ABSTRACT

PHILLIPS, PAMELA PREVETTE. The Impact of E-Education on At Risk High School Students' Science Achievement and Experiences during Summer School Credit Recovery Courses (Under the direction of Margaret R. Blanchard).

Nationally, at risk students make up to 30% of U.S. students in public schools. Many at risk students have poor attendance, are disengaged from the learning environment and have low academic achievement.

Educational failure occurs when students do not complete the required courses and as a result do not receive a high school diploma or a certificate of attendance. Many at risk students will not graduate; nearly one-third of all United States high school students have left the public school system before graduating, which has been referred to as a national crisis. Many at risk students fail science courses that are required for graduation, such as biology. Clearly, many students are not responding positively to the conditions in many public school classrooms, suggesting the need for different methods of educating at risk students, such as e-education.

Three research questions guided the study: 1) Who are the students in an e-education, online summer school credit recovery course? 2) Do students’ beliefs about their learning environment or other personal factors influence their academic achievement?, and 3) How do students describe their experiences of an e-education science course?

This mixed methods study investigates thirty-two at risk students who were enrolled in one of three e-education science education courses (biology, earth science, and physical science) during a summer session in a rural county in a southeastern US state. These students failed their most recent science course taken in a traditional classroom setting. Artino’s (2010) social-cognitive model of academic motivation and emotion was used as a
theoretical framework to highlight the salient motivational factors toward learning science (e.g., task characteristics, task value beliefs, positive emotions). Student data included pre and post tests for all e-education lessons, a final exam, survey data (Students Motivation towards Science Learning (SMTSL), time (on task and idle), field notes, and interview data. Twenty-eight of the students were interviewed individually or as a member of a focus group. During the study, students were enrolled in either a biology course \((n =10)\), earth science \((n =10)\) or physical science \((n =12)\). The students who participated in the study included thirteen females (37.5%) and nineteen males (62.5%). Students were classified as Caucasian (56.25%) or African American (43.75%) as well as non-Hispanic (87.5%) or Hispanic (12.5%). For analyses, Welch’s t-tests were employed to investigate the effects of race/ethnicity or gender on how at risk students interacted with an e-education science course.

Analyses revealed that self-efficacy by gender was statistically significant at the 0.01 critical level. Males had a higher self-efficacy mean than did females; however, females had higher academic growth. Learning environment stimulation was statistically significant at the 0.01 critical level for African American students. Time-on-task had a significant impact on academic growth for students who had previously failed the pretests.

At risk students who completed one of the summer school science courses using an e-education program reported an increase in science self-efficacy, expressed satisfaction with their achievement, appreciated the autonomy afforded by the program, and expressed having positive emotions toward using the program. Students who could not demonstrate science proficiency during the pretest benefitted the most from the e-education program; students who failed the course due to non-academic reasons received virtually no academic benefit.
from the e-education program. However, the e-education program did serve to mitigate negative interactions with their face-to-face teachers, providing a neutral vehicle for content delivery. The program, while not benefitting all students equally, enabled all students who finished the course to earn a graduation credit. A majority of the students expressed great satisfaction with their ability to determine their own pace and ultimately to take control of their education.
The Impact of E-Education on At Risk High School Students' Science Achievement and Experiences during Summer School Credit Recovery Courses

by
Pamela Prevette Phillips

A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the Degree of Doctor of Philosophy

Science Education

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2015

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DEDICATION

This dissertation is dedicated to my husband, Bobby Lee Phillips and daughter, Katie O’Hara Williams. They gave me wings to pursue my dreams. I love you both very much. It is also dedicated in honor of my parents, Dr. John E. Prevette, M.D. and Shirley Prevette, R.N.

They instilled in me the love of learning at a very young age.
BIOGRAPHY

Pamela Prevette Phillips was born in 1958 and raised in a rural community in central North Carolina. Science was a passion of hers for as long as she could remember. She worked as a glorified lab assistant in her father’s Gynecology and Obstetrics practice every summer during her high school and college career. She matriculated at East Carolina University where she graduated with a Bachelor in Psychology with the intention of entering medical school. While an undergraduate at East Carolina University she was a member of Kappa Delta Sorority and Psi Phi Honor Fraternity. The dream of becoming a doctor was put on hold when her father developed prostate cancer. Pam’s father encouraged her to earn her Master of Science Education at East Carolina University and enter the teaching profession, which she ultimately did.

She began her teacher career in Pitt County as a high school science teacher. She taught for one year before moving to Georgia with her military husband and a new baby boy. While in Georgia, the family grew by one daughter. She once more entered the classroom, but this time at an alternative school setting, where she taught science to at risk students.

Pam moved with her family back to her home town when the children were quite young and had the privilege of living with her mother, who helped to raise her two small children. Her teaching career began in earnest at another alternative setting in her home town, where she once more taught science to at risk students. She remained in this teaching position for eight years before once more continuing her education.
She became a Principal Fellow and earned her Master in School Administration at NCSU. While pursuing her degree, she was honored to be inducted into Phi Beta Kappa. Pamela worked as a school administrator in two rural south eastern counties before returning to her first love, teaching. Once she decided to reenter the classroom, she was fortunate to be able to return to her former school where she once more began teaching science to at risk students. Including the previous years of teaching at the alternative school setting and now, she has been teaching at risk students for the past sixteen years.

Several events impacted her life and her decision to pursue her Doctorate in Science Education. Her mother passed away of a lingering illness, she remarried, her son joined the Navy and her daughter went to NCSU to pursue a biology degree. Her new husband, as well as her daughter, encouraged her to pursue her dreams and when her daughter was a freshman at NCSU, Pamela applied and was accepted into the Doctoral Program in Science Education at NCSU. While in the program at NCSU, she was honored to be inducted into Kappa Delta Pi, and won the outstanding Science Teacher Award by Sigma Xi, Scientific Research Society.

Pamela is married to Bobby Phillips and they live on his family farm in rural eastern North Carolina. They share their home with their two dogs and one cat. Only with his support and caring was this journey possible.
ACKNOWLEDGMENTS

I will be forever grateful to my colleagues at my alternative school, my colleagues at NCSU and my friends who have supported me during this journey.

First and foremost, I must acknowledge and thank my committee chair, Dr. Margaret Blanchard. She has been with me from the beginning of this journey and has held my hand when I told her of my husband’s lung cancer and she embraced me when we found out he was cancer free. This dissertation would never have been written if I did not have her support during this trying time of my life. Dr. Patricia Simmons, a committee member, has been an inspiration to me and has helped me tremendously. With her encouragement, I let go of the preconceived idea that only regression analyses would answer a research question. Dr. Matthew Lammi, another committee member, guided my statistical analysis and encouraged me to pursue my research. Dr. Niki Robertson, the final committee member, opened her cell biology laboratory to me, and with her help, I was able to manipulate DNA and to teach my students not just from a textbook but from real life experiences.

I must thank my colleagues at my school. Specifically, my principal, Mr. Junior Creech allowed me to conduct a pilot study using my own science students. He has also been there when I called at 5:00 in the morning to tell him that I was transporting my husband via ambulance to the hospital due to his illness. His only words were to take care of him and school would be there when I returned. Without his patience and love, this paper definitely would not be where it is today. Dr. Karen McCann, my dear colleague, has guided me by sharing her own dissertation journey. She has had the patience and temerity of a true
educator and more importantly, a friend. Dr. Robin Herridge, the Title I coordinator at my school, has helped by paving the way for the study that took place and was the backbone of this dissertation. Both these fine ladies have worked with me to ferret out the intricacies of the student interviews. The love these women have shown me is immeasurable.

I must also thank the participants of the study. The students were more than willing to share their thoughts of school with me. The interviews were not always flattering to the educational system, but were always honest and thought provoking. For the insights that you gave me, I will forever be in your debt.

My daughter, Katie O’Hara Williams, has been a beacon of joy and companionship as we both were enrolled at NCSU. She was always willing for me to join her for the tailgating during football season and was there constantly when Bobby was diagnosed with lung cancer and throughout the treatment process. You love your children, but she is very special to me.

Finally, I must publicly thank my husband, Bobby Phillips. He always said that he would not hold his education against me! He earned his Master of Nuclear Physics from Duke and his Doctorate in Physics from MIT. He has been my inspiration and my love for the past nine years. We have just recently celebrated our fifth year wedding anniversary and I am looking forward to at least twenty-five more. He was diagnosed with lung cancer and I thought my world would cease to exist, but he came back to me and is now cancer free. Without him, none of this would have been possible.
# TABLE OF CONTENTS

## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>v</td>
</tr>
</tbody>
</table>

## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

## CHAPTER ONE: INTRODUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

  **THEORETICAL FRAMEWORK:**

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

## CHAPTER TWO: REVIEW OF THE LITERATURE

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
</tr>
</tbody>
</table>

## CHAPTER THREE: METHODS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
</tr>
</tbody>
</table>

## CHAPTER FOUR: FINDINGS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
</tr>
</tbody>
</table>

## CHAPTER FIVE: DISCUSSION

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
</tr>
</tbody>
</table>

## CHAPTER SIX: CONCLUSION AND IMPLICATIONS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>139</td>
</tr>
</tbody>
</table>

## REFERENCES

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>146</td>
</tr>
</tbody>
</table>

## APPENDIXES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>164</td>
</tr>
<tr>
<td>B</td>
<td>165</td>
</tr>
<tr>
<td>C</td>
<td>168</td>
</tr>
<tr>
<td>D</td>
<td>173</td>
</tr>
<tr>
<td>E</td>
<td>174</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 2.1. Comparison of On-Line Learners to Face-to-Face Learners ..........................38

Table 3.1. Study Participants ..........................................................................................45

Table 3.2. Students’ Motivation Towards Science Learning .........................................48

Table 3.3. Initial Interview Questions .............................................................................60

Table 3.4. Second Interview Questions ..........................................................................60

Table 3.5. Exemplary Quotations for Coding of Transcripts .......................................61

Table 4.1. Description of study participants ..................................................................69

Table 4.2 Student’s Motivation Towards Science Learning Data for all Students ...........70

Table 4.3. Self-efficacy Items Including Mean and Standard Deviation of All Students .....72

Table 4.4. Mean and Standard Deviation of Science Self-Efficacy Scores with Mean Comparisons of Groups .................................................................73

Table 4.5. Active Learning Items Including Mean and Standard Deviation of All Students .75

Table 4.6. Active Learning Strategy Scores by Groups ....................................................75

Table 4.7. Science Learning Value Items, Means and Standard Deviations .....................76

Table 4.8 Science Learning Value Scores for All Student Groups .................................77

Table 4.9. Performance Goal Items Including Mean and Standard Deviation of All Students ..........................................................................................................................76
Table 4.10. Performance Goal Scores, means and standard deviations ......................................79

Table 4.11. Achievement Goal Items Including Mean and Standard Deviation
of All Students .........................................................................................................................80

Table 4.12. Achievement Goal Scores, Means, and Standard Deviations ...............................80

Table 4.13. Learning Environment Stimulation Items Including Mean and Standard
Deviation of All Students ........................................................................................................82

Table 4.14. Learning Environment Stimulation Scores, Means, and Standard Deviations .....83

Table 4.15. Academic Growth Indices, Means, and Standard Deviations ............................83

Table 4.16. Individual Idle Time in hours, Active Time in hours, Pretest and Posttest,
divided by passing and failing the pretest ..................................................................................92

Table 4.17. Passing/Failing Scores as Compared to Active Times, Idle Times, Pretest and
Posttest, Means, and Standard Deviations ..............................................................................94
LIST OF FIGURES

Figure 1.1. Predicted social-cognitive model of academic motivation and emotion ........10

Figure 2.1. Motivation terms relevant to academic achievement and motivation ..........22

Figure 3.1. Convergent mixed methods parallel design of study ................................42

Figure 3.2. An example of an attendance log for Earth Environmental Science ........55

Figure 4.1. Comparing self-efficacy subscales by gender ...........................................87

Figure 4.2. Comparing mean % academic growth by gender ......................................87

Figure 4.3. Comparison of Gender and Race/Ethnicity % Time-on-Task to
final % e-grade .............................................................................................................90

Figure 4.4. Comparison of Gender and Race/Ethnicity Idle time in hours to
Active time in hours with the final e-grade ...............................................................91

Figure 4.5. Comparison of Pretest Passing and Failing .................................................94

Figure 4.6. Theoretical framework based on Artino (2010) including
six factors of motivation from the SMTSL ...............................................................97
CHAPTER ONE

INTRODUCTION

The high school dropout problem has been called a national crisis. Nearly one-third of all United States high school students leave the public school system before graduating (Swanson, 2004). The National High School Center, supported by a grant from the U.S. Department of Education, has shown that the ninth grade is a ‘make it or break it’ year (Heppen & Therriault, 2008). Students who fall behind find it difficult to make up this lost ground (Heppen & Therriault, 2008). Although not every student who fails will drop out, studies have shown that failing students are more likely to drop out rather than to continue with school (Bridgeland, DiIulio Jr, & Morison, 2006; Rumberger, 2001).

By the year 2020, it has been estimated that the majority of students in America’s public schools will be living in circumstances traditionally regarded as placing them at risk of educational failure (Cassidy & Bates, 2005; Rossi & Stringfield, 1995; Schussler & Collins, 2006). The authors point out that many of these students will live in substandard housing, be undernourished, subject to drug abuse, and lack strong and positive role models. The institutions that were created to help these students have not been able to do so, for reasons including misunderstanding of what is required, a lack of resources, and/or a lack of regard for these students (Cassidy & Bates, 2005; Rossi & Stringfield, 1995).

In academia, the term ‘at risk’ refers to students who will not graduate from high school. Unfortunately, there is no single factor that can accurately predict which students are at risk of not graduating (Hammond, Linton, Smink, & Drew, 2007). Students who are at risk do not have just one characteristic or one variable that will allow them to be identified
readily. Hammond et al. (2007) conducted a meta-analysis of 75 studies of at risk students, and noted that at risk indicators could be housed in one of four domains: individual, family, school, and community.

The at risk indicators identified by Hammond et al. (2007) can further be divided to better understand these students and their struggles. The four domains include characteristics such as early adult responsibilities; level of family stress; student body characteristics and performance; and demographic makeup of the area.

In a study of 1,300 students, Wang and Fredericks (2014) documented a strong link between lack of school engagement and dropping out of school. The authors reported that females were more likely than males to remain engaged in school and African American students were less engaged in school than their European American counterparts. A longitudinal study of 201 students over the course of ten years indicated that students who had a physical or emotional disability had a higher rate of dropping out than students who did not have a disability (Barry & Reschly, 2012). Balfanz, Bridgeland, Bruce & Fox (2012) reported that the dropout rate is decreasing for most ethnicities whereas the dropout rate is increasing for recent Hispanic immigrants. This fact is problematic due to the 2010 census data (Ennis, Rios-Vargas, & Albert, 2011), which states that Hispanics are the fastest growing minority group within the United States.

While the aforementioned studies allude to many students dropping out of school, there are many students who complete the high school journey and are very successful. Virtually every child is capable of attaining an adequate level of basic skills that are required
to successfully pass the courses for a high school diploma (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Ursache, Blair, & Raver, 2012). These authors point out that the substantial proportion of students who fail to attain a high school diploma says nothing about the capacity of these students; rather it points out how the available resources are not being used properly to educate the failing students. Only 70% of high school students nationwide will graduate; specifically, 51% of all African American students and only 52% of all Hispanic students will graduate from their high school, compared to the 72% for Caucasian students (Greene & Forster, 2003).

Drop-out rates are compiled at the high school level but identification of at risk students can begin at the elementary school level. In Barry and Reschly’s (2012) longitudinal study, the authors developed two models that could be used to predict the drop-out rate based on gender and race, and their predicted drop-out rates ranged from 75% to 88% for the two models. Their study did not address how to ameliorate the issues that can lead to dropping out of school, only how to identify the known parameters.

Several of the aforementioned studies have identified students as being at risk, but definitions of at risk vary by federal agencies and state governments (e.g., NCDPI 2013, USDOE 2014). One such example from North Carolina’s Department of Public Instruction (NCDPI) describes at risk as those unlikely to graduate from high school due to several risk factors, such as: low achievement, poor school attendance, gender, having one or more disabilities, low socioeconomic status (SES), and attendance at schools with large numbers of poor students (Pang & Foley, 2006). Additionally, minority students who are male are more likely to be at risk. School systems are not equipped nor mandated to address all of the risk
factors. There are a variety of ideas about the best ways to address problems of at risk students, such as: dropout prevention programs, after school remediation, and tutoring at community centers (e.g., Pang & Foley, 2006; Stern, 2009; Zepke & Leach, 2010).

Improvement of self-efficacy is one strategy to reduce the dropout rate of at risk students.

Self-Efficacy

Many students who are labeled at risk have behaviors that magnify other actions. For example, skipping school or classes leads to not completing the required work for classes (Appleton, Christenson, & Furlong, 2008; Finn & Rock, 1997; J. Lee & Shute, 2010). Lee and Shute (2010) conducted a literature review of 150 studies and found that the combined effect of at risk factors, such as low SES and poor attendance, may well lead to the belief by students that they cannot overcome the academic hurdles of the school system. The authors assert that these students may develop feelings of low self-esteem as well as low self-efficacy. Self-efficacy refers to beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments (Bandura, 1999). Schunk (2003) asserts that self-efficacy affects students’ performance and learning behaviors regarding such aspects as the tasks they choose, their exertion, perseverance, and performances.

Self-efficacy of students including at risk students can be improved by additional resources outside the purview of normal school programs, as indicated in a study conducted by Graham & Harris (1989). The study included 22 Learning Disabled (LD) students and 11 regular education students. All students in the study received resource room services such as decoding words and comprehension strategies, which led to improved self-efficacy for all students in the study.
Self-esteem, as defined by Lopez (2011), is a term used in psychology that reflects a person’s overall emotional evaluation of their own worth and it is a judgment as well as an attitude toward the self. He posits that self-esteem encompasses beliefs such as ‘I am competent’ or ‘I am worthy,’ and encompasses both positive and negative emotions such as triumph, despair, pride and shame.

If a student has low self-esteem and low self-efficacy toward school in general or toward specific courses, these psychological constructs will prevent the student from reaching their potential (Bong & Skaalvik, 2003; Marsh & Seaton, 2013). On the other hand, if the student has high self-esteem as well as high self-efficacy regarding school, the student may well choose to attend school on a regular basis, complete assigned tasks, and participate in extracurricular activities in spite of being denoted as at risk, often due to circumstances beyond the student’s control (Appleton et al., 2008; Oyserman, 2013).

There is a discrepancy between the self-esteem and self-efficacy of students who are labeled at risk and do not succeed in school and students who are labeled at risk and do succeed (James Patrick Connell, Spencer, & Aber, 1994). In a study conducted in three separate cities (Atlanta, New York and Washington, D.C.) with a total of 2,600 10- to 16-year old African American students, Connell, Spencer and Aber (1994) reported that successful at risk students are more engaged in school, and that successful at risk students have high self-esteem and high self-efficacy regarding educational outcomes.

In an effort to better understand the indicators of being at risk of dropping out of school, Bowers, Sprott and Taff (2013) reviewed 6,434 studies that were ultimately culled to 36 studies. From these studies, the authors identified 110 flags that would indicate that the
student is at risk of leaving school prior to graduation. The indicators included: disciplinary issues; failing or being retained in one or more grades; low academic scores; not speaking English fluently; the child not living with one or both parents; low self-esteem, low self-efficacy and having friends who were not interested in school, among others. The authors stressed the importance of being able to correctly identify at risk students so that the school districts could best use the resources available for this vulnerable group of students. Students who have high self-efficacy are more engaged in school and are more likely to stay in school and not become a drop out statistic (Bakker, Vergel, & Kuntze, 2014; Caraway, Tucker, Reinke, & Hall, 2003). The environment in which at risk students are taught is as important as what they are taught.

