/College
 Publication/Presentation
 Other (please specify) _____

e. Dates research will be conducted: 08/11/2016 to 05/21/2017

B. All research and researchers must a) Protect the rights and welfare of all human subjects, b) Inform students and/or parents that they have the right not to participate in the study, c) Adhere to board policies and applicable laws which govern the privacy and confidentiality of students records.

C. This request applies to research conducted within and by local school personnel. All other research requests must be submitted by completing a GPCS Research Application and submitting it electronically according to instructions. For complete details and instructions, please visit our Web Page at the following link: <http://tinyurl.com/ce7pmpm> or you can simply go to gwinnet.k12.ga.us. When you open our webpage, click on "I want to" section.....Apply for Research Approval." This will take you to our webpage.

D. Principals ONLY need to approve Local School Research Requests. The copy sent to the Research & Evaluation Office is for filing purposes only. No further approval is necessary.

E. After approval by the principal, please forward a copy of this completed form to:

Via GPCS Courier: Colin Martin GPCS - Research & Evaluation ISC	Via US Mail: Dr. Colin Martin, Executive Director Research & Evaluation Department Gwinnett County Public Schools 437 Old Peachtree Road, NW Suwanee, GA 30024	Via Fax: Colin Martin 678-301-7088
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5/17/16