**Social Cognitive Theory**

Social cognitive theory (Bandura, 2001) refers to a psychological model of behavior with an emphasis on the acquisition of social behaviors. The theory emphasizes that learning occurs in a social context and that much of what is learned is gained through observation (Denler, Wolters, & Benzon, 2014). The social cognitive perspective of self-regulation provides a framework for education and can offer insights as to how students can learn. Bandura (1997) has noted that students have the belief that they do have control over their own functioning and the environment in which they learn.

Regular education students and alternative school students have different views of who controls their educational environment. Locus of Control is defined as the tendency of people to ascribe achievements and failures to either internal factors, they are in control, (effort, ability, motivation), or external factors, they are being controlled, (chance, luck,
others’ actions) (Rotter, 1966). In a study of 234 students, it was determined that the alternative school students were much more likely to attribute good grades to luck and less to their academic achievements, which indicates they had an external locus of control. Students who believe that they can determine their academic success are said to have an internal locus of control (Miller, Fitch, & Marshall, 2003). It may be possible that alternative educational opportunities such as e-education may shift the locus of control from external to internal for many alternative or at risk students.

*The potential of e-education for at risk students*

Students, either at risk or not, who are not engaged in the classroom and possibly disrupting the classroom are at risk of failing in a traditional classroom. However, internet and multimedia technologies are reshaping the way knowledge can be delivered, and e-learning offers a real alternative to traditional classroom learning. E-learning can be defined as technology-based learning in which learning materials are delivered electronically to remote learners via a computer network (Zhang, Zhao, Zhou, & Nunamaker Jr, 2004). The authors found that many of the e-learning programs integrate and present learning materials in diverse media such as text, image, sound, and video, which may help the at risk student to better understand the material.

Glanz, Rimer, and Viswanath (2008) delineated constructs of the social cognitive theory that can help to explain how students learn. The environment includes the social supports for students as well as the physical classroom. Students bring to the classroom the knowledge of computers or the skill to learn the e-education program. The classroom can provide opportunities for self-monitoring, goal setting, problem solving, and self-reward.
The authors go on to explain that behaviors can be learned by watching the outcomes and actions of fellow students. These learned behaviors will be reinforced by incentives such as receiving rewards in the guise of passing grades. Self-efficacy can be increased in the classroom when the students set and obtain their goals. Students, including at risk students, do not learn in a vacuum but in a dynamic classroom that includes other students, teachers, and the physical environment, that can at times include e-education. These constructs are also included in the social-cognitive model of academic motivation and emotion, as proposed by Artino (2010).

**At Risk Students**

Identification of at risk students is based on many parameters including disengaging from school and actually disrupting the learning environment (Bakker et al., 2014; Bowers, Sprott, & Taff, 2013). Once the students are identified, there are several programs in place in many of the high schools, such as mentoring students (Keating, Tomishima, Foster, & Alessandri, 2002; Tolan, Henry, Schoeny, Lovegrove, & Nichols, 2014), and family therapy (Miklowitz et al., 2013). In schools, there are programs designed to keep at risk students in school and allow them to graduate from high school (Castaneda, 2013; Jay Smink & Center, 2013). There are also schools designed especially for at risk students (Barr, 2013).

If at risk students are not enrolled in an alternative school, it is possible that the students will benefit from smaller class size. Biddle and Berliner (2014) reviewed research conducted in Indiana, Tennessee, Wisconsin and California. The evidence from all the studies suggested that small classes in the early grades generate substantial gains for students in all disciplines; in particular it was found that at risk students retained these gains well into
the later years of school. The authors posited two hypotheses to explain the gains. At risk students possibly become more engaged and therefore retain the material they have been exposed to. Or, in smaller classrooms with fewer distractions, the students are able to focus and will master the material. Unfortunately, Biddle and Berliner point out that most educational systems do not have the tax base to allow all schools to reduce the class size.

Many at risk students are surrounded by violence either in the schools or at home. When at risk students are able to form relationships with a teacher, it is possible that the teacher will become a promoter as well as protect the students from violence (Krohn, Lizotte, Bushway, Schmidt, & Phillips, 2014). Academic achievement and educational aspirations are adversely affected by delinquent behavior. Thus, students who are shielded from aberrant behavior will attempt to master the taught material (Murray, Irving, Farrington, Colman, & Bloxsom, 2010).

Students who are identified as having an exceptionality (e.g., Learning Disabled; Attention Deficit Disorder) are deemed at risk of not completing high school, but teachers can have a positive impact upon this population of students (Murray & Zvoch, 2011). Programs can be put into place that will allow these students to demonstrate academic growth (Gresham, 2014).

At risk students deserve the same educational opportunities as any other student, yet may require different methods in order to be successful (Reyes, Brackett, Rivers, White, & Salovey, 2012). One promising method of providing these opportunities may be in the form of e-education. With e-education, different learning outcomes are possible, ranging from affective (e.g., student interest and motivation) and behavioral (e.g., engagement with
learning) to specific objectives that are skills based, cognitive, or both (Darling-Hammond, Zielezinski, & Goldman, 2014). These authors recommend that schools consider the benefits to at risk students from technologies designed to promote high levels of interactivity and engagement, and that provide data and information in multiple forms. Applying Bandura’s (2011) social cognitive theory to the use of e-education, at risk students are allowed to interact with their peers, teachers, and learning environment to produce favorable academic outcomes. Artino (2010) based his social-cognitive model of academic motivation and emotional theoretical framework for e-education situations, based on Bandura’s social cognitive theory.

**Theoretical Framework**

![Theoretical Framework Diagram](image)

*Figure 1.1. Predicted social-cognitive model of academic motivation and emotion (adapted from Artino, 2010, based on pilot data from Phillips, 2013).*
The model in Figure 1.1 uses a socio-cognitive approach to e-education in the on-line classroom. The learning environment includes the various assigned tasks, available resources, and the culture of the classroom, which can directly influence the motivation of the students as well as their emotions as they continue through the course. Personal factors such as motivational beliefs and emotions, either positive or negative, are just as important as the physical classroom. The students’ own motivational beliefs can in many ways predict if they will succeed or fail. According to the model, a student who has high self-efficacy will be more willing to engage in learning methods such as e-education. These students may also believe that the tasks that have been assigned to them are valuable for their education and should be viewed as such. The student who has low self-efficacy is less willing or able to find the motivation to succeed on the given tasks. Academic outcomes include various learning strategies employed by e-education, the level of student achievement, and the student’s level of satisfaction. Academic outcomes are also directly influenced by the learning environment in which students find themselves. This model is very fluid in terms of the interaction between the learning environment, personal factors and academic outcomes. Each part of Artino’s model (2010) will be explained in greater detail in Chapter Two.

**Research Questions**

The overarching focus of this study is the role of motivation and achievement for at risk high school students who use an on-line science program (e2020®) during a six week school-based Summer Academy (remediation) experience. The specific questions addressed are:

1. Who are the students in an e-education, online summer school credit recovery course?
2. Do students’ beliefs about their learning environment or other personal factors influence their academic achievement?

3. How do students describe their experiences of an e-education science course?

The review of literature will be covered in detail in Chapter Two. In this review, key terms such as at risk and goal orientation are defined. The use of e-education is introduced and relevant research will be presented. The theoretical framework guiding the study, Artino’s (2010) social-cognitive model of academic motivation and emotion, will be further explained.

Chapter Three details the qualitative and quantitative methods that were used to collect and analyze the data collected. The mixed methods approach and embedded parallel design will be explained. Chapter Four discusses the findings of the present study and Chapter Five situates the information in light of the literature. Chapter Six provides a conclusion and key implications and a recommendation for the use of e-education with at risk students. The chapter also provides suggestions for further study.
CHAPTER TWO
REVIEW OF THE LITERATURE

The review of the literature includes analyses of studies about at risk students and their academic engagement, achievement, and choice of achievement goals. The literature provides direction for the investigation of the research questions as well as giving insight into the factors that either inhibit or facilitate students’ engagement with an e-education program.

Government and Education

By the year 2020, it has been estimated that the majority of students in America’s public schools will be living in circumstances traditionally regarded as placing them at risk of educational failure (Cassidy & Bates, 2005; Rossi & Stringfield, 1995; Schussler & Collins, 2006). The authors point out that many of these students will live in substandard housing, be undernourished, be subject to drug abuse, and will lack strong and positive role models. At risk students historically have not been helped due to a misunderstanding of what is required for these students, the lack of resources and a disregard for this fragile population (Cassidy & Bates, 2005; Rossi & Stringfield, 1995).

The federal government, up until the last 50 years, has not imposed restrictions on the development of education within the United States (USDPI, 2012). The report further states that education is primarily a state and local responsibility in which the states and communities, as well as public and private organizations of all kinds, establish schools and colleges, develop curricula, and determine requirements for enrollment and graduation (United States Department of Public Instruction, 2012).
The Elementary and Secondary Education Act (ESEA) of 1965 emerged during the administration of President Lyndon Johnson. This Act was part of his Great Society initiative, which was designed to eliminate poverty. Through this act, the federal government disbursed funds to elementary and secondary schools. That same year, the Higher Education Act authorized assistance for postsecondary education, including financial aid programs for needy college students (USDPI, 2012). In 1980, under President Jimmy Carter, the cabinet level post of Secretary of Education was created. During the tenure of President Reagan, the publication of “A Nation at Risk” was released in 1983. As part of the response to this publication, the Department of Education increased standardized testing. By 1984, some schools acknowledged that they were seeing higher dropout rates. Mr. Greg Anrig, former state commissioner of education in Massachusetts stated “For the first time, we are seeing high school dropout rates increasing” (Strauss, 2011). He went on to state,

Does this mean we are getting higher standards, or does the threat of tests encourage teachers just to get rid of kids who might not pass? In other words, are we having more push-outs? And doesn’t that tend to hurt minorities? (Strauss, 2011, p. 1).

In an effort to remedy the ills of the education system, President Bush signed the ‘No Child Left Behind Act’ (Miller, Kennedy, Boehner, & Gregg, 2001) in 2002. Rep. George Miller, a leading architect of the No Child Left Behind legislation, said

he never anticipated that the landmark education law would ignite the testing obsession that engulfed the nation’s schools, leading to what some have charged is a simplistic “drill and kill” approach that subverts real instruction (Baron, 2014).

Duncan (2012) stated that President Obama offers states flexibility from NCLB in exchange
for comprehensive plans to raise standards by creating fair, flexible and focused accountability systems, and improving systems for teachers’ and principals’ evaluation and support. This flexibility does not give states a pass on accountability, but requires real reform. Duncan’s position is that, by working together, ,

10 years from now children in the U.S. will have the education they so richly deserve — one that challenges them to achieve to high standards, and provides them with the highly effective teachers and principals who can prepare them for success in college and the workforce (Duncan, 2012).

The federal government and state programs such as ‘No Child Left Behind’ and the ‘Elementary and Secondary Education Act’ were launched with the intention to provide a sound education for every child (Bush, 2001; McLaughlin, 1975). The following section defines the term ‘at risk’ as it is used in this study.

At Risk Students

The high school dropout problem has been called a national crisis, given that from 12 to 41% leave the public school system before graduating (Swanson, 2004). The National High School Center, supported by a grant from the U.S. Department of Education, has shown that the ninth grade is a ‘make it or break it’ year. Students in ninth grade who fall behind find it difficult to make up this lost ground (Heppen & Therriault, 2008). Although not every student who fails will drop out, studies have shown that failing students are more likely to drop out rather than continue with school (Bridgeland et al., 2006; Rumberger, 2001).

The Census Bureau of the United States analyzed data detailing seven risk factors and
identifying which groups of students are more likely to be considered to be at risk (US Department of Commerce, 2014):

- having at least one disability;
- retained in a grade at least once;
- speaks English less than ‘very well’;
- does not live with both parents;
- either parent emigrated within the past five years;
- family income below $10,000; and
- neither parent/guardian employed.

Forty-six percent of all school age children have at least one risk factor, while 18% of all children have two or more risk factors (Kominski, Jamieson, & Martinez, 2013). The best predictor of risk, unfortunately, is having other risk factors. For example, a student with a learning disability is more likely to fail a class in high school and/or be held back or retained during the first nine years of school (Barnett, Clarizio, & Payette, 1996). A risk factor associated with not being promoted to the next grade level in school has been positively correlated to an increased rate of students dropping out of school and failing to graduate (McMillen, Kaufman, & Klein, 1997). Researchers have concluded that dropping out of high school is determined by multiple factors; lower sixth-grade school performance, lower high school achievement and motivation, drug use and poverty (Hawkins, Jaccard, & Needle, 2013; Wang & Fredricks, 2014). This is not to conclude that every student that is born into poverty will not succeed, only that schools must work diligently to retain children in school.
and provide them with every possible opportunity to succeed (Clark, 1990; Hafiz, Tehsin, Malik, Muhammad, & Muhammad, 2013).

Early school failure may act as a starting point in a cycle that weakens a student’s attachment to school, and eventually leads to dropping out of high school (Shaul, 2002). In a study of 8,104 high school students, African American students were the least engaged in school. Disengagement in school entails skipping school, not turning in homework, and not paying attention in class (Hammond et al., 2007; Johnson, Crosnoe, & Elder Jr, 2001). Conversely, females are traditionally more engaged and attached to school than either males or African American students (Johnson et al., 2001; M. T. Wang, Hill, & Hofkens, 2014).

At risk has become a general term for young teens in trouble. The term has been applied to juvenile offenders, school dropouts, drug abusers, teenage mothers, premature infants, and adolescents with personality disorders (Tidwell & Garrett, 1994). Cohen (1998) stated that at risk students are future high-school dropouts, in danger of abusing drugs, and being involved in other forms of delinquency. An at risk student is defined as one who is in danger of failing to complete his or her education with an adequate level of skill (Lauer et al., 2006; Lehr, Tan, & Ysseldyke, 2009). Risk factors include low achievement, retention in grade, behavior problems, poor attendance, low socioeconomic status, and attendance at schools with large numbers of poor students. Socioeconomic status (SES) was used to label at risk students in research funded by The National Endowment of the Arts (Catterall, Dumais, & Hampden-Thompson, 2012). Bowen and Chapman (1996) pointed to dire poverty, poor neighborhoods and lack of social support as the mitigating factors leading to
The Alternative Learning Programs (ALP) in the southeastern United States has defined an at risk student as a student who has been placed or assigned to an alternative school in any of the Local Education Agencies (LEA’s) (North Carolina Department of Public Instruction, 2013a). A much broader definition by the Curriculum and School Reform Services of the same southeastern state defined an at risk student as:

A young person who, because of a wide range of individual, personal, financial, familial, social, behavior or academic circumstances, may experience school failure or other unwanted outcomes unless intervention occurs to reduce the risk factors. Circumstances which often place students at risk include not meeting state/local/proficiency standards; grade retention; unidentified or inadequately addressed learning needs; alienation from school; unchallenging curriculum and/or instructors; tardiness and/or poor school attendance; negative peer influence; unmanageable behavior; substance abuse and other health risk behaviors; abuse and neglect; inadequate parental, family, community and/or school support; limited English proficiency; or other risk factors (NCDPI, 2013b, p. 10).

Unfortunately, the students who are deemed at risk are usually assigned to a school that uses the same curricula and instructional methods that led these students to an alternative school program (Lehr et al., 2009). In order for students to be successful in school, schools need to be willing to think outside the box and have the courage to implement unconventional strategies alongside or instead of conventional ones to motivate students and
to build strengths (Mendler, 2003). For this research, the definitions that will be used to identify at risk students was formulated by the Curriculum and School Reform Services of the Southeastern state (Gattis, 2013).

The North Carolina State Department of Public Education (NCDPI) reported that 14,093 students were placed in alternative schools or programs; this represents an increase of 16.5% between the school years 2009-10 to 2010-11 (NCDPI, 2011). During this same time period, the drop-out rate fell, suggesting the success of alternative programs in helping students to stay in school.

The annual high school dropout rate decreased from 3.75 percent to 3.43 percent for 2010-11. A total of 15,342 high school students dropped out in 2010-11 as compared to 16,804 students in 2009-10 (8.7% decrease). For all grades, the number of students dropping out decreased to 15,773 from 17,346 the prior year. About 63 percent of North Carolina school districts experienced a decrease in dropout rates (NCDPI, 2011).

Students who are at risk will always be identified by the various parameters that are utilized by either the state or local level. The following section will discuss studies concerning at risk students.

**Factors Related to At Risk Students’ Achievement**

Many at risk students have poor attendance, are disengaged from the learning environment and have low academic achievement (Klem & Connell, 2004). By high school, as many as 40% to 60% of students (urban, suburban and rural) become chronically
disengaged from school – this is not counting the students who have dropped out (Sedlak, 1986). Klem and Connell (2004) conducted a study of students at six elementary schools (1,846 students) and three middle schools (2,430 students) in an urban school district. The students were divided into two groups, regular and at risk. The elementary students considered at risk had attendance rates below 89% and/or a reading percentile below 35%. In the study, the middle school students considered at risk had attendance rates below 79% and/or a reading percentile below 25%. All students were given a Student Performance and Commitment Index which assessed student achievement and behavior as well as a Research Assessment Package for Schools which assessed engagement. Their results indicated that approximately 35% of all elementary students and 31% of middle school students were disengaged from school. Elementary students who were disengaged were 56% less likely to demonstrate high levels of attendance and academic performance. A similar pattern was seen in middle school students. These results indicate that there may be a link between engagement and academic performance in school (Klem & Connell, 2004).

Similar results were seen in a study with 302 sixth grade mathematics students in Israel (Eshel & Kohavi, 2003). The sample included 163 females and 139 males. The students were given an extended form of the Student Decision-Making Scale. The authors postulated that academic achievement was linked to perceived classroom control and self-regulated learning. The students who perceived that they had little control over their learning also had low mathematics achievement scores. Conversely, students who perceived they had control over their learning showed higher mathematics achievement scores (Eshel & Kohavi, 2003; Madjar, Nave, & Hen, 2013). Granting students opportunities for choice may enhance
their intrinsic motivation, as well as their investment in learning (Lee, Lee, & Bong, 2014; Zimmerman, 2000).

Active engagement in the classroom is characterized by the application of effective learning and problem-solving strategies (Keller, 2009; Shernoff, Csikszentmihalyi, Shneider, & Shernoff, 2003). The students’ use of these strategies is dependent on a belief that effort leads to success and failure can be remedied by a change in strategy (Cohen, 2014; Garner, 1990). Low achieving or at risk students may not understand how to use strategies or how to change strategies if the ones they are using are not effective (Covington, 1985; Keklik & Keklik, 2012).

There is data to suggest that at risk students view their abilities differently than non-at risk students (Cho, Hallfors, & Sánchez, 2005). The at risk student will not engage in school or has become disengaged due to the school environment. Motivation terminology will be defined for both the at risk and non-at risk students in the following sections.

**Definitions of Motivational Terms**

Researchers in motivation have used varying, and at times confusing, terms to describe the constructs of motivation, and have referenced the same construct with different language. To better understand how the terms utilized by the educational community, Murphy and Alexander (2000) searched the literature and determined that researchers used 20 terms to describe motivation and academic achievement. Their results are shown in Figure 1.

Murphy and Alexander (2000) divided the larger construct of motivation into five smaller constructs. The five smaller constructs were divided further. Self-schema was
subdivided into self-competence, agency, attribution, and self-efficacy. Intrinsic and extrinsic motivation were not divided into further constructs. Goal was sub-divided into social goal and goal orientation. Goal orientation was further divided into work-avoidance, task, ego, mastery, performance and learning goals. Interest was subdivided into situational and individual interest.

For this study of at risk students, self-efficacy will be used to refer to self-schema; mastery and performance goals will be used to describe goal orientation (Murphy & Alexander, 2000).

**Self-Efficacy**

Bandura and Schunk (1981) defined self-efficacy as concern with judgments about how well one can organize and execute courses of action required to deal with prospective situations containing many ambiguous, unpredictable, and often stressful elements. Wentzel

![Motivation Diagram](image-url)

*Figure 2.1.* Motivation terms relevant to academic achievement and motivation. (Adapted from Murphy and Alexander (2000).)
(1989) viewed self-efficacy as the relationship between self-referent beliefs and task-performance outcome. Perceived ability is how self-efficacy was defined in a study with 119 undergraduate statistics students (Miller, Behrens, Greene & Newman, 1993). Nichols and Miller (1994) in a study of 62 Algebra II students defined self-efficacy as the students’ self-perceptions of ability. A much more detailed definition was posited during a study of 297 high school mathematics students. Self-efficacy is defined as people’s beliefs about their ability to successfully perform a task which will influence their willingness to attempt the task, the level of effort they will expend, and their persistence in the face of a challenge (Larson et al., 2014). The present study will adhere to Bandura’s (1982) definition that perceived self-efficacy is concerned with judgments of how well one can execute courses of action required to deal with prospective situations.

Motivation

Motivation as indicated can either be intrinsic or extrinsic (refer to Figure 1). A study consisting of 275 middle school science students provided the means to define extrinsic motivation (Meece, Blumenfeld, & Hoyle, 1988). In their study extrinsic motivation is seen in students that have a preference for social approval and reinforcement. Extrinsic motivation is usually developed in students with low perceived ability (Meece et al., 1988). Extrinsic motivation is also seen in students who are motivated by the desire to obtain grades, not necessarily to win teacher approval, and to meet the external demands of the school system (Csikszentmihalyi & Nakamura, 2014). Several researchers will utilize the term performance goal and not extrinsic motivation (Brophy, 2013; Pintrich & Schunk, 1996)

Intrinsic motivation, conversely, is seen in students that are interested in the subject
material, curiosity, and a preference for challenge. Deci and Ryan (1991) identify students with intrinsic motivation as having an achievement goal orientation. These students are not concerned with being compared to other students, garnering attention of their teachers, but rather achieving valuable goals (Gillet, Vallerand, & Lafrenière, 2012).

**Interest**

“Genuine interest is the accompaniment of identification through action, of the self with some idea for the maintenance of a self-initiated activity” (Dewey, 1913, p. 14). Interest can either be situational or individual (see Figure 1). A definition for situational interest refers to an interest that people acquire by participating in an environment or context (Renninger & Hidi, 2011; Swarat, Ortony, & Revelle, 2012).

**Goals**

Performance goals and mastery goals can be bifurcated into mastery approach goals, mastery avoidance goals, performance approach goals and performance avoidance goals (Bounoua et al., 2012; Elliot & McGregor, 2001). Mastery approach goals concern the individual person striving to do the best that they can. An example of this type of approach would be a student affirming the statement “I desire to completely master the material presented in this class.” Mastery avoidance goals concern the individual person ensuring that they do not make a mistake or lose their ability. An example of this type of approach would be “I am afraid that I may not understand the coursework as thoroughly as I would like.” Performance approach goals encompass the comparing of an individual to the group and being concerned with the appearance of being the best or brightest in the classroom. An example of this type of goal is “It is important for me to do better than others in the class.”
Performance avoidance goals are also concerned with a group but this time, the individual is more concerned that they do not appear to be incompetent when compared to the group. An example of this type of goal is “My goal in this class is to avoid performing poorly.” Social goals are seen when students demonstrate high ability or try to please the teacher (Meece et al., 1988). For the present study, Elliot and McGregor’s (2001) bifurcated definitions of mastery and performance goals will be used. The next section will review the recent research on motivation, academic achievement and goals.

**Expectancy Theories of Motivation**

Expectancies refer to beliefs about how one will do on different tasks or activities, and values have to do with incentives or reasons for doing the activity (Eccles & Wigfield, 2002). Achievement expectancies play a significant role in students’ academic choices and ultimately how they will approach tasks. In particular, how will the student approach the task or even if they will attempt the task at hand (Eccles & Wigfield, 1995; Wigfield & Eccles, 2000)?

When students are assigned a task, they ask themselves several questions. “Can I do this?” “Do I want to do this?” “How do I go about starting?” If the student’s response is affirmative for these questions, there is a greater likelihood that they will be motivated to complete the task at hand, and then choose more challenging tasks in the future (Eccles & Wigfield, 2002). The theory of self-efficacy as proposed by Bandura (1997), suggested that as individuals’ confidence in their ability to organize and execute a given course of action to solve a problem or accomplish a task increases, they are able to take on more complex tasks. This is not to suggest that all students must have attained the highest level of intersubjectivity.
or to have reached the formal operation stage to successfully complete the task at hand, but it
does suggest that there is a process that students will proceed through to reach educational
maturity.

Bandura further elucidated his theory of self-efficacy by distinguishing between two
kinds of expectancy beliefs. He suggested that there are outcome expectations and efficacy
expectations. Outcome expectations are beliefs that certain behaviors will lead to certain
outcomes such as studying for an exam will lead to a good grade. Efficacy expectations are
beliefs about whether one can effectively perform the behaviors necessary to produce the
outcome that is desired such as ‘if I study effectively, I will be able to understand the subject
matter’ (Eccles & Wigfield, 2002).

Locus of control theories are another type of expectancy-based theory. According to
this theory, a student should expect to succeed to the extent that he or she feels in control of
their successes and failures (Eccles & Wigfield, 2002). Connell and Wellborn (1991)
integrated control beliefs and psychological needs: competence, autonomy and relatedness.
They noted that students who believe that they control their achievement outcomes should
feel more competent. This is related to the amount of autonomy that the students are given
when assigned a task. Relatedness concerns how the first two needs are fulfilled; when the
students have their needs met, they will be fully engaged in their tasks. If the needs are not
met, the students will become disaffected and disengaged from their tasks (Connell &

**Student Engagement**

Students can either be intrinsically or extrinsically motivated to pursue a task
(Sansone & Harackiewicz, 2000). They assert that intrinsic motivation is the result of the student enjoying the task and the student is genuinely interested in the task such as reading a book or playing a video game. Students who are interested in a task will have a higher quality of learning (Schiefele, 1999). In general, interest in a task is more strongly related to indicators of deep-level learning than to surface-level learning such as rote memorization. Extrinsic motivation is the result of receiving a reward for pursuing a task such as an award or receiving a good grade on a project (Sansone & Harackiewicz, 2000).

**Goal Theory**

Goals serve to direct behavior toward a specific outcome and are situational (Wentzel, 2000). Students’ goals for success may have emanated from their teacher as well as the students themselves. Wentzel (2000) argues that goals must be viewed within their context and who set the goals. Goals can include many levels of challenge: they can be either social or task-related, proximal or distal, and they can specify certain standards or definitions of performance. Goal orientation will also determine if the student will approach success or try to avoid failure (Senko, Hulleman, & Harackiewicz, 2011; Wentzel, 2000).

Students and teachers will not always choose the same goal orientation in classroom settings. Teachers desire the students to master the curriculum, not just out perform their peers. Students choose varying goal orientations depending upon the subject matter; a performance goal stance may be appropriate for a mathematics class whereas a learning goal stance would be more appropriate when reading a text. It is important to understand which goal orientation the student is approaching tasks from in order to understand their motivation to learn.
Modern Expectancy-Value Theory

The modern expectancy-value theories link achievement performance, persistence, and choice most directly to individuals’ expectancy-related and task-value beliefs (Eccles & Wigfield, 2002). Expectancies and values are assumed to be positively related to each other (Eccles & Wigfield, 2002). Achievement performance is based on the student’s self-concept of ability. Self-concept of ability is defined as the assessment of one’s own competency to perform specific tasks or to carry out role-appropriate behaviors (Wigfield & Eccles, 2000). In the expectancy-value model proposed by Wigfield & Eccles (2000), choices are assumed to be influenced by both negative and positive task characteristics, and all choices are assumed to have costs associated with them precisely because one choice often eliminates other options. Consequently, the relative value and probability of success of various options are key determinants of choice (Wigfield & Eccles, 2000).

The value of any specific task is a function of three major components: the attainment value of the task; the intrinsic value of the task and; the utility value of the task for future goals. Attainment value is the importance of doing well on a task (Wigfield & Eccles, 2000). The attainment value of the task is associated with the individual’s needs and self-perceptions. The intrinsic value is the inherent, immediate enjoyment one gets from engaging in an activity. Utility value, on the other hand, is determined by the importance of the task for a future goal such as graduating from high school and having to pass a biology course (Eccles & Wigfield, 2002).

The Control-Value Theory of Achievement Emotions

Emotions are seen as multi-component, coordinated processes of psychological
subsystems including affective, cognitive, motivational, expressive, and peripheral physiological processes (Pekrun, 2006). He notes that achievement emotions, on the other hand, are defined as emotions tied directly to achievement activities or achievement outcomes. For at risk students using e-education, this could be boredom when listening to a ‘dry’ taped lecture, frustration or anger at not being able to complete an online task, or enjoyment of doing well on the quiz at the end of the e-lesson. Pekrun (2006) distinguish between two types of achievement emotions differing in object focus: activity emotions pertaining to ongoing achievement-related activities and outcome emotions pertaining to the outcomes of these activities.

**On-Line Education**

On-line education differs from traditional education in that on-line education includes a variety of formats including asynchronous web-based instruction (stand-alone modules); bulletin board discussions; e-mail communication; on-line chat; net conferencing; and synchronous communication (Kearsley, 2000). The use of computers in the classroom has become almost synonymous with education. By 1986, personal computers such as the Apple II became a mainstay in the elementary classroom while DOS based computers were used primarily in the high school by (“History of Computers in Education,” 2013). Many universities now require freshman to purchase a laptop computer as part of the enrollment process (Altman, 2008; Smith, Rainie, & Zickuhr, 2011). Most high schools now have computers in each classroom with several computer labs available for students to use (USDPI, 2009) and there are various e-learning programs available to high schools, colleges and universities. The most popular programs are WebAssign®, Moodle™ and
Blackboard™, with 27% of high school students enrolled in an e-education course (Nagel, 2010). In many county systems across the country, as well as individual LEA’s, the choice is e2020®. As of late 2012, e2020® has been used by approximately half a million students across the United States (“Edgenuity,” 2013). The use of computer programs to facilitate education is known as e-education.

**E-Education**

E-education is defined as the use of and delivery of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters (Guri-Rosenblit, 2005; Koohang & Harmon, 2005). E-education or e-learning can be defined in terms of communication, interaction and collaboration tools with less emphasis on the information and more on the delivery of the information. The exchange of information and interaction between students and instructors that utilizes computerized communication systems as an environment for communication is also defined as e-education (Bermejo, 2005). Many educators view e-education as a new way of learning or as an improvement on an existing educational paradigm (Sangrà, Dimitrios, & Nati, 2012). E-learning can be very stimulating with the use of various new multimedia technologies; the Internet can be used to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration (Alonso, Lopez, Manrique, & Vines, 2005).

Thirty-three experts from around the world were asked to develop a comprehensive definition of e-education (Sangrà et al., 2012). Their definition is as follows:
E-learning is an approach to teaching and learning, representing all or part of the educational model applied, that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction and that facilitates the adoption of new ways of understanding and developing learning. Although there was consensus on the above definition by the experts, two additional items were suggested be included when defining e-education; the evolution of the technologies used for learning and teaching should be taken into consideration and that the e-learning concept is also based on certain socioeconomic factors that may not need to be explicitly included in the definition but should nevertheless be taken into account (Sangrà et al., 2012, p. 152).

The delivery method for e-education utilizes either asynchronous communication or synchronous communication (Murphy, Rodriguez-Manzanares, & Barbour, 2011). Asynchronous online teaching involves students working on a prescribed curriculum with the aid of an instructor. The authors note that the facilitator and the students are usually separated both temporarily and geographically. The tools that can support this form of communication include pre-recorded lectures, e-mail, discussion forums, on-line quizzes and tests, and social media such as blogs or wikis. Moodle™, Blackboard™ and e2020® utilize this form of communication to deliver the prescribed curriculum.

Synchronous communication or synchronous e-education relies on videoconferencing, audio conferencing, and/or online discussion (Bernard et al., 2004). This format is similar to a typical high school classroom, with the exception that students and
instructors are separated geographically (Bernard et al. 2004). Murphy et al. (2011) posits that instructors and students must be able to meet at prescribed times to fully implement the curriculum. Students may interact with the instructors in real time if all participants are available and are able to access the required video or audio equipment.

At the college level and some high schools, e-education is identified as distance education (Guri-Rosenblit, 2005). The point can be made that Distance Education and e-education are not the same; e-education does not necessarily indicate distance and distance education can indicate any form of education away from an instructor, such as independent work. E-education at the most basic level involves the use of a computer program or computer platform.

On-line tutoring can also be considered a form of e-learning, some of which use 3D virtual world platform (e.g., Second Life). In some programs, the teachers can “travel to exotic locales” and never leave their schools, via avatars. The avatars can participate in lectures, converse with fellow (avatars) students and interact with the environment that they are in (Hawkridge & Wheeler, 2010).

Moodle is an Open Source Course Management System (CMS), very popular among educators around the world as a tool for creating online dynamic web sites for their students in face-to-face or online courses (Moodle, 2013). WebAssign® is program that is also utilized by many universities and colleges to provide homework assistance, automatically grade science and math problems, and reinforce learning through practice and immediate feedback (“WebAssign,” 2013). Blackboard™ is a program that allows students to take
courses online, collaborate with their peers and interact with their professors (“Blackboard K – 12,” 2013). E2020® is an online platform that can be used as a standalone course or as a blended-learning course that the teacher in the classroom directs (Sohn, 2013). A blended-learning course may enable the instructor to utilize the best of the face-to-face environment in a classroom with the best that an online class has to offer (Osguthorpe & Graham, 2003). They assert that the teacher has the ability to revise the teaching methods to maximize student learning, thus maximizing the benefits of both face-to-face and online methods.

The amount and types of e-learning utilized by students, faculty and school systems are increasing every year (Aud et al., 2011). In the school year 2007 – 2008, 20.4% of undergraduates took at least part of their coursework through distance education and 3.7% took their entire classwork through distance education (Aud et al., 2011). The use of online courses in American high schools increased by 14% in 2010 (Nagel, 2010).

Self-Regulated Learning and a Blended Learning Environment

The first theory to elucidate distance education was known as Transactional Distance Theory, which stated that when learners and facilitators are geographically separated there are pedagogical implications (Moore, 1993). The separation of learners and teachers leads to special patterns of behavior and communication, which is the transactional distance (Moore, 1993).

Gorsky and Caspi (2005) presented a theoretical framework of dialogue for distance education systems between instructors and students. They theorized that (L)earning is an individual activity characterized by internal mental processes; learning is mediated by intrapersonal dialogue; learning is facilitated by interpersonal
dialogue; dialogue is enabled by structural and human resources; and that dialogue and learning outcomes are related. Dialogue in their model could be face-to-face or mediated by either synchronous or asynchronous media. (p. 138)

Five self-regulatory attributes are seen as especially important for distance learner (on-line) success. They are: motivation which incorporates self-efficacy and goal orientation; Internet self-efficacy; time management; study environment management; and learning assistance management (Lynch & Dembo, 2004). A high sense of self-regulatory efficacy enhances task performance efficacy, which in turn motivates further self-regulation in pursuit of further academic attainment. Empirical research conducted by Schrum and Hong (2002) indicated that experience with technology is an important element for on-line success. They posited that developing self-efficacy as it relates to the course content is also central to ensuring that learners are both comfortable and competent using on-line tools.

Time management is an indication that the student will be able to effectively utilize the on-line course materials (Palloff & Pratt, 2010). A Web-based course can require two to three times the amount of time investment as a traditional face-to-face class experience (Palloff & Pratt, 2010)

Self-regulated learners also are aware of the important role other people, either peers or teachers, can play in their learning (Hara & Kling, 2000). In an empirical study conducted by Lynch and Dembo (2004) 94 undergraduate marketing class students were enrolled in a blended learning class. The students were given a Motivated Strategies for Learning Questionnaire (Pintrich, Smith, García, & McKeachie, 1993) to determine if intrinsic goal orientation, self-efficacy for learning and performance, time and study
environment management, help seeking and Internet self-efficacy would be predictive of academic performance (final grades). There was a positive correlation between self-efficacy and performance in the course, and students who have low self-efficacy may be at risk of not completing the course. They recommended that these students should be identified and given efficacy enhancing activities and feedback for the course.

*Locus of Control and On-Line Learning*

On-line students have been found to exhibit a greater external locus of control than traditional students (Wang & Newlin, 2000), which is a generalized belief of one’s personal efficacy (Rotter, 1966). Liu, Lavelle, and Andris (2002) in an empirical study of 12 graduate students in an on-line course found that on-line instruction is an effective method for changing a learner’s locus of control from external to internal. Furthermore, the findings of Liu et al. (2002) suggest that instructional intervention is a powerful variable in promoting personal change, (i.e., changing from external locus of control to internal locus of control). When student has more self-efficacy and believes that he is in control (internal locus of control), the student will be more likely to use strategies like self-regulation and time management to regulate their learning (Ng, 2002). In a separate study conducted by Drennan and Kennedy (2005), 248 undergraduates attending the University of Queensland, were surveyed to measure the level of satisfaction while taking on-line courses. The students indicated that they had positive perceptions towards the on-line learning environment that utilized an autonomous learning style. A higher level of course satisfaction is correlated with an internal locus of control (Drennan & Kennedy, 2005).
Learning Outcomes

To further the understanding of the relationship between motivational goals, beliefs, strategy use and learning outcomes when students are enrolled in an on-line course, Ng (2002) surveyed 1200 tertiary Chinese distance learners enrolled in Hong Kong Universities. The results indicated that mastery oriented goals predicted positive attitudes toward the course but not necessarily the level of achievement as measured by the final course grade. In contrast, performance oriented goal and work-related goals predicted achievement levels (but not attitudes) towards the course. The type of goal orientation that the student brings to the course, either on-line or face-to-face appears to have more bearing on how well the students will perform in the class (Ng, 2002).

Choosing to Remain in an On-line Course

In a study of 122 undergraduates, students who preferred the on-line learning environment or were curious about taking an on-line course had higher self-efficacy than students who enrolled solely because of course availability (A. Y. Wang & Newlin, 2002). In an empirical study of 540 undergraduate students, Carswell & Venkatesh (2002) determined that learner outcomes are positively correlated to intention to remain using on-line instruction; engagement in the on-line instruction; and performance outcomes as related to the final grade. In another study of 96 graduate students, learning styles and learning patterns did not affect the overall outcome of the course (Lu, Yu, & Liu, 2003). A study consisting of students across five semesters who were enrolled and completed electronically delivered, undergraduate core courses taught using WebCT showed that more successful students were found to have an internal locus of control than the students who failed to
complete the on-line course (Morris, Wu, & Finnegan, 2005). A study conducted by Wang (2008) indicated that Taiwanese university students (n = 286) continued utilizing on-line education whether they were planning on taking just a few courses or taking their entire course load on-line. Other variables that correlated positively with the continuance of on-line courses included computer self-efficacy, expended effort, expected grades, social influences and the facilitation of the course.

Comparing On-Line Learning with Face-to-Face

On-line learning environments may provide students with opportunities to engage with the learning process; however, it cannot be assumed that the students will take advantage of the possibilities of e-instruction (Wallace, 2004). Alonso, López, Manrique and Viñes (2005) identified two pitfalls that can occur in on-line education environments. The first is the failure to accommodate the learning process which may place an undue cognitive burden on the student and cause disengagement. The second is that the learner may not see the relevance of the material presented and will also become disengaged from the learning process. The ability to understand the material and to synthesize the material is based on Bloom’s taxonomy, which describes several knowledge levels, intellectual capabilities and skills that a student can achieve through learning (Forehand, 2010).

Students may have the ability to evaluate material presented by a face-to-face instructor, but may not be able to do the same with on-line instruction. See Table 2.1 for a comparison of on-line learners and face-to-face learners (Lim, 2004).
Table 2.1
Comparison of On-Line Learners to Face-to-Face Learners

<table>
<thead>
<tr>
<th>On-Line Learners</th>
<th>Face-to-Face Learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to evaluate the material presented by a computer program but not use relevant learning strategies</td>
<td>Ability to evaluate material presented by teacher and use relevant learning strategies</td>
</tr>
<tr>
<td>Students may become overwhelmed by content of on-line course material</td>
<td>Students may be comfortable with content of face-to-face course material</td>
</tr>
<tr>
<td>Students may become overwhelmed by the process of using the on-line course materials</td>
<td>Students may be comfortable with the process of face-to-face course materials</td>
</tr>
<tr>
<td>Students may become overwhelmed with how to interact with the on-line course</td>
<td>Students may be comfortable with the interaction of face-to-face course materials</td>
</tr>
<tr>
<td>Students will have to learn new technologies in order to be successful in an on-line course</td>
<td>Students may be comfortable with the lack of technology in a face-to-face course</td>
</tr>
</tbody>
</table>

Teachers can provide instructions that will teach the students to ‘learn on-line’ (Lim, 2004). Students must be taught how to interact with the programs including how to post answers and how to access lessons embedded within the programs. E-2020®, a stand-alone on-line course has a seventeen minute introductory course built into the software program. When students are enrolled in science courses using e-2020®, they are automatically directed
to this section prior to beginning the course (“Edgenuity,” 2013). It is probable that some students will browse through the lessons without engaging the program. Authentic activities have the capability to motivate and encourage learner participation by facilitating the students’ engagement with the lesson that is being provided on-line (Reeves, Herrington, & Oliver, 2002).

‘Authentic’ activities are based on real situations and simulation models focus on applying new knowledge and skills (Reeves, Herrington, & Oliver 2002). The researchers’ assert that authentic activities should: have real world relevance to students, be well defined, complex, and require more than a few minutes to complete and include several resources.; involve students collaborating with their peers and then reflecting on the assignments; include cross-curricular, integrated lessons; assignments should be a finished product in its own right; and integrate various viewpoints (Reeves, Herrington, & Oliver, 2002). Complex and sustained activity can motivate students to learn, provide meaning and relevance to complex content, enable collaborative problem solving, justify the creation of polished products, and provide integrated assessment of achievement (Herrington, Reeves, Oliver & Woo, 2004).

Simulations also allow students to immerse themselves into a problem and work cooperatively to solve an unknown problem (“Second Life | Linden Lab,” 2013). The student can be transported to other worlds or environments that would not otherwise be possible. Students enrolled in the SUNY Learning Network were surveyed regarding their experience with on-line course. Of the 1,409 students that responded to the survey, 45%
stated that there was more interaction with the on-line course than face-to-face instruction (Swan, 2001).

The e2020® science program utilizes Gizmo!® exclusively. Gizmo!® is a program that allows the students to perform experiments and manipulate variables such as weight and mass when a laboratory situation is not available (“Edgenuity,” 2013). Computer simulations allow students to experiment with objects that may not be available to classrooms or are too dangerous to manipulate. Students are able to get immediate feedback from their experiments and discuss with their classmates (Bell & Smetana, 2008). The Gizmos used in the e2020 science program meet the authentic activities as outlined by Reeves et al. (2003).

**Conclusion**

The literature regarding at risk students and on-line education is extensive. At risk students are a fragile yet large group of the larger population of students with the United States. The literature provides definitions of this population and how they approach their educational opportunities. Many at risk students can benefit from non-traditional methods of education in a classroom such as science e-education courses. The following chapter details the methods of a study of at risk students utilizing a science e-education course in a summer school program.
CHAPTER THREE

METHODS

The purpose of this study was to understand how at risk high school students interacted with science e-education programs, specifically e2020®. A convergent parallel mixed methods study (Creswell & Clark, 2007) was used to collect both quantitative (e.g., survey and test data) and qualitative (e.g., focus group and individual interviews) data. In this chapter, the research design, participants, research context, data collection, content validity and reliability of the survey instruments and data collection procedures, variables, and data analyses will be described.

Study Design

This study used a mixed methods, embedded design, using a combination of qualitative and quantitative research approaches (Creswell & Clark, 2007).

The prototypical variant of the embedded design occurs when the researcher will embed a supplemental data set within a larger design to address different questions. The most common example is the embedded-experiment variant, which occurs when the researcher embeds qualitative data within an experimental trial (Creswell & Clark, 2007, p. 95).

In this study, at risk students enrolled in an e-education summer school course to replace the grade of a failed science course (earth science, biology or physical science). In order to determine the impact of the e-course on their learning and other factors, different sources of quantitative data were collected. The students’ scores on the Students’ Measurement Towards Science Learning (SMTSL) survey (Tuan, Chin, & Shieh, 2005) were
collected near the beginning of the summer school course. The e2020® program

Timeline

<table>
<thead>
<tr>
<th>SMTSL survey: June 2014</th>
<th>e2020® science course (Summer Academy)</th>
<th>Posttest: August 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest: June 2014</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3.1.** Convergent mixed methods parallel design of study.

(Edgenuity, 2013) for either biology, earth science, or physical science provided the following information for each student: pretest scores, posttest scores, active time, or idle time, a comprehensive exam score, and the final course grade. The qualitative data consisted of both individual and focus group interviews with students, which were carried out initially and throughout the study. The data collected were used to triangulate the results to further understand how at risk students respond when they use a science e-program to make up course credit during a summer session. The student interviews were used to gain a better understanding of how students’ experienced the e-education course.

**Students and Context**

The students in this study attended one of eight high schools located in a southeastern United States (SE US) rural county school district. The demographics of the student
population in this SE US county were 64% Caucasian, 18% African American, 12% Hispanic, 0.9% American Indian, 0.7% Asian and 0.1% Native Hawaiian, and 3% two or more races as reported by school, county and state demographic surveys (Glimpse, 2015; US Department of Commerce, 2014). However, the student population of the study did not include American Indians, Asians or Native Hawaiians, but did consist of Caucasians, African Americans, Hispanic and students who self-reported as two or more races. Of the thirty-two high school students who consented to participate in the study, 15 (46.9%) self-identified as Caucasian, 11 (34.38%) self-identified as African-American, 2 (6.25%) self-identified as Caucasian/Hispanic, 2 (6.25%) self-identified as Hispanic/two-or-more races and 2 (6.25%) self-identified as two-or-more races. Due to the small number of this race/ethnic category, as well as the small sample size, the decision was made to place all students in one of two racial/ethnic categories. The bifurcated categories were Caucasian/African American and Hispanic/non-Hispanic. The four students, who self-reported they were of Hispanic ethnicity, were placed in the Hispanic category. Two students who self-reported Hispanic/two-or-more races were categorized as African American due to their racial/ethnic background, as was one of the students who self-reported two-or-more races. The remaining student who self-identified as two or more races was categorized as Caucasian. He was of Asian descent, but his scores were similar to that of Caucasians, so it was decided to place him in the Caucasian category for statistical purposes. Therefore, for the analyses in this study, the majority of the students (56.25%) were Caucasian, African Americans comprised 43.75% of the study, 12.5% were Hispanics and 87.5% were non-Hispanic. All students enrolled the study were considered at risk based on
the definition set out by this school district.

The rural county generally uses the e-education program e2020® in their summer academy for students who failed a science course in the previous school year(s). Each of the 8 high schools in the county as well as the Evening Academy hosts a summer academy for the students who attend those schools. One of the high schools decided to hire a teacher instead of using the e-program. Therefore, the students enrolled at this school site were not invited to be a part of this study. (See Table 3.1.)

To be eligible for the study, students must have failed a science course in the past year and be enrolled in the summer school academy to retake the course using e-education. A total of 49 students met these criteria and were invited to be a part of the study. Of these students, 32 (67%) agreed to participate in the study, allow all of their e-program data to be used, and completed the survey. Of these 32 students, 28 (85%) students agreed to be interviewed. The enrollment for the summer school program sites involved in the study ranged from one to twelve science students.

The students who enrolled in the science courses during the summer school academy had taken either the state’s End-of-Course test (EOC) for Biology or a final state exam for Physical Science or Earth Science, depending upon the courses in which the students had enrolled. The grading scale used by the county school district requires a 70% average for students to pass a course, and also requires that the student has had no more than 8 unexcused absences per semester during the school year. In addition, the policy requires that the biology students pass the Biology End-of-Course test. If a biology student passes the course with a 70% average or higher but has failed the state’s Biology End-of-Course test, the
student will not receive credit for the course. Physical science and earth science students are required to take the state’s final exam, but unlike the biology exam; failing these exams do not result in an automatic failure. To receive a science credit, the students must have an average of 70% or above, which includes the exam grade (20% of course grade) and their grades from each semester (80% of course grade). The summer academy is held during the break between Spring Semester and Fall Semester and was in session for six weeks.

Table 3.1

Study Participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Gender</th>
<th>Race/Ethnicity</th>
<th>Current grade</th>
<th>Course enrolled in</th>
<th>Prior Use of e-education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allie</td>
<td>female</td>
<td>Caucasian</td>
<td>11</td>
<td>Biology</td>
<td>No</td>
</tr>
<tr>
<td>Patty**</td>
<td>female</td>
<td>two or more/Hispanic</td>
<td>11</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Lenny</td>
<td>male</td>
<td>Caucasian</td>
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<td>Biology</td>
<td>No</td>
</tr>
<tr>
<td>Harry</td>
<td>male</td>
<td>Caucasian</td>
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<td>Biology</td>
<td>No</td>
</tr>
<tr>
<td>Bob</td>
<td>male</td>
<td>Caucasian</td>
<td>11</td>
<td>Biology</td>
<td>No</td>
</tr>
<tr>
<td>Jimmy</td>
<td>male</td>
<td>Caucasian/Hispanic</td>
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<td>Biology</td>
<td>No</td>
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<tr>
<td>Allen</td>
<td>male</td>
<td>Caucasian</td>
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<td>Biology</td>
<td>Yes</td>
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<tr>
<td>Roger</td>
<td>male</td>
<td>Caucasian</td>
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<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Tom</td>
<td>male</td>
<td>Caucasian</td>
<td>12</td>
<td>Biology</td>
<td>Yes</td>
</tr>
<tr>
<td>Eddie**</td>
<td>male</td>
<td>two or more/Hispanic</td>
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<tr>
<td>Laura</td>
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</tr>
<tr>
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<td>Earth Science</td>
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</tr>
<tr>
<td>Holly</td>
<td>female</td>
<td>Caucasian</td>
<td>12</td>
<td>Earth Science</td>
<td>No</td>
</tr>
<tr>
<td>First Name</td>
<td>Gender</td>
<td>Race/Ethnicity</td>
<td>Age</td>
<td>Subject</td>
<td>Enrolled</td>
</tr>
<tr>
<td>------------</td>
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</tr>
<tr>
<td>KB**</td>
<td>female</td>
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</tr>
<tr>
<td>JK</td>
<td>female</td>
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</tr>
<tr>
<td>Missy</td>
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<td>Earth Science</td>
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</tr>
<tr>
<td>Cathy</td>
<td>female</td>
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<td>Earth Science</td>
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</tr>
<tr>
<td>Doug</td>
<td>male</td>
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<td>Earth Science</td>
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<tr>
<td>Lee</td>
<td>male</td>
<td>African American</td>
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<td>Earth Science</td>
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<tr>
<td>Cabe</td>
<td>male</td>
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<td>Earth Science</td>
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<tr>
<td>Emma</td>
<td>female</td>
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<td>No</td>
</tr>
<tr>
<td>Dee</td>
<td>female</td>
<td>Caucasian</td>
<td>10</td>
<td>Physical Science</td>
<td>No</td>
</tr>
<tr>
<td>Kate</td>
<td>female</td>
<td>African American</td>
<td>12</td>
<td>Physical Science</td>
<td>Yes</td>
</tr>
<tr>
<td>CT</td>
<td>female</td>
<td>Caucasian</td>
<td>12</td>
<td>Physical Science</td>
<td>Yes</td>
</tr>
<tr>
<td>Kyle</td>
<td>male</td>
<td>African American</td>
<td>10</td>
<td>Physical Science</td>
<td>No</td>
</tr>
<tr>
<td>Nick</td>
<td>male</td>
<td>Caucasian</td>
<td>10</td>
<td>Physical Science</td>
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</tr>
<tr>
<td>Tyler*</td>
<td>male</td>
<td>two or more</td>
<td>11</td>
<td>Physical Science</td>
<td>No</td>
</tr>
<tr>
<td>Dan</td>
<td>male</td>
<td>African American</td>
<td>10</td>
<td>Physical Science</td>
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</tr>
<tr>
<td>AJ</td>
<td>male</td>
<td>African American</td>
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<td>Physical Science</td>
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<tr>
<td>KJ</td>
<td>male</td>
<td>African American</td>
<td>12</td>
<td>Physical Science</td>
<td>Yes</td>
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<tr>
<td>Dave</td>
<td>male</td>
<td>African American</td>
<td>12</td>
<td>Physical Science</td>
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</tr>
<tr>
<td>Sam</td>
<td>male</td>
<td>Caucasian/Hispanic</td>
<td>11</td>
<td>Physical Science</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note: The study participants were 13 (40.6%) female, 19 (59.4%) male, 11 (34.38%) African American, 15 (46.9%) Caucasian, 2 (6.25%) Caucasian with Hispanic ethnicity, 2 (6.25%) two or more races and 2 (6.25%) two or more races/Hispanic ethnicity. Amended racial/ethnic categories; 56.25% Caucasian, 43.75% African American, 12.5% Hispanic, and 87.5% non-Hispanic.*Asian descent. **African American descent.
The district Superintendent granted written permission to the researcher prior to the summer session for all schools that provided summer school to allow the researcher entry and to be able to invite all science students to participate in the study. The researcher visited each of the 8 summer school sites during the first three days of the summer session, introduced herself to the principal and explained the study parameters, and reported that an approved IRB was on file at her university as well as at the school district office. All correspondence between the researcher and the superintendent was available to the summer school principals. The principals of the eight summer school sites allowed the researcher to introduce herself to the students, to describe the study and invite their participation.

In addition to students’ consent to allow their e-education data to be mined for the dissertation study, all students involved in the study were invited to be interviewed either individually or as part of a focus group, at their respective school site and during normal summer school hours. Students were given a brief explanation of the study along with a consent form to be signed by the student and the student’s parent or guardian. Students were informed that their survey responses and interview responses would be kept in strictest confidence, as per the IRB. (See Appendixes A and B for complete IRB.)

**Quantitative Data**

The quantitative research portion of the study consisted of descriptive and inferential statistical analyses of the Students’ Motivation Towards Science Learning survey (Tuan et al. 2005). The analyses of the Pre- and Posttest scores from each lesson of the science e-program and analyses of the final e-grade was an indicator for academic growth. Time-on-Task for the study participants was also analyzed.
Students’ Motivation Towards Science Learning

The survey, Students’ Motivation toward Science Learning (SMTSL) (Tuan et al., 2005) was given at the beginning of the summer session. The SMTSL was validated on 1,407 high school students from central Taiwan. The SMTSL is a thirty-five item survey where students responded on a 5 point Likert scale of 1 (strongly disagree), 3 (neither agree nor disagree) and 5 (strongly agree). Six subscale scores were generated from the 35 questions, including: self-efficacy; active learning strategies; science learning value; performance goal; achievement goal; and learning environment stimulation. The scales can be used individually to determine levels of self-efficacy, for example, as well as the total score of the SMTSL to determine a student’s motivation regarding learning science (Tuan et al., 2005). The questionnaire items can be found in Table 3.2. Students took the survey online through the Qualtrics® (Qualtrics, 2014) program provided by NCSU.

Table 3.2
Students’ Motivation Towards Science Learning

<table>
<thead>
<tr>
<th>Self-Efficacy (1–7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Whether the science content is difficult or easy, I am sure that I can understand it.</td>
</tr>
<tr>
<td>2. I am not confident about understanding difficult science concepts. *</td>
</tr>
<tr>
<td>3. I am sure that I can do well on science tests.</td>
</tr>
<tr>
<td>4. No matter how much effort I put in, I cannot learn science. *</td>
</tr>
<tr>
<td>5. When science activities are too difficult, I give up or do just the easy parts. *</td>
</tr>
</tbody>
</table>
Table 3.2 Continued

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>During science activities, I prefer to ask other people for the answer rather than think for myself. *</td>
</tr>
<tr>
<td>7.</td>
<td>When I find science content too difficult, I do not try to learn it. *</td>
</tr>
</tbody>
</table>

**Active Learning Strategies (8 – 15)**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>When learning new science concepts, I attempt to understand them.</td>
</tr>
<tr>
<td>9.</td>
<td>When learning new science concepts, I connect them to my previous experiences.</td>
</tr>
<tr>
<td>10.</td>
<td>When I do not understand a science concept, I find relevant resources that can help me.</td>
</tr>
<tr>
<td>11.</td>
<td>When I do not understand a science concept, I would discuss with the teacher or other students to clarify my understanding.</td>
</tr>
<tr>
<td>12.</td>
<td>During the learning processes, I attempt to make connections between the concepts that I learn.</td>
</tr>
<tr>
<td>13.</td>
<td>When I make a mistake, I try to find out why.</td>
</tr>
<tr>
<td>14.</td>
<td>When I am introduced to science concepts that I do not understand, I will try to learn them.</td>
</tr>
<tr>
<td>15.</td>
<td>When new science concepts that I have learned conflict with my previous understanding, I try to understand why.</td>
</tr>
</tbody>
</table>

**Science Learning Value (16 – 20)**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>I think that learning science is important because I can use it in my daily life.</td>
</tr>
<tr>
<td>17.</td>
<td>I think that learning science is important because it stimulates my thinking.</td>
</tr>
<tr>
<td>18.</td>
<td>In science, I think that it is important to learn to solve problems.</td>
</tr>
<tr>
<td>19.</td>
<td>In science, I think it is important to participate in inquiry activities.</td>
</tr>
<tr>
<td>20.</td>
<td>It is important to have the opportunity to satisfy my own curiosity when learning science.</td>
</tr>
</tbody>
</table>

**Performance Goal (21 – 24)**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>I participate in science courses to get a good grade. *</td>
</tr>
<tr>
<td>22.</td>
<td>I participate in science courses to perform better than other students. *</td>
</tr>
<tr>
<td>23.</td>
<td>I participate in science courses so that other students think that I am smart. *</td>
</tr>
</tbody>
</table>
Table 3.2 Continued

24. I participate in science courses so that the teacher pays attention to me. *

**Achievement Goal (25 – 29)**

25. During a science course, I feel most fulfilled when I earn a good score in a test.

26. I feel most fulfilled when I feel confident about the content in a science course.

27. During a science course, I feel most fulfilled when I am able to solve a difficult problem.

28. During a science course, I feel most fulfilled when the teacher accepts my ideas.

29. During a science course, I feel most fulfilled when other students accept my ideas.

**Learning Environment Stimulation (30 – 35)**

30. I am willing to participate in this science course because the content is exciting and always changing.

31. I am willing to participate in this science course because the teacher uses a variety of teaching methods.

32. I am willing to participate in this science course because the teacher does not put a lot of pressure on me.

33. I am willing to participate in this science course because the teacher pays attention to me.

34. I am willing to participate in this science course because it is challenging.

35. I am willing to participate in this science course because the students are involved in discussions.

Note: * denotes being reversed scored.

**Validation of the Survey Instrument**

Tuan et al.’s (2005) Students’ Motivation toward Science Learning (SMTSL) is a valid, published instrument with six subscales. For this study, the Cronbach alpha reliability coefficient was computed for each scale, and ranged from 0.70 to 0.87. Cronbach’s alpha is a reliability measurement that is sensitive to content sampling error and that assesses the
content homogeneity of the inventory (Reynolds et al. 2009).

The self-efficacy score is a continuous variable and is considered to be the independent variable. In an Australian study (Carroll, Gordon, Haynes, & Houghton, 2013) involving 88 delinquents (18% female), 97 at risk students (20% females) and 95 students (20% females), the self-efficacy scores of the non-at-risk students were higher ($M = 4.97; SD = 0.92$) than the at-risk students ($M = 4.11; SD = 1.10$) or of delinquents (incarcerated students) ($M = 3.7; SD = 1.29$) when using Bandura’s Children’s Self-Efficacy Scale (Bandura, 2006).

The study conducted by Tuan et al. (2005) included 1407 Taiwanese students who responded to the SMTSL. In their study, the self-efficacy scores ($M = 23.37; SD = 5.25$) were comparable to a study of 350 Greek undergraduate students ($M = 24.87; SD = 5.47$) (Dermitzaki, Stavroussi, Vavougios, & Kotsis, 2013). The lowest possible score for the self-efficacy subscale is seven whereas the highest possible score is thirty-five. A score of 21 on the self-efficacy subscale indicates that the students have no opinion in regards to self-efficacy in the science classroom.

Active learning strategies is an indication of how active a role students take in using a variety of learning strategies to construct new science knowledge. The learning strategies employed by students depend on the nature and motivation of their learning goals. Tuan et al. (2005) derived their subset of active learning strategies from the MSLQ (Pintrich et al., 1993). A total of eight questions composed the active learning strategy with the scores ranging from eight to forty.

Science learning value (task value) is the value that students place on acquiring
problem-solving competency, experience inquiry activities; stimulate their own thinking and finding the relevance of science in their everyday lives. Task value as defined by Eccles and Wigfield (2002) is students’ judgments of how interesting, important, and useful a lesson, unit or course is to them. A higher score is an indication that students will be motivated to learn science, a total of five questions with a range of scores from five to twenty-five made up the science learning value factor.

Performance goal was the fourth factor of the SMTSL (Tuan, et al. 2005). Performance goal pertains to the students’ desire to gain attention from the teacher and to compete with their classmates. The higher subscale on the performance goal is an indication that students want to perform better than their peers and to impress the teacher with their skill set (Brophy, 2013). The performance goal score was determined by four questions, the range of scores between four and twenty.

The idea that students feel satisfaction as they increase their competence while learning science was measured with the achievement goal factor. Students with high achievement goal scores are intrinsically motivated to increase their own competence (Anghelcev & Eighmey, 2013; R. M. Ryan, 1991). The Achievement goal factor consisted of five questions with a range of scores from five to twenty-five.

The final factor of the Students’ Motivation Towards Science Learning is Learning Environment Stimulation, with a range of scores of six to thirty. Learning environment stimulation is measured by the six statements involves the environment surrounding the student, including the classroom, the curriculum, teacher and pupil interaction. Tuan et al. (2005) chose to include this subscale to address the importance of creating a supportive
environment in the science classroom.

*Welch's t-test*

Inferential statistics such as a t-test is used to determine if the comparison of two means is statistically different from each other. The samples could be independent, such as comparing men and women from a population; or dependent, such as comparing pretests and posttests of a sample of the population. The distribution of the scores relies on the premise that the sample from the population (either independent or dependent) is normally distributed. The standard deviation of the populations must be known and be similar as well as having a large sample (greater than 30) available for study. If any of these parameters are not met, the probabilities of the results will not be accurate (Urdan, 2001).

A histogram of the means of the subscale data from the SMTSL and the academic growth indices were created. From the histogram, it was determined that the means of the various subscales as well as the differences between the pretest and posttests were not normally distributed. As such, Welch’s t-test was selected to determine if the difference of the means of the groups that were compared were statistically significant.

A Welch’s t-test is the non-parametric statistic that is widely used to infer if the means of the two samples are statistically significant. The variances of the two samples are not required to be equal. The sample size is also taken into account when this type of t-test is utilized without an increase in the type I or type II errors (Ruxton, 2006).

*Academic Growth*

Academic growth for this study was defined as the point difference between the e-education posttest scores mean and the pretest scores mean. A student beginning a lesson in
the e-program was automatically assigned to take the pretest to determine if the lesson would be required; if the students’ pretest score was 80% or higher, the student was allowed to bypass that particular lesson. The pretest score associated with the bypassed lesson was not included in the student’s final average. If a student had to complete the lesson which included the pretest, various activities and posttest, the pretest did not count toward the final grade for the lesson. Students completed from twelve to one hundred forty-seven lessons, so the academic growth for each student is based on the difference between the means of all of their lessons’ pretest scores and all of their lessons’ posttest scores for the course.

**Time-on-Task**

Time on task was derived from e2020® by accessing the student’s attendance log. When the students log into the e2020® science program, the program keeps track of the active time as well as the idle time. Active time is defined as,

[T]he time a student spends on an activity up to submission for score. This time includes watching videos, answering questions, taking eNotes, reading transcripts or reviewing the Glossary. Active Time ends when an activity is completed and a score is assigned (“Edgenuity,” 2013). Idle time is defined as, ‘All time that is not Active Time, including time reviewing previously completed activities, time in the Organizer, Lobby, or Course Map’ (“Edgenuity,” 2013).

It was noted that during the idle times, the students were either taking notes or reviewing what they had learned. The total time that the students were actively engaged was divided by the total time the students were logged in to obtain the percentage of time-on-task. The students who were actively engaged in the program had a high percentage time-on-task.
Figure 3.2 is an example of an attendance log. In this example, the student was actively engaged for a total of 1 Hour and 21 minutes, was idle for 9 minutes, and total time the student was logged into the e2020® program was 1 Hour and 30 minutes.

<table>
<thead>
<tr>
<th>8:19 AM-9:49 AM</th>
<th>1 Hr 30 Mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC Earth Environmental Science</td>
<td>1 Hr 21 Mins</td>
</tr>
<tr>
<td>Idle Time</td>
<td>9 Mins</td>
</tr>
</tbody>
</table>

Figure 3.2 An example of an attendance log for Earth Environmental Science.

E2020

The computer program that was used for the intervention is the e2020® science component. The program houses curricular modules that are aligned with the standard course of study. Each module is a stand-alone lesson on one specific topic such as machines for physical science; cell organelles for biology and; the rock cycle for earth science.

Students enrolled in the e2020® science were assigned a predetermined course at the school to which they were assigned. Each student began each module with a pretest; if the student earned a score of 80% or higher, the module was marked complete. Any score below an 80% on the pretest forced the student to work a series of assignments and a posttest. The first assignment was vocabulary, followed by the students reading passages and answering questions on the passages. Following these two assignments, the students were directed to a journaling activity and possibly a virtual laboratory assignment (Gizmo™). The final activity prior to a posttest was a test review. All assigned activities were focused on one
specific topic within their curriculum.

A Physical Science lesson on ‘Measuring Motion’ for example, includes the following activities: vocabulary, direct instruction, journal activity, lab lecture, lab assignment, and culminating quiz. If the student understood the principles of ‘Measuring Motion,’ and demonstrated this by receiving a score of 80% or better on the pretest, this entire lesson would be bypassed. Conversely, if the student did not understand these principles at an 80% or better proficiency level, then the entire lesson would be assigned.

**Qualitative Data and Analysis**

The qualitative research portion of this study consisted of a series of semi-structured interviews. Interviews are a useful qualitative tool to gather opinions, beliefs, and attitudes about issues of interest to a research topic; test assumptions regarding the research; encourage discussion about a particular topic; encourage participants to become excited about the topic; and to provide an opportunity to learn more about the topic at hand (Simon, 1999). Interviews were used in this study to better understand the impact of an e2020® science program on the students in the study.

Each interview session was audiotaped. The audio portion of each focus group was transcribed by the researcher. Saldaña (2012) defines code as a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute to language data. The transcribed interviews were coded using Descriptive Coding to document and categorize the beliefs of the participants. Coding is not just labeling the data; it is linking the data to an idea and from an idea to all the data pertaining to that data (Richards & Morse, 2007). The transcribed data were coded by the researcher as well as by two colleagues to
obtain intercoder reliability. The colleagues that volunteered to assist me both obtained their doctorates in Educational Leadership. One colleague teaches at the same school as the researcher, and the other colleague was assigned to the researcher’s school as the director of at risk schools in the county.

Samples (13 pages of 39) of the transcribed interviews were coded independently by the researcher and her two colleagues. The interviews that were coded by all three coders were chosen due to the depth of the interviews. An initial focus group interview and an exit interview were coded using codes based on Artino’s (2010) framework and the SMTSL (Tuan et al., 2005); examples of the coding included ‘autonomy,’ ‘achievement,’ and ‘increase of self-efficacy.’ An intercoder reliability of 90% (Lombard, Snyder-Duch, & Bracken, 2004) is the desired goal and was obtained.

Saldaña, (2012) defined code as a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute to language data. The transcribed interviews will be coded using Descriptive Coding to document and categorize the opinions of the participants. Coding is not just labeling the data; it is linking the data to an idea and from an idea to all the data pertaining to that data (Richards & Morse, 2007). In this manner, the coded data will be triangulated with quantitative data as well as with other qualitative data.

Each student was given a pseudonym and confidentiality of the data collected was maintained at all times during the study. The transcribed material was located on an external hard drive which was kept in a locked cabinet in a locked room. The researcher and her advisor were the only persons that had access to the raw data and the transcribed data.
All data was stored on a password protected external hard drive and was stored in a locked office. A master list was created, and was stored on the password protected external hard drive, which enabled the researcher to link the data with the participants. All participants were given a pseudonym to maintain confidentiality.

**Interviews**

A semi-structured interview schedule featuring open-ended questions was used (Barriball & While, 1994). Interviews were conducted at the beginning of the summer academy (pre), during the semester and again at the end of the summer academy (post). All students were invited to participate in the interviews.

One of the more common strategies is maximal variation sampling, in which diverse individuals are chosen who are expected to hold different perspectives on the central phenomenon, in this case, the use of e2020® (Creswell & Clark, 2007, p. 174).

The students who chose to be interviewed were asked a series of questions (see Table 3.3 and 3.4). The questions allowed the researcher to gather data about how the at risk students interacted with the science e2020® program, and if they believed that the program made them more successful in the science class. The interviews were audiotaped to ensure that all responses are clearly understood.

The researcher met with the participants once a week during the six weeks of the summer school session at the eight schools. Focus group sessions varied in length, as did the individual interviews. A total of 39 double spaced pages were transcribed verbatim from the interviews for the study. Focus group interviews comprised 29% of the interviews and individual interviews included the remaining 71%. The transcripts from the focus group
interviews ranged in length from one page to four pages and encompassed 38% of the transcribed interviews. The individual transcripts ranged in length from one page to four pages and made up the remaining 62% of the transcribed pages. The students were asked a series of open-ended questions to understand how their view of science and the impact of the e2020® science program on their views of science. Every time the students met with the researcher, the sessions were audiotaped.

The first set of questions included questions to understand if students liked using the e2020® program and whether any student had used an on-line program in the past. The interviews used a focus group format when possible and individual interviews if a focus group was not possible. The students who were involved in the study had to complete a certain percentage of the course prior to taking the cumulative exam, if the students completed the course, they were allowed to exit the summer school session. Several of the students completed the summer session prior to the researcher’s final focus group interviews. Each interview session used the same format and the same questions. The second set of questions focused on how the students interacted with the program, whether they were successful and if their self-efficacy had improved while using the program. The interviews were transcribed and coded using the nVivo® program (Fraser & Solutions, 2000). During the interviews, the students were asked if what they stated is what they meant. While not given a copy of the transcribed interviews the students nonetheless had the opportunity to ensure that what they stated in the interviews were correct.
Table 3.3
Initial Interview Questions

1. Have you used an e-education program before? (If yes, when? Which one?)
2. If so, did you enjoy learning in that manner?
3. Can you tell me why you failed either the final exam or the science course that you are repeating at this time?

Note: Each student was asked these initial questions in the first interview.

Table 3.4
Second Interview Questions

1. Would you rather use e2020® for your classes or would you rather be taught by a teacher in a traditional classroom? Please explain your answer.
2. Do you feel as if you have more control over your education with e2020® or in a regular science classroom?
3. What are your opinions about the lab simulations found in e2020®? Were there any that you would like to talk about?
4. Has the e2020® program helped you to be successful or not helped you? Are you thinking of any modules in particular?
5. If you had a friend that was struggling with science, what would you say to your friend about e2020®?
6. What do you think about using e2020® science program? (Is this the same or different than you used to feel about science?)

Note: Each student was asked these follow-up questions in the subsequent interviews.

Coding

The transcribed data was coded using an a priori format. The a priori codes will be based on SMTSL (Tuan et al., 2005) and Artino’s theoretical framework in order to better understand how the at risk students viewed the program. The major a priori codes were
divided according to the theoretical framework headings and included ‘prior to e-learning experience,’ ‘learning environment,’ ‘motivational beliefs,’ ‘achievement emotions,’ and ‘academic outcomes.’ The headings were further divided and these subheadings were used to code the transcribed data.

The data was coded using the Nvivo 10 software program (Fraser & Solutions, 2000). The transcriptions were read through twice prior to being coded to ensure that the researcher was familiar with the responses of the students. Inter-rater reliability is a measure of agreement between multiple coders about how they apply codes to data. Agreement can be used to measure about how they apply codes. Agreement can also be used to measure the reliability of the coders as instruments to identify and mark themselves in a text, or as a proxy for the validity of the constructs that emerge from the data (G. W. Ryan, 1999). The inter-rater reliability method developed by Kurasaki (2000) was used. The method has three distinct steps which include creating a codebook; establishing inter-rater reliability; applying the codebook systematically to the data. After the inter-rater reliability was determined and maintained at a level of 90%, the researcher proceeded to code the remaining interviews as seen in Table 3.5.

Table 3.5
Exemplary Quotations for Coding of Transcripts

<table>
<thead>
<tr>
<th>Code</th>
<th>Theoretical Framework</th>
<th>Representative quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>Prior to e-learning experience</td>
<td>I have some teachers who if you make a bad test on a grade, they will not let you take it over.</td>
</tr>
<tr>
<td>Classroom</td>
<td>Prior to e-learning experience</td>
<td>Learning Environment</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Learning Environment Stimulation (SMSTL)</td>
<td>...this helps a lot because to me face to face to me feels crushing</td>
<td></td>
</tr>
<tr>
<td>Autonomy</td>
<td>Learning Environment</td>
<td>it doesn’t seem to be as much pressure</td>
</tr>
<tr>
<td>e-Classroom Characteristics</td>
<td>Learning Environment</td>
<td>I like it a little bit more because you can do what you want, you don’t have to sit there and hurry up and get everything done and you can take your time.</td>
</tr>
<tr>
<td>No face-to-face teacher</td>
<td>Learning Environment</td>
<td>You don’t have to worry about other kids being loud or the teacher not sending them out.</td>
</tr>
<tr>
<td>Pace</td>
<td>Learning Environment</td>
<td>I like it because I don’t have to interact with any teachers.</td>
</tr>
<tr>
<td>Science Learning Value (SMSTL)</td>
<td>Personal Factors/Motivational Beliefs</td>
<td>yes, the teacher tells you what you need to know but this program allows you to find what you need to know.</td>
</tr>
<tr>
<td>Self-efficacy improved (SMSTL)</td>
<td>Personal Factors/Motivational Beliefs</td>
<td>I feel like I have more confidence to do what needs to be done now.</td>
</tr>
<tr>
<td>No change in self-efficacy</td>
<td>Personal Factors/Motivational Beliefs</td>
<td>I could do the work before I came to summer school, I can do the work now</td>
</tr>
<tr>
<td>Task Value Beliefs</td>
<td>Personal Factors/Motivational Beliefs</td>
<td>But I think I can take what I have learned from here – taking notes on what is important and I think I could apply it to the other courses I have to take in science.</td>
</tr>
<tr>
<td>Positive Emotions</td>
<td>Personal Factors/Achievement Emotions</td>
<td>you don’t have to worry about people judging you</td>
</tr>
</tbody>
</table>
Table 3.5 Continued

<table>
<thead>
<tr>
<th>Negative Emotions</th>
<th>Personal Factors/Achievement Emotions</th>
<th>Academic Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>I know I was making 40’s in the classroom but am making better grades here.</td>
<td></td>
</tr>
<tr>
<td>Active Learning Strategies (SMTSL)</td>
<td>I like that I can skip the things I know all ready.</td>
<td></td>
</tr>
<tr>
<td>Would use e-education again</td>
<td>there needs to be more e2020 classes.</td>
<td></td>
</tr>
<tr>
<td>Would not use e-education again</td>
<td>No, I do not like it</td>
<td></td>
</tr>
<tr>
<td>Achievement goal (SMTSL)</td>
<td>but here I study and I end up passing it</td>
<td></td>
</tr>
<tr>
<td>Performance goal (SMTSL)</td>
<td>I like hands on with a teacher</td>
<td></td>
</tr>
</tbody>
</table>

Limitations

Caution must be taken when extrapolating the data provided by this study of low-wealth, rural, at risk students enrolled in a summer school program to other studies consisting of differing populations. The demographics of the students in the study did match the demographics of the county in which the study took place. The sample size also included a significant portion of students who have been identified as being in the exceptional children’s’ program in the county where the study took place. It is not recommended to extrapolate any data from this study to studies that do not have the same parameters.

The data sample was relatively small compared to the number of students that are enrolled in the semester long science courses. The SMSTL (Tuan et al., 2005) survey is self-reported and may be not be completely accurate.
Researcher Bias

This research that was carried out to learn more how to best teach at risk students, a subject that is closely tied to the researcher’s experiences as a teacher of over twenty years and as a mother of two at risk children. The researcher has taught in an alternative high school for the past fifteen years and serves as science teacher for all required high school science subjects (physical science, earth/environmental, and biology). For many years, three subjects were taught concurrently during the same class period throughout the school day. For the past two years, the researcher was able to use the e2020® science program in her classroom. The success with the program led to the pilot study, and subsequently, this dissertation study.

In the researcher’s experience, and what was discovered in a pilot study is that the e2020® science program provided enough incentive and enough encouragement that these students started to believe that they can not only be successful in science but in the other course they are enrolled in. Therefore, it is possible that the views on what has happened with similar students could have colored her interpretations of the qualitative data. However, in order to address this possible bias, she enlisted two knowledgeable science education co-coders, with whom researcher established inter-rater reliability. These colleagues had no direct experiences with e2020 or the students.

Summary

In this chapter, data was collected on thirty-two students enrolled in a summer school science course using an e-education program at eight high schools throughout the county in which the study took place. Data was collected using the Student Motivation Toward
Science Learning (Tuan et al., 2005) survey, pretest scores, posttest scores, and time on task provided by E-2020® (“Edgenuity,” 2013). Interviews were conducted at the beginning and the end of the study. The findings will be presented in chapter four.
CHAPTER FOUR
FINDINGS

The objective of this study was to understand more about the potential of on-line education science courses with at risk students enrolled in a summer school credit recovery program. A variety of data sources were used in order to better understand the potential of e-education with this population of students. In this chapter, the data will be presented and the results of the data analyses will be described, as they pertain to the research questions. First, descriptive data will be presented to learn more about the nature of the at risk students who were enrolled in the summer school science courses. Next, quantitative data will be presented and analyses will be presented for these students and to identify any relationships between students’ personal factors and achievement. Finally, students’ interview data analyses are presented that describe their course experiences and help to explain the quantitative findings in light of the theoretical framework.

Students enrolled in e-education courses

Of the 55 high school students enrolled in summer school to remediate a failed science course, 32 (58%) consented to participate in the study and completed the questionnaire. Demographic and classification information comprised the first twelve questions of a 47 item questionnaire. These demographic questions related to their personal characteristics (name, gender, race, and ethnicity), their current grade (the most recently completed year of school), what science course they were enrolled in, and whether they had previously used e-education. The remaining 35 questions in the survey consisted of the Student Motivation toward Science Learning survey items (Tuan et al., 2005), which will be
discussed later in the chapter.

The grading scale used by the county school district requires a 70% average for students to pass a course, and also requires that the student has had no more than 8 unexcused absences per semester during the school year. The policy also requires that the biology students pass the Biology End-of-Course test. If a biology student passes the course with a 70% average or higher but has failed the state’s Biology End-of-Course test, the student will not receive credit for the course. Physical science and earth science students are required to take the state’s final exam, but unlike the biology exam, failing the exam in physical science or earth science is not an automatic failure. To receive credit in physical science and earth science, the students must have an average of 70% or above, which includes the exam grade (20% of course grade) and their grades from each semester (80% of course grade).

The average grade of the at risk students entering the summer school program was a 65%, as reported by the testing coordinator of the county in which the study took place. In this school district, the policy states that the student’s first 9-weeks grade cannot be lower than a 60%. Therefore, if a student has received a 0-59%, the grade will be adjusted to a 60%. However, the student’s second 9-weeks grade is not increased regardless of the percent; the student receives the percentage grade that they earned. If the student fails the course due to absences but received a passing grade (70% or higher), school board policy mandates that this passing grade will be changed to a 69% to indicate failure due to absences only. If, on the other hand, the grade was below a 70%, it will not be changed. Therefore, all of the students who enrolled in the summer e-program were doing so to remediate a failing grade from that school year in physical science, biology, or earth science. Seven of the
students in the study would have failed due to absences, but additionally, these students failed the science course due to receiving a failing grade.

The majority of the participants in the study were male (19; 59.4%) and 13 (40.6%) were females. The majority of the students in the study were in the 11\textsuperscript{th} grade (31%), followed by 10\textsuperscript{th} grade students (28%), 12\textsuperscript{th} grade students (25%), and 9\textsuperscript{th} graders, who made up the remaining 16%.

Students were asked to self-report their race/ethnicity. The two ethnicity categories that the students could choose were Hispanic ethnicity or non-Hispanic. The racial categories available to the students included Caucasian, African American or ‘two or more races.’ Five of the students self-reported that they considered themselves ‘two or more races.’ Due to the small number of this race/ethnic category, as well as the small sample size, the decision was made to place all students in one of three racial/ethnic categories. The categories were Caucasian, African American and Hispanic. The two students who self-reported they were of Hispanic ethnicity as well as ‘two or more races,’ were placed in the Hispanic category. Two other students, who self-reported ‘two or more races,’ were placed in the African American category due to their racial/ethnic background. The final student was of Asian descent, and his scores were similar to that of the Caucasians, so it was decided that he would be placed into the Caucasian category. Therefore, for the analyses in this study, the majority of the students (50%) were Caucasian, non-Hispanic; African Americans comprised 37.5% of the study, and the remaining 12.5% were Hispanics.

The students were enrolled in physical science (37.5%), earth science (31.25%) or biology (31.25 %). The same number of students (18) reported the prior use of e-education as
not using e-education (18). Therefore, the ‘typical’ at risk student enrolled in the summer school e-program for science was male, in 11th grade, Caucasian (non-Hispanic), and enrolled in physical science. The least typical student enrolled was female, in 9th grade, Hispanic, and enrolled in biology. See the summary information in Table 4.1.

<table>
<thead>
<tr>
<th>Course</th>
<th>Male</th>
<th>Female</th>
<th>Caucasian</th>
<th>African-American</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Science</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Physical Science</td>
<td>8</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

**Personal factors of students in the summer e-program**

**Student’s Motivation Towards Science Learning (SMTSL) data**

All students involved in the study completed the Student’s Motivation Towards Science Learning survey (SMTSL) (Tuan et al., 2005). The results were analyzed by item (see summary information in Table 4.2) to assess internal reliability. A Cronbach’s alpha was computed on the 35 items on the Student’s Motivation Towards Science Learning, including 6 subscales: self-efficacy, active learning strategies, performance goals, achievement goals, and learning environment goals. Cronbach’s alpha is a measure of internal consistency; that is, how closely related a set of items are as a group (Tavakol & Dennick, 2011). The Cronbach’s alpha ranged from 0.80 to 0.84, which are acceptable
ranges. These scores also are consistent with the Cronbach’s alpha for the SMTSL (Tuan et al., 2005). See Table 4.2 for summary information.

Table 4.2

**Student’s Motivation Towards Science Learning Data for all Students**

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Cronbach’s a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>7</td>
<td>23.03</td>
<td>4.84</td>
<td>0.8190</td>
</tr>
<tr>
<td>Active Learning Strategy</td>
<td>8</td>
<td>29.81</td>
<td>4.21</td>
<td>0.8145</td>
</tr>
<tr>
<td>Science Learning Value</td>
<td>5</td>
<td>16.75</td>
<td>4.30</td>
<td>0.8299</td>
</tr>
<tr>
<td>Performance Goal</td>
<td>4</td>
<td>12.59</td>
<td>3.19</td>
<td>0.8103</td>
</tr>
<tr>
<td>Achievement Goal</td>
<td>5</td>
<td>18.12</td>
<td>4.43</td>
<td>0.8032</td>
</tr>
<tr>
<td>Learning Environment</td>
<td>6</td>
<td>19.44</td>
<td>6.21</td>
<td>0.8286</td>
</tr>
</tbody>
</table>

*Note. N = number of students, M = Mean, SD = Standard Deviation, Cronbach’s a = Cronbach’s alpha*

In the following sections, each of the subscales will be analyzed based on the responses of the students, who are grouped by gender and then by race/ethnicity. As there were only 32 students in the study, the groups of students were relatively low. For instance, there were only four Hispanics in the study. When the scores of a small group of students (e.g. Hispanics) is extremely low or high, the means and the standard deviations of the group
could misrepresent the actual mean of the group, leading to a misinterpretation of the data. If the scores of one member of a group of Hispanic students, for instance is much higher than the scores of other members (e.g., one student scores a 35 on the self-efficacy scale, the others all score around 23), this one student with a 35 could be considered an outlier. The outlier can cause the average to be much higher than is representative of the students, and cause a high standard deviation. Some researchers suggest that outliers will skew the data and recommend removing them (Sim & Hartley, 2006). Other researchers are of the opinion that if outliers are removed, the results will not accurately represent the individuals in the study (Seaman & Allen, 2010). For the present study, due to a low number of students, all data will be included. If the data is highly skewed, it will be noted.

In the next sections, the results for all of the subscales of the SMTSL will be displayed and analyzed. In order to look for trends, analyses will be conducted between the following subgroups: males will be compared to females; each of the ethnicity/race groups will be compared to one another, including Caucasian, African American and Hispanic students.

*Self-efficacy*

Self-efficacy in science is one of the sub-scales in the SMTSL (Tuan et al., 2005). Table 4.3 lists the seven items that comprise the self-efficacy subscale. Table 4.3 displays the mean and standard deviation of each self-efficacy item for all students. See Table 4.4 for a summary of data for the self-efficacy subscale.
Table 4.3

*Self-efficacy Items Including Mean and Standard Deviation of All Students*

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (M)</th>
<th>Standard Deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether the science content is difficult or easy, I am sure that I</td>
<td>3.44</td>
<td>0.84</td>
</tr>
<tr>
<td>am sure that I can understand it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am not confident about understanding difficult science concepts.</td>
<td>3.10</td>
<td>1.03</td>
</tr>
<tr>
<td>I am sure that I can do well on science tests.</td>
<td>3.5</td>
<td>.88</td>
</tr>
<tr>
<td>No matter how much effort I put in, I cannot learn science.</td>
<td>3.25</td>
<td>1.14</td>
</tr>
<tr>
<td>When science activities are too difficult, I give up or do just the</td>
<td>2.91</td>
<td>1.20</td>
</tr>
<tr>
<td>easy parts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>During science activities, I prefer to ask other people for the</td>
<td>3.31</td>
<td>1.06</td>
</tr>
<tr>
<td>answer rather than think for myself.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When I find science content too difficult, I do not try to learn it</td>
<td>3.53</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Note.  *M* = Mean,  *SD* = Standard Deviation

A Welch’s unpaired t-test was performed to determine if the means of the females (*M* = 20.54, *SD* = 0.93) and males (*M* = 24.74, *SD* = 1.16) for the science self-efficacy scores were significant. The t-statistic was significant at the .05 critical level, \( t(31.95) = 2.83, p = 0.008 \). African American students (*M* = 22.8, *SD* = 5.06) had a higher mean than the Caucasian students (*M* = 22.44, *SD* = 4.74). When the Welch’s t-test was run on the means, the results indicated that the difference in the two means was not significant at the 0.5 critical level, \( t(29.07) = 0.76, p = 0.45 \). Hispanic students (*M* = 25, *SD* = 0.71) and had a higher mean than non-Hispanic students (*M* = 22.75, *SD* = 0.97). From these results, the only
statistically significant results were seen when males and females were compared; males had higher science self-efficacy than females. The students in this study slightly agree that they have science self-efficacy in the classroom.

Table 4.4

Mean and Standard Deviation of Science Self-Efficacy Scores with Mean Comparisons of Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>23.03</td>
<td>4.84</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>24.74</td>
<td>1.16</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>20.54</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>male/female</td>
<td>32</td>
<td></td>
<td></td>
<td>0.0080**</td>
</tr>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>22.44</td>
<td>4.74</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>22.79</td>
<td>5.06</td>
<td></td>
</tr>
<tr>
<td>Caucasian/African</td>
<td>32</td>
<td></td>
<td></td>
<td>0.4506</td>
</tr>
<tr>
<td>American</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>22.75</td>
<td>5.11</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>25</td>
<td>1.41</td>
<td></td>
</tr>
</tbody>
</table>

Note: n = number of students, M = Mean, SD = Standard Deviation, *p < 0.05 is significant, p** < 0.001 is highly significant. A Welch’s t-test was used.

Active learning strategies

Active learning strategies scores are indicative of students taking an active role when using a variety of strategies to construct new knowledge, based on their previous
science understanding. Table 4.5 lists the items found on the active learning subscale, with the means and standard deviations for each item. Table 4.6 compares the responses of the subgroups.

Active learning strategy scores of males ($M = 30.63$, $SD = 3.85$) and females ($M = 28.62$, $SD = 4.57$) were not significantly different at the 0.05 critical level, $t (24.49) = 1.30, p = 0.20$. The next means compared were Caucasian ($M = 29.22$, $SD = 4.41$) and African American students ($M = 30.57$, $SD = 3.96$), which also were not significant at the 0.05 critical level, $t (31.39) = -0.91, p = 0.37$. The last comparison of means included non-Hispanic ($M = 29.46$, $SD = 0.82$) and Hispanic students ($M = 32.25$, $SD = 0.62$). Overall, the students in this study somewhat agree that they will try to make sense of science concepts in the classroom.

Table 4.5

Active Learning Items Including Mean and Standard Deviation of All Students

<table>
<thead>
<tr>
<th>Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>When learning new science concepts, I attempt to understand them.</td>
<td>4.03</td>
<td>0.65</td>
</tr>
<tr>
<td>When learning new science concepts, I connect them to my previous experiences.</td>
<td>3.75</td>
<td>0.67</td>
</tr>
<tr>
<td>When I do not understand a science concept, I find relevant resources that help me.</td>
<td>3.88</td>
<td>0.66</td>
</tr>
<tr>
<td>When I do not understand a science concept, I would discuss with the teacher or other students to clarify my understanding.</td>
<td>3.59</td>
<td>0.84</td>
</tr>
<tr>
<td>During the learning processes, I attempt to make connections between the concepts that I have learned.</td>
<td>3.66</td>
<td>0.65</td>
</tr>
</tbody>
</table>
Table 4.5 Continued

<table>
<thead>
<tr>
<th>Statement</th>
<th>Score Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I make a mistake, I try to find out why.</td>
<td>3.66</td>
<td>0.70</td>
</tr>
<tr>
<td>When I am introduced to science concepts that I do not understand, I will try to learn them.</td>
<td>3.59</td>
<td>0.95</td>
</tr>
<tr>
<td>When new science concepts that I have learned conflict with my previous understanding, I try to understand why.</td>
<td>3.66</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Note: $M = \text{Mean, } SD = \text{Standard Deviation}$

Table 4.6

*Active Learning Strategy Scores by Groups*

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>29.81</td>
<td>4.21</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>30.63</td>
<td>3.85</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>28.62</td>
<td>4.57</td>
<td></td>
</tr>
<tr>
<td>male/female</td>
<td>32</td>
<td></td>
<td>0.2042</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>29.22</td>
<td>4.41</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>30.57</td>
<td>3.96</td>
<td></td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>32</td>
<td></td>
<td>0.9097</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>29.46</td>
<td>4.38</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>32.25</td>
<td>1.26</td>
<td></td>
</tr>
</tbody>
</table>

Note: $n = \text{number of students, } M = \text{Mean, } SD = \text{Standard Deviation, } *p < 0.05$ is significant. Welch’s t-tests were performed.
Science learning values

Science learning value is a score that indicates how much students value science in their everyday lives as well as acquiring the ability to solve problems. Table 4.7 lists the items found on the science learning values subscale with the mean and standard deviation of each item. Table 4.8 compares the responses to the subgroups.

Females ($M = 17.15, SD = 3.15$) who had completed the Science Learning value subscale had a higher mean than their male counterparts, ($M = 16.47, SD = 5.00$). When a Welch’s unpaired t-test was performed on the data, it indicated that gender was not significant, $t (31.73) = -0.47, p = 0.64$ at the 0.5 critical level. A Welch’s unpaired t-test was performed on Caucasian students ($M = 16.94, SD = 4.07$) and African American students ($M = 16.5, SD = 4.74$). The t-test also showed that differences between these groups were not significant for the Science Learning Value subscale, $t (27.48) = 0.28, p = 0.78$. The last groups of students to be compared were the Hispanic students ($M = 18.5, SD =2.52$) and non-Hispanic students ($M = 16.5, SD = 4.48$). The students in this study as indicated by their scores slightly agree that learning science is important.

Table 4.7

<table>
<thead>
<tr>
<th>Science Learning Value Items, Means and Standard Deviations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>M</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>I think that learning science is important because I can use it in my daily life.</td>
</tr>
<tr>
<td>I think learning science is important because it stimulates my thinking.</td>
</tr>
</tbody>
</table>
Table 4.7 Continued

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>In science, I think that it is important to learn to solve problems.</td>
<td>3.34</td>
<td>0.97</td>
</tr>
<tr>
<td>In science, I think it is important to participate in inquiry activities.</td>
<td>3.41</td>
<td>0.98</td>
</tr>
<tr>
<td>It is important to have the opportunity to satisfy my own curiosity when learning science.</td>
<td>3.63</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Note:  $M =$ Mean, $SD =$ Standard Deviation

Table 4.8

*Science Learning Value Scores for All Student Groups*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>16.75</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>16.47</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>17.15</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>male/female</td>
<td>32</td>
<td></td>
<td></td>
<td>0.6408</td>
</tr>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>16.94</td>
<td>4.07</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>16.5</td>
<td>4.74</td>
<td></td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>32</td>
<td></td>
<td></td>
<td>0.2800</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>16.5</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>18.5</td>
<td>1.26</td>
<td></td>
</tr>
</tbody>
</table>

Note: $n =$ Number of students, $M =$ Mean, $SD =$ Standard deviation, *$p < 0.05$ is significant. Welch’s t-tests were performed.
Performance goals

Performance goals in science relate to the student competing with fellow students and trying to gain the attention of the teacher. Table 4.9 lists the items found on the performance goal values subscale with the mean and standard deviation of each item. Table 4.10 compares the responses to the subgroups.

Similar to prior subscale scores, females ($M=13.15, SD = 3.87$) had a higher mean than males ($M = 12.21, SD = 2.68$) on the Performance Goal subscale. The Welch’s unpaired t-test, $t (20.96) = -.076, p = 0.45$, indicated that gender was not significant at the 0.5 critical level. Similar results were found when Caucasian students ($M = 12.89, SD = 3.38$) were compared to African American students ($M = 12.21, SD = 3.02$). As with gender, race was not significant at the 0.5 critical level; $t (31.42) = 0.60, p = 0.56$. Hispanic students ($M = 11.5, SD = 1.29$) and non-Hispanic students ($M = 12.75, SD = 3.36$) had similar means. The students in this study agreed very slightly that they were participating to receive the attention, recognition or reward for doing so.

Table 4.9

*Performance Goal Items Including Mean and Standard Deviation of All Students*

<table>
<thead>
<tr>
<th>Item</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I participate in science courses to get a good grade.</td>
<td>2.59</td>
<td>1.07</td>
</tr>
<tr>
<td>I participate in science courses to perform better than other students.</td>
<td>3.34</td>
<td>1.00</td>
</tr>
<tr>
<td>I participate in science courses so that other students think that I am smart.</td>
<td>3.22</td>
<td>1.01</td>
</tr>
</tbody>
</table>
Table 4.09 Continued

| I participate in science courses so that the teacher pays attention to me. | 3.32 | 1.05 |

Table 4.10

Performance Goal Scores, means and standard deviations

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>12.60</td>
<td>3.19</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>12.21</td>
<td>2.68</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>13.17</td>
<td>3.87</td>
<td></td>
</tr>
<tr>
<td>male/female</td>
<td>32</td>
<td></td>
<td></td>
<td>0.4541</td>
</tr>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>12.89</td>
<td>3.38</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>12.21</td>
<td>3.02</td>
<td></td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>32</td>
<td>0.5558</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>12.75</td>
<td>3.36</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>11.5</td>
<td>1.29</td>
<td></td>
</tr>
</tbody>
</table>

Note: n = Number of students, M = Mean, SD = Standard deviation *p < 0.05 is significant. Welch’s unpaired t-tests were performed.

Achievement goal

Achievement goal subscales of the Student’s Motivation Towards Science Learning are a measure of the student’s satisfaction as they increase their competence and achievement.
in the science classroom. Table 4.11 lists the items found on the achievement goal values subscale with the mean and standard deviation of each item. Table 4.12 compares the responses to the subgroups.

Table 4.11

*Achievement Goal Items Including Mean and Standard Deviation of All Students*

<table>
<thead>
<tr>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>During a science course, I feel most fulfilled when I earn a good score on a test.</td>
<td>3.84</td>
</tr>
<tr>
<td>I feel most fulfilled when I feel confident about the content in a science course.</td>
<td>3.65</td>
</tr>
<tr>
<td>During a science course, I feel most fulfilled when I am able to solve a difficult problem.</td>
<td>3.61</td>
</tr>
<tr>
<td>During a science course, I feel most fulfilled when the teacher accepts my ideas.</td>
<td>3.39</td>
</tr>
<tr>
<td>During a science course, I feel most fulfilled when other students accept my ideas.</td>
<td>3.50</td>
</tr>
</tbody>
</table>

Note: *M* = Mean, *SD* = Standard Deviation

Table 4.12

*Achievement Goal Scores, Means, and Standard Deviations*

<table>
<thead>
<tr>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>18.13</td>
<td>4.43</td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>18.05</td>
<td>4.16</td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>18.23</td>
<td>4.97</td>
</tr>
</tbody>
</table>
Table 4.12 Continued

<table>
<thead>
<tr>
<th></th>
<th>32</th>
<th>0.9162</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>17.56</td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>18.86</td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>32</td>
<td>0.4285</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>17.96</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>19.25</td>
</tr>
</tbody>
</table>

Note: *n* = number of students, *M* = Mean, *SD* = Standard Deviation, no significant differences were found, with *p < 0.05* is significant. Welch’s t-tests were performed.

No significant differences were found in any analyses between groups on the Achievement Goal subscale. Female students (*M* = 18.23, *SD* = 4.97) had a higher mean than the males (*M* = 18.05, *SD* = 4.16) on the Achievement Goal subscale. Even though females had a higher mean, the Welch’s t-test indicated that the scores were not significant at the 0.5 critical level, *t* (24.38) = -0.11, *p* = 0.92. African American students (*M* = 18.86, *SD* = 4.85) had a higher mean than Caucasian students (*M* = 17.56, *SD* = 4.12) on the Achievement Goal subscale. As with the males and females on the same subscale, these means were also not significant at the 0.5 critical level, *t* (27.28) = -0.80, *p* = 0.43. Hispanic students (*M* = 19.25, *SD* = 2.63) had a slightly higher mean than non-Hispanic students (*M* = 17.96, *SD* = 4.64). The students in this study somewhat agree that they have confidence in themselves to do what is required in the science classroom.
Learning environment stimulation

Learning environment stimulation, the final subscale involves the curriculum, teachers’ teaching and student interaction as it pertains to the students’ motivation in science learning. Table 4.13 lists the items found on the achievement goal values subscale with the mean and standard deviation of each item. Table 4.14 compares the responses to the subgroups.

Table 4.13

*Learning Environment Stimulation Items Including Mean and Standard Deviation of All Students*

<table>
<thead>
<tr>
<th>Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am willing to participate in this science course because the content is exciting and always changing.</td>
<td>3.10</td>
<td>1.11</td>
</tr>
<tr>
<td>I am willing to participate in this science course because the teacher uses a variety of teaching methods.</td>
<td>3.29</td>
<td>1.04</td>
</tr>
<tr>
<td>I am willing to participate in this science course because the teacher does not put a lot of pressure on me.</td>
<td>3.90</td>
<td>3.55</td>
</tr>
<tr>
<td>I am willing to participate in this science course because teacher pays attention to me.</td>
<td>3.13</td>
<td>1.06</td>
</tr>
<tr>
<td>I am willing to participate in this science course because it is challenging.</td>
<td>2.90</td>
<td>1.01</td>
</tr>
<tr>
<td>I am willing to participate in this science course because the students are involved in discussions.</td>
<td>2.97</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Note:  *M = Mean, SD = Standard Deviation*
Table 4.14

*Learning Environment Stimulation Scores, Means, and Standard Deviations*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>all students</td>
<td>32</td>
<td>19.44</td>
<td>6.21</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>19</td>
<td>19.58</td>
<td>7.40</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>19.23</td>
<td>4.17</td>
<td></td>
</tr>
<tr>
<td>male/female</td>
<td>32</td>
<td></td>
<td></td>
<td>0.8664</td>
</tr>
<tr>
<td>Caucasian</td>
<td>18</td>
<td>17.44</td>
<td>5.26</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>22.0</td>
<td>6.56</td>
<td></td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>32</td>
<td></td>
<td></td>
<td>0.0467*</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>28</td>
<td>18.71</td>
<td>5.39</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>24.5</td>
<td>9.88</td>
<td></td>
</tr>
</tbody>
</table>

Note: \( n \)= number of students, \( M \) = Mean, \( SD \) = Standard Deviation, \( * \) \( p < 0.05 \) is significant. Welch’s t-tests were performed.

Males (\( M = 19.58, SD = 7.40 \)) had a higher mean on the Learning Environment Stimulation subscale than female students (\( M = 19.23, SD = 4.17 \)). The Welch’s unpaired t-test was insignificant at the 0.5 critical level, \( t (30.78) = 0.17, p = 0.87 \) for males and females.

African American students (\( M = 22.0, SD = 6.56 \)) when compared to Caucasian students (\( M = 17.44, SD = 5.26 \)) was significant when compared on the Welch’s unpaired t-test, \( t (26.18) = -2.12, p = 0.04 \). Hispanic students (\( M = 24.5, SD = 9.88 \)) had a higher mean than non-Hispanic students (\( M = 18.71, SD = 5.39 \)). In summary, Learning environment stimulation
scores were not significant when comparing subgroups by gender, or race/ethnicity. Students in this study agreed slightly that they are willing to participate due to the content of the science course.

**Academic Growth**

*Success of Students*

All but one of the thirty-two students in the study completed the summer school course and earned a unit to be used for graduation requirements. The one unsuccessful student, a Caucasian male, seemed uncomfortable in the summer school setting, kept to himself, and dropped out after one week of summer school. Because he did not complete the course, his scores are not analyzed with the students who completed the science courses. The average overall e-grade for the students who completed the e-education program was a 79.0% and the average e-exam score for the students in the study was a 78.3%. These grades are equivalent and both the e-grade and e-exam grade would be considered a C- on a 7 point scale.

Per county policy, the grades the student received for the failed course during the school year will not be replaced by the passing grade in summer school, but rather students will be given credit for the course. That is, their Grade Point Average (GPA) will not reflect a passing grade for the summer school course, but as stated earlier, their transcript will indicate that a failed course was replaced with a passing course without a change in their GPA.

*Academic Growth Indices*

Academic growth for this study was defined as the point difference between the e-
education posttest scores mean and the pretest scores mean. A student beginning a lesson in the e-program was automatically assigned to take the pretest to determine if the lesson would be required; if the students’ pretest score was 70% or higher, the student was allowed to bypass that particular lesson. The pretest score, either passing or failing was not included in the students’ final average. The pretest scores were used only for statistical analysis to determine if growth had occurred. The final grade for each completed lesson included the various activities such as vocabulary, lab assignments and the posttest score. Students completed from twelve to one hundred forty-seven lessons, so the academic growth for each student is based on the difference between the means of all of their lessons’ pretest scores and all of their lessons’ posttest scores for the course.

Academic growth indices of males \( (M = 10.11, SD = 7.38) \) and females \( (M = 20.15, SD = 6.76) \) were significantly different at the 0.001 critical level, \( t(29.35) = -3.93, p = 0.0005 \).

The next means compared were Caucasian \( (M = 12.64, SD = 11.78) \) and African American students \( (M = 13.73, SD = 8.90) \), which were not significant at the 0.05 critical level, \( t(30.73) = 0.29, p = 0.77 \). Hispanic students \( (M = 20.28, SD = 7.70) \) had a higher mean

Table 4.15

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n )</td>
<td>( M )</td>
<td>( SD )</td>
</tr>
<tr>
<td>all students</td>
<td>31</td>
<td>66.75</td>
<td>10.58</td>
</tr>
</tbody>
</table>
Table 4.15 Continued

<table>
<thead>
<tr>
<th></th>
<th>18</th>
<th>70.06</th>
<th>10.09</th>
<th>80.16</th>
<th>6.01</th>
<th>10.11</th>
<th>7.38</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>13</td>
<td>60.72</td>
<td>6.58</td>
<td>80.87</td>
<td>4.28</td>
<td>20.15</td>
<td>6.76</td>
</tr>
<tr>
<td>male/female</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>0.0005</strong></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>17</td>
<td>68.42</td>
<td>10.33</td>
<td>81.06</td>
<td>10.33</td>
<td>12.64</td>
<td>11.78</td>
</tr>
<tr>
<td>African American</td>
<td>14</td>
<td>64.73</td>
<td>10.92</td>
<td>78.47</td>
<td>3.74</td>
<td>13.73</td>
<td>8.90</td>
</tr>
<tr>
<td>Caucasian/African American</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>0.7712</strong></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>27</td>
<td>66.18</td>
<td>8.43</td>
<td>80.47</td>
<td>5.29</td>
<td>14.30</td>
<td>8.09</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4</td>
<td>60.11</td>
<td>12.22</td>
<td>80.39</td>
<td>6.09</td>
<td>20.28</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Note. $N$ = number of students, $M =$ Mean, $SD =$ Standard Deviation, $**p < 0.001$ is significant. Welch’s t-tests were performed.

than non-Hispanic students ($M = 14.30$, $SD = 8.09$). From these results, the only statistically significant results were between males and females, with females having the highest growth index. The mean pretest score for all was 66.75%, which is an F, and the mean posttest score for all was a 79.89%, which is a C. Therefore, in general, all of the students in the course learned enough from the material to pass the lesson posttests with a grade of C. The students who had the most growth were the Hispanic students and the females, both increasing their average posttest scores by 20 percentage points. They were followed in growth by Caucasian students (15.10 % increase) and African American students (13.48 % increase).

**Self-Efficacy and Academic Growth**

From previous analyses of the SMTSL (Tuan, et al., 2005), it was discovered that gender was one category that was statistically significant as it related to science self-efficacy.
The subcategory, Learning Environment Stimulation was significant for race/ethnicity; however, there was not a significant difference between race/ethnicity for academic growth. Due to that fact, only gender will be analyzed in relation to academic growth. The male student who did not complete the course was not included in any analyses due to his small number of pretest and posttest scores, and complete lack of e-exam score and e-final score. Regression analysis of these variables was not considered due to the small sample size of males and females.

Figure 4.1 is a descriptive comparison of the mean self-efficacy scores of males ($M = 25.50, SD = 3.90$) and females ($M = 20.54, SD = 3.36$) and Figure 4.2 is a comparison of the mean % academic growth of males ($M = 10.5, SD = 7.38$) and females ($M = 20.15, SD = 6.76$). Interestingly, males had significantly higher self-efficacy scores than females, yet their academic growth was much lower than females. Correspondingly, females had significantly lower self-efficacy than males, yet females had significantly higher academic growth. Further analysis was carried out on the self-efficacy subscales and academic growth of both males and females. The results can be viewed in Table 4.15.
E-grade and E-exam scores

Students who had enrolled in a summer school science course did so in order to earn one credit toward high school graduation. As stated earlier, the passing grade that they earn in the e-education course will not change their Grade Point Average (GPA), but would help students to earn the sufficient science course credit hours for graduation requirements.

The ‘e-final grade’ is a cumulative average of the posttests, lesson activities and the final cumulative exam provided by the e-education program. The pretests associated with bypassed lessons were not included in the ‘e-final grade.’ Students enrolled in an e-education science course had a final e-exam provided by the e-education science course, and were allowed to access the exam when the required percentage of lessons were completed by the student. The exam provided by the e-education program is a cumulative exam based on the lessons completed by the student.

In addition to all pre and posttest scores, students took a final e-exam. With the exception of the one male student who dropped out, all 31 students who were enrolled in summer school passed the e-exam. All students entered the course having received a failing final grade from their previous science course and left the e-education course, with one exception, with a passing final grade. The scores for the e-exam ranged from 70% to 89% ($M = 78.3$, $SD = 6.36$). The final e-grade for students ranged from 70% to 89% ($M = 79.00$, $SD = 5.26$) as well.

Analyses of Time-on-Task

The e-education program that was utilized in the summer program maintained a log for each student. The log included the active time and the idle time for each student while
they were engaged with the various e-education science programs. Active time is defined as the time a student spends on any e-activity up to submission for scoring purposes. The e-program updates students’ active time every two minutes. The e-program checks for a host of student actions to determine whether the student is still active: answering questions, completing vocabulary words, playing or pausing videos, clicking on tools, and uploading files. As long as the student has taken any of these actions, the e-program will continue to update the Attendance Log with two more minutes of active time. Once the student saves, submits, or closes the browser, the e-program will stop recording active time. If the student is not actively engaged with the program for two minutes, the e-program logged this time as idle time. The program is unable to account for time students are reviewing notes or writing definitions of the vocabulary terms, as they happen outside of the program, rather than simply not working. Thus, all of these activities are tallied as idle time by the e-program. The e-program will automatically log out a student after 30 minutes of inactivity to more accurately report active and idle time.
Figure 4.3. Comparison of Gender and Race/Ethnicity % Time-on-Task to final % e-grade.

Activity times and idle times were logged using hours as the unit of measure. Time on task was defined as the percentage of activity hours divided by total hours logged on the computer. Figure 4.3 compares the means of time-on-task and final % e-grade for all student groups.

A Spearman’s Correlation was carried out on the Final % E-grade and % Time-on-Task for all groups of students to determine if a relationship existed between Time-on-Task and final grade. Females had the lowest Time-on-Task (Mean = 74.96) but not the lowest final e-grade (Mean = 79.82), \( r_s = 0.64, p = 0.0191 \). None of the other groups of students were found to have a relationship between Final % E-grade and % Time-on-Task. Although no other relationships were discovered between the percentages of time on task and the e-grades, further analyses were conducted on idle and active time (in hours) by student group
to uncover any trends in the previous results. See Figure 4.4 for group comparisons of active and idle time in hours as well as final e-grade. (See table 4.16 for idle time in hours, active time in hours, pretest and posttest scores for all participants in the study.) Table 4.16 is subdivided by the passing or not passing the pretest for the e-education program.

![Figure 4.4. Comparison of Gender and Race/Ethnicity Idle time in hours to Active time in hours with the final e-grade.](image)

The difference in active time \((M = 38.98, SD = 20.71)\) and idle time \((M = 11.61, SD = 6.75)\) for males was 27.38 hours. Females had more idle time \((M = 20.56, SD = 14.68)\) as well as active time \((M = 59.12, SD = 24.47)\) and the difference between the two was 38.55 hours. Hispanics, non-Hispanics, African Americans and Caucasians followed the same general pattern. The difference in active time \((M = 51.11, SD = 37.37)\) and idle time \((M = 14.47, SD = 10.17)\) for Hispanics was 36.64 hours. Non-Hispanics had slightly less active time \((M = 46.88, SD = 22.60)\) however had slightly more idle time \((M = 15.49, SD = 11.85)\) and the difference between the two was 31.39 hours. The difference in active time \((M = 53.86, SD = 24.71)\) and idle time \((M = 11.61, SD = 8.18)\) for African Americans was 42.25 hours. Caucasians had more idle time \((M = 14.44, SD = 14.14)\) but less active time \((M =
41.40, \( SD = 22.77 \) and the difference between the two was 26.96 hours. African American students had the greatest difference of idle time and active time and males had the least difference between the two times. The amount of idle or active time logged by the students did not appear to affect the final e-grade for any of the groups.

Table 4.16

*Individual Idle Time in hours, Active Time in hours, Pretest and Posttest Scores, divided by passing or failing the pretest*

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Gender</th>
<th>Idle Time in Hours</th>
<th>Active Time in Hours</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initially Failed Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doug</td>
<td>male</td>
<td>70.83</td>
<td>25.70</td>
<td>50.18</td>
<td>69.23</td>
</tr>
<tr>
<td>Eddie</td>
<td>male</td>
<td>77.88</td>
<td>13.62</td>
<td>55.54</td>
<td>74.21</td>
</tr>
<tr>
<td>AJ</td>
<td>male</td>
<td>26.98</td>
<td>6.00</td>
<td>56.35</td>
<td>78.33</td>
</tr>
<tr>
<td>Lee</td>
<td>male</td>
<td>56.10</td>
<td>13.75</td>
<td>56.84</td>
<td>80.40</td>
</tr>
<tr>
<td>Nick</td>
<td>male</td>
<td>35.42</td>
<td>13.62</td>
<td>65.71</td>
<td>77.31</td>
</tr>
<tr>
<td>Cabe</td>
<td>male</td>
<td>46.55</td>
<td>15.25</td>
<td>66.00</td>
<td>80.00</td>
</tr>
<tr>
<td>Bob</td>
<td>male</td>
<td>59.32</td>
<td>15.63</td>
<td>66.29</td>
<td>74.43</td>
</tr>
<tr>
<td>Patty</td>
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<td>27.67</td>
<td>44.89</td>
<td>76.34</td>
</tr>
<tr>
<td>Cathy</td>
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<td>6.78</td>
<td>54.76</td>
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</tr>
<tr>
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<td>6.00</td>
<td>55.65</td>
<td>79.07</td>
</tr>
<tr>
<td>Dee</td>
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<td>56.10</td>
<td>13.75</td>
<td>56.84</td>
<td>80.40</td>
</tr>
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<td>57.83</td>
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</tr>
<tr>
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<td>60.19</td>
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</tr>
<tr>
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<td>21.67</td>
<td>62.07</td>
<td>80.91</td>
</tr>
<tr>
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<td>77.06</td>
</tr>
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<td>Name</td>
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<td>Idle Time</td>
<td>Average</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>------</td>
<td>-------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Kate</td>
<td>female</td>
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<td>15.25</td>
<td>66.33</td>
</tr>
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</tr>
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</tbody>
</table>

Initially Passed Pretest

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<th>Code</th>
<th>Active Time</th>
<th>Idle Time</th>
<th>Average</th>
<th>Pretest</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>37.63</td>
<td>6.00</td>
<td>70.49</td>
<td>75.79</td>
</tr>
<tr>
<td>Dan</td>
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<td></td>
<td>41.15</td>
<td>7.18</td>
<td>73.54</td>
<td>74.62</td>
</tr>
<tr>
<td>Allen</td>
<td>male</td>
<td></td>
<td>39.65</td>
<td>7.18</td>
<td>74.02</td>
<td>76.56</td>
</tr>
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<td></td>
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<td>6.00</td>
<td>75.28</td>
<td>91.25</td>
</tr>
<tr>
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<td>69.23</td>
<td>21.02</td>
<td>75.93</td>
<td>81.79</td>
</tr>
<tr>
<td>KJ</td>
<td>male</td>
<td></td>
<td>19.32</td>
<td>6.00</td>
<td>80.14</td>
<td>82.50</td>
</tr>
<tr>
<td>Roger</td>
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<td></td>
<td>15.22</td>
<td>6.00</td>
<td>80.53</td>
<td>92.50</td>
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<td></td>
<td>7.35</td>
<td>6.00</td>
<td>80.71</td>
<td>70.00</td>
</tr>
<tr>
<td>Dave</td>
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<td></td>
<td>32.73</td>
<td>23.33</td>
<td>81.18</td>
<td>83.00</td>
</tr>
<tr>
<td>Sam</td>
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<td></td>
<td>22.10</td>
<td>13.75</td>
<td>84.10</td>
<td>78.33</td>
</tr>
<tr>
<td>Jimmy</td>
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<td></td>
<td>15.97</td>
<td>2.87</td>
<td>87.22</td>
<td>85.00</td>
</tr>
</tbody>
</table>

Note: 100% of the females failed the initial pretest with an average of 60.31; the remaining students passed the initial pretest with a 78.47.

The group of students who initially failed the pretest was composed of all the females and only seven males. The remainder of the males (11) passed the pretest. The amount of active time spent within the program by the students who failed the pretest ($M = 57.08$, $SD = 22.19$) was roughly double the active time spent by the students who passed the pretest ($M = 29.88$, $SD = 17.12$). The same pattern repeated for the idle time of the students who failed the pretest ($M = 18.54$, $SD = 12.43$) and those who passed the pretest ($M = 9.57$, $SD = 6.76$).
Unremarkably, the pretest scores of the students who failed the pretest were lower than those who passed the pretest; however, the posttest scores of the students who failed the pretest ($M = 79.26$, $SD = 4.63$) were also lower, but only slightly ($M = 81.03$, $SD = 6.90$). See Figure 4.5.

![Figure 4.5. Comparison of Pretest and Posttest scores of students who initially failed the pretest or initially passed the pretest.](image)

Table 4.17

**Passing/Failing Scores as Compared to Active Times, Idle Times, Pretest and Posttest, Means, and Standard Deviations**

<table>
<thead>
<tr>
<th></th>
<th>$n$</th>
<th>$M$</th>
<th>$SD$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle time (initially failed pretest)</td>
<td>20</td>
<td>18.54</td>
<td>12.43</td>
<td></td>
</tr>
<tr>
<td>Idle time (initially passed pretest)</td>
<td>11</td>
<td>9.58</td>
<td>6.77</td>
<td></td>
</tr>
<tr>
<td>Idle / Idle</td>
<td>31</td>
<td></td>
<td></td>
<td>0.0142*</td>
</tr>
<tr>
<td>Active time (initially failed pretest)</td>
<td>20</td>
<td>57.08</td>
<td>22.19</td>
<td></td>
</tr>
</tbody>
</table>
When comparing the students based on whether they passed or did not pass the pretest of the e-education program, significant differences were discovered between the idle times, active times and pretest; no significant differences were seen in the posttest scores.

The students who failed the pretest ($M = 18.54, SD = 12.43$) had a higher idle time mean than the students who passed the pretest ($M = 9.58, SD = 6.77$) and these differences were significant at the 0.01 critical level, $t (30.97) = 3.79, p = 0.00$. When comparing the active times, similar results were seen; students who failed the pretest ($M = 57.08, SD = 22.19$) had a higher active time mean than the students who passed the pretest ($M = 29.88, SD = 17.12$) and these differences were significant at the 0.5 critical level, $t (27.85) = 2.60, p = 0.0007$. Comparison of the pretest scores also indicated significant differences; students who failed
the pretest \((M = 60.31, SD = 6.37)\) had a lower pretest score \((M = 78.47, SD = 5.02)\) than the students who passed the pretest, and these differences were significant at the 0.01 critical level, \(t (27.47) = -8.73, p = 0.0000\). No significant differences were observed between the posttests of the two sets of students. The students who failed the pretest had a lower mean \((M = 79.26, SD = 4.64)\) than the students who passed the pretest \((M = 81.03, SD = 6.90)\), yet these differences were not significant at the 0.5 critical level, \(t (16.07) = -0.76, p = 0.46\).

**Qualitative Data Analysis**

The qualitative data collected throughout the study was coded and analyzed using the modified theoretical framework of Artino (2010) using the six factors of motivation: self-efficacy, active learning strategies, science learning value, performance goal, achievement goal and learning environment stimulation provided by the Student Motivation Towards Science Learning (Tuan et al., 2005). (See figure 4.6 for Artino’s model). In this section, an overview of each of the codes are given, which will then be followed by exemplars from the students’ interview transcripts.

An additional category, ‘prior to e-learning experience’ was added to the framework of Artino (2010) to better understand the students’ mindset when they entered the science e-classroom. Artino’s categories, ‘learning environment,’ ‘personal factors,’ and ‘academic outcomes,’ were used to understand the students’ mindset while engaged with the science e-program.

When describing their prior learning experiences, nine of the twenty-eight students interviewed described either the characteristics of their science teacher or the characteristics of the science classroom. All of the students described stressful or antagonistic situations.
The codes ‘characteristics of the traditional science teacher’ and the ‘traditional science classroom’ were derived from the students’ transcripts.

The ‘learning environment’ is in the first category of Artino’s theoretical framework and was used to understand the task characteristics of the science e-program as well as how the students interacted with the curriculum of the science e-program. The ‘learning environment stimulation’ from the SMTSL and the task characteristics included codes for ‘autonomy,’ ‘lack of face-to-face teacher,’ ‘e-classroom characteristics,’ and ‘pace’ based on students’ transcripts. Examples of these will be given in a later section. The majority of the students indicated that the science e-program’s characteristics were well suited to their science learning.

Figure 4.6. Theoretical framework based on Artino (2010) including six factors of motivation from the SMTSL (Tuan et al. 2005).
‘Personal factors’ is the second category of Artino’s (2010) framework, which includes both ‘motivational beliefs’ and ‘achievement emotions.’ Students’ statements that were coded as motivational beliefs were further delineated into one of the following codes: ‘self-efficacy,’ ‘science learning value,’ and ‘task value beliefs.’ Of the students interviewed, only two indicated that their self-efficacy was not improved or did not change with the program. The codes for ‘achievement emotions’ included statements that described how the students felt about the e-program. The majority of the students described feelings of pleasure while using the program and only a few did not like the science e-program.

The final category in the framework as well as for the coding was academic outcomes. This category housed six codes. These codes included ‘achievement,’ ‘an indication that the students would or would not consider using another science e-education course,’ ‘achievement goal,’ ‘performance goal’ and ‘active learning strategies.’ Most of the students indicated that they would utilize another science e-course and all of the students indicated that they felt as if they achieved their goals for the summer.

The voices of the students described their feelings of accomplishments as well as their frustrations when in a non e-education science classroom. The transcripts will only refer to the students pseudonyms and not reference their gender or race/ethnicity. Table 3.1 has a complete listing of the students’ gender, race/ethnicity as well as the course in which they were enrolled.

**Prior to the summer e-education experience**

Of the twenty-eight students interviewed, nine specifically described their experiences prior to the summer e-education experience. The students who discussed their
experiences with their former teachers and the interactions within the classroom were heartfelt and compelling. Characteristics of the non e-education classroom teacher and the non e-education classroom will be presented in excerpts in the following sections.

**Characteristics of the Teacher**

Six of the thirty-two students spoke directly to interactions with their face-to-face science teachers. None of the students indicated that teachers had tried to help them or alleviate any of the stress in the classroom. For instance, JK, was visibly upset when recounting how her teacher worked with other students but not with her and especially when the teachers did not follow educational plans put in place to help students.

“My friend T was failing, but the teacher did something and she passed. She is not in summer school….the teacher goes down your throat because you did not pass the test, well OK, I am able to make it up and I say I can make it up, they say no, you should have studied and all that. I do study but I never pass my tests in science.

Two students stated specifically that their teachers talked too fast or went too fast for them to keep up. For instance, Jenny explained,

My science teacher teaches too fast – before I understand what she is saying, she goes on to another topic. I have not learned what she was talking about and she just keeps going. You are in the middle of learning something and before you really understand it – the teacher is on another topic.

Another unflattering characteristic relayed about teachers was to judge the student prior to getting to know them. Lenny, a student from Michigan with pink hair described his situation,
Teachers do not take the time to get to know you and if you do not look like everyone else. They think you are doing drugs or that you will hurt people. Specifically they think that you cannot do the work. This is what kinda (sic) happened to me this year at my school and one of my teachers – nothing bad happened, it was just that one of my teachers did not like me. Teachers will judge you and put more pressure on you if they think that you cannot do the work.

Classroom

Students described their experience in the non e-education science classroom as being antagonistic and stressful. For instance AJ stated that he felt that ‘people [were] judging you.’ Emma described her experiences with her science teacher in great detail. We had a teacher who would bang his head on the board when the kids did not get the topic he was teaching…but he will go up to a student and hit his hand on the student’s desk if their head is down just for a minute.

Jenny described the classroom as “crushing.” She lifted her hands over her head and then pushed down on her head to explain how she felt. She went on to say that she “felt caved in and you are not able to get up and move around when you need to.”

During the E-Education Course

Learning Environment

Instructional Resources

Instructional resources are the aspects of the program including the curriculum that have been made available to the students. Not every student found the instructional resources of high quality and useful to them, in particular, three students mentioned the
excessive length of the video lessons and the boring instructors. Approximately two thirds of the students (23) discussed program features that were helpful. For instance, students liked being able to stop and rewind the video, being able to hear the vocabulary terms spoken and used in a correct sentence, power points embedded in the lecture and having the ability to utilize close captioning. For example, CT described her experience with the program in this way, “this program allows you to find what you need to know. I can grasp the concepts better, I can read and listen at the same time – the lectures have graphics that I can see to help me learn.” Kate explained that the way the curriculum was presented helped her, “You can see the plan every day with the program. You can see the curriculum, it is not as if you show up to class one day and it is oh, what are we going to learn today?”

**Autonomy**

Autonomy refers to the students’ ability to decide how much time to devote to topic without having to follow a prescribed pacing guide. Of the twelve students that spoke directly to autonomy, all agreed that they ‘had more control.’ CT spoke for the students when she succinctly stated, “You don’t put your learning in someone else’s hands.”

The students in a regular science course are forced to follow precisely what the teacher is mandated to cover and when it is to be covered. An example of this aspect of the program was detailed by Tom when he said, “I like the fact that there is a pretest before the lesson. You don’t have to waste your time with something you know already. You don’t have to relearn it.”

While interviewing students at one site, I detailed an incident between a facilitator (students cannot be unsupervised, each school had a facilitator in the e-classroom per county policy) and a student. The detailed incident spoke directly to the autonomy in the e-
classroom and lack of such in a regular classroom. Bob, while listening to an e-lecture, began looking for shoes on the split screen on the computer. The facilitator chastised the student and began haranguing him for not paying attention to the lecture. The tirade lasted for well over two minutes and Bob just responded that the lecture was boring. The facilitator explained precisely why e-education is a valuable tool. He stated,

You are just looking at the audiovisuals and not listening to the lecture – I am not saying you are wrong because everyone learns different – from a long time ago, everyone always knew. The problem is that this everyone teaches differently – we all have to learn to learn differently and that is one thing that is not emphasized. We have to learn how to learn because we are exposed to different types of teaching. It won’t matter if you are visual learner, you will have to read something to learn, but one of these days, you may run into something that is not up your alley, you will have to learn how to adjust to learn how it is being presented. So these are the times you are learning how you will learn and go through the rest of your life. The one thing about this type of learning is that if you have a question – you are able to quickly to get the information to answer the questions you have been posed – you will not always have this type of teaching. In the classroom, you don’t always have this ability and you may not always have this in the real world.

Classroom characteristics

The characteristics of the e-education classroom are much different than in a traditional classroom. In a regular classroom setting, the students are traditionally in rows of seats with interactions between the students and interactions between the students and
teachers; the rooms can be noisy and distracting. In an e-classroom, the students are seated at computers, with fewer distractions and very little interactions with their fellow students. For example, Emma said, “You don’t have to worry about other kids being loud or the teacher not sending them out.” Of the six students who discussed the classroom, Kate was most sincere with her explanation. “If you mess up, you are sent out [of a regular classroom] and you miss the entire lesson, with this program, if you get sidetracked, you can go back and listen to it again, you don’t miss anything.”

No face-to-face teachers

The e-program by design does not have traditional face-to-face teachers but does have video lectures that the students can listen to. This trait of not having a face-to-face teacher was discussed by all students. Only four of the twenty-eight students would have preferred to have a face-to-face teacher, and then not for all classes. For instance, Patty mentioned that at times that she would like a real person to answer her questions. Lenny and Jimmy, while both liking the program would have liked having a biology teacher with them during their summer course.

Two thirds (24) of the students stated that they liked the aspect of not having face-to-face teachers. For example, Allie stated, “I don’t like teachers!” Jenny explained, “It helps me a whole lot better here than face to face …Little things that teachers do can make me feel bad about me, e2020 does not do this.” One student remarked there is less drama in an e-education classroom.

The consensus among the students was that they did not have to ‘listen to a teacher. An example was when students were discussing a teacher who would “bang his head on the
board when the kids do not get the topic he is teaching – but he will go up and hit a student’s desk hard if their head is on the table just for a minute.” Lenny described his interactions or rather the lack of interaction with teachers in this way, “When I come to [summer] school, there is not a teacher who hates me.”

_Pace_

Pace involves the students being able to go through the curriculum as they need to, not following the prescribed county wide pacing guide. Many of the students (15) agreed that going at their own pace was a good trait of the program. For example, Nick said, “It is simpler online than it is in the classroom, you can go at your own pace…It is self-paced, it doesn’t seem to be as much pressure.” Kate added, “The program lets you know what you have to do and how you have to pace yourself every day.”

For many of the students, being able to decide their pace was a new experience. One student explained, “I am better off going at my own pace instead of uhm, finishing at a certain time, I can move at my pace and not at a different pace.” Dee added that allowing her to move at her own pace, she was able to pass six pretests in one day.

**Personal Factors**

Personal factors include motivational beliefs and achievement emotions. Motivational beliefs entail how useful the program is to the students and the various tasks associated with the e-program. Achievement emotions pertain to the negative or positive emotions elicited by the e-program.

_Motivational beliefs_

Artino (2010) included self-efficacy and task value beliefs in his theoretical
framework that encompassed motivational beliefs. The science learning value subcategory of the SMTSL was added to the framework for the purposes of better understanding the students’ willingness to utilize the program.

*Science Learning Value*

Science learning value incorporates the concept that science has relevance in the students’ daily lives. The students did not discuss the relevance of science on their daily lives but did discuss the ability of the e-course to stimulate their thinking. An example was when one student stated, “This program allows you to find what you need to know.” The majority of the science learning value was observed when students were involved with the virtual labs.

My field notes detailed an incident with a student who was having difficulty with a lab inquiry lesson on levers for his physical science course. The facilitator for this site had broken her knee cap and was on crutches. She was unable to move about the room and give suggestions when a student was having trouble with part of the program. I was able to sit down and help Nick with the particular lesson and explain how to manipulate the virtual levers. He was willing to learn how to better utilize the program and he was very pleased with his results.

Of the twenty-eight students interviewed, twelve spoke directly and positively regarding the science learning value of the e-program. For instance, one group remarked that they liked the virtual labs, ‘they help you learn.’

*Science self-efficacy*

Self-efficacy is the belief that one can accomplish a given task; science self-efficacy
is the belief that one can accomplish a task that involves the use of science. The majority of the students indicated that their science self-efficacy had improved. However, one student stated the e-program did not alter his science self-efficacy. Roger stated that he understood the biology curriculum and that the e-program did not help him understand it any better.

Many of the students experienced success for the first time in a science course and expressed their beliefs in this way, “I understood the course.” Another stated, “When I feel good about myself, I hold on to my self-confidence … I was proud of myself and I knew I could do anything!” CT explained her feelings regarding science in this way, “I feel like I have more confidence to do what needs to be done now.”

Kate described science self-efficacy in terms of a game.

Yeah, it is more like a game; it is like playing basketball, when you do well in one game, you know you can do well on the next game. As long as it is on the same topic or same lesson, not so much for different topics – it starts all over again. When I have had success on one module, I know that I can do well on the next module. Yes, I have done that, especially with the topic test review. When you do the review, you feel as if you can really do well on the topic test. That really helps out.

Lenny discussed at great length how the program allowed a change in his science self-efficacy.

Yes, that kinda (sic) has to do with how it had the, what I would call a dashboard I think, where it says this is where you should be but this is where you are and this is where you can end because for me I got through with program, e2020 really quickly. So it would say that are supposed to be at 5 but oh look here, I was at 30 something,
oh, it made me feel good about myself and then where it says you only have only 60 or 70% more to go and that number, that percentage keeps getting lower and lower and being able to see my grade throughout so I have about a 90 throughout this whole thing, I thought that was kinda (sic) neat. That made me more, more self-courage, more self-confidence and knowing that I can reach the goal of getting done with it.

**Task Value Beliefs**

Task value beliefs can be defined as how interesting or how useful the e-program was for the students. The majority of the students explained why they believe the program was useful or interesting to them. For example, one student stated, “I like the fact that there is a pretest before the lesson. You don’t have to waste your time with something you know already. You don’t have to relearn it.” Another student explained,

I learned more with the computer, it is very compact and it tells you what you have to know. The teacher makes you write down notes that you will never use, I just get confused. But I think I can take what I have learned from here – taking notes on what is important and I think I could apply it to the other courses I have to take in science.

In field notes, two of the students were observed taking notes. When asked if they had taken these kinds of notes in their previous classes, both students stated that they had not. Patty explained that her teacher spoke too fast and she could not keep up. This program afforded students the ability to stop and start the e-program at will and take notes on the material if needed.

One student in explaining why she liked this program described her classroom experience and not being able to stop or slow her teacher down.
My science teacher teaches too fast – before I understand what she is saying, she goes onto another topic. I have not even learned what she was talking about and she just keeps going. You are in the middle of learning something and before you really understand it – the teacher is on another topic.

Achievement Emotions

Achievement emotions can either be positive or negative depending upon how the students view the program. The positive emotions are the result of being successful and learning a new concept whereas negative emotions are associated with being bored with e-program.

Positive Achievement emotions

Of the 28 students interviewed, 18 spoke specifically to the positive aspects of the program. Every student agreed that the program made them successful and that they enjoyed using it. For example one student said, “I know I was making 40’s in the classroom but am making better grades here. This is better!” Jenny happily explained, “here I study and I end up passing it.”

Negative Achievement Emotions

Not every student liked using the e-program; six specifically discussed why they did not like it. One student said simply, he did not like computers. Several students mentioned the boring lectures, for instance, Bob said, “Everything he says is on the screen, and he is boring. He just talks too slow; he wastes a lot of time – that is why I don’t listening to him.”

Academic Outcomes

Artino (2010) included the use of learning strategies, achievement, satisfaction and
instructional choices in his theoretical framework. The modified framework that was used to understand academic outcomes included active learning strategies, achievement, satisfaction, and the SMTSL performance goal and achievement goal indicators which were housed under the heading, socio-cultural influences.

Achievement

Achievement can be equated to doing well on one lesson or module or for receiving credit for the summer session course. Every student except for one was successful in that all received credit for the course they were enrolled in. All students interviewed for the study remarked at how well they had done in the e-education courses, including the student who did not complete the summer session. Examples of their opinions follow.

One student was so pleased with her success; she went to suggest that “all the teachers need to use it.” She added

I know some kids that will be in the classroom, they are smart, just not classroom smart, but when they get on the computer, they are learning (she snapped her fingers) like crazy. This would actually help them; this would help a lot of kids who are trying to graduate early. It would help them graduate. I find it useful; I find it very useful for kids to use it now.

One student explained that the reason he was in summer school was that he had 60’s for both semesters. There was no way he could have gotten graduation credit if it were not for this program. Lenny discussed the lack of information provided by his classroom biology teacher, he had not passed the course due to his failure of the biology state exam. After the e-education course, he was required to take the biology state exam again, which he passed
and was given biology credit.

Satisfaction

Satisfaction for the theoretical framework was the idea that the students would either choose to use an e-education course again or not. The majority of the students indicated that they liked the e-education course, would take another e-education course and would recommend to a friend. For example, several students said “There needs to be more e2020 classes.” Another student inquired if the courses could be provided during the school year and not only in summer school. Only one student specifically indicated that he would not take another e-education course.

Achievement Goal

Achievement goal is an indicator of students feeling satisfaction as they increase their science achievement and competence. The majority of the students indicated that they were pleased with their progress in the e-education course. For example, Nick was observed making a 90 on a posttest, he said, “I am very happy with my progress.” Many students stated they were happy with their results in the course. Specifically, Dee said, “Yes, I know that I can do the work.” All of the students except for one involved in the study were successful and increased their competence within the e-education courses they were enrolled in.

Performance Goal

Performance goal is an indicator of competing with their fellow classmates and getting attention from the teacher. Due to the parameters of the e-education course, only a few students described wanting to gain a teacher’s attention. For instance, Cabe said, “For
some science courses, I feel like I need a teacher, others I am OK with e2020.” No student interviewed indicated that they were trying to compete with their fellow classmates.

**Active Learning Strategies**

Active learning strategies are an indicator that the students in the study were taking an active role in their science education. The e-education program utilizes several learning strategies including listening to lectures, answering questions, vocabulary and virtual labs. Every student interviewed described their use of the various learning strategies available to the students in the e-education course.

For example, Bob explained why he liked reading the transcript of the course and not listening to the lecture, “By just looking at the notes, [transcript of lecture] you can learn enough to pass the course.” Other students discussed how the labs added information to their understanding of the course. Still others commented on the graphics that could be viewed while listening to the lecture. For instance, CT explained, “I can read and listen at the same time – the lectures have graphics that I can see to help me learn.” Dave also explained that “I can rewind the video, I can go back over it, the lecture, like when you don’t understand it, and the teacher explains it.” In contrast to a regular science classroom, Dee remarked how she was able to take notes and not be confused by a teacher talking too fast or not explaining what notes should be taken.

One aspect of the program that was only discussed by several students was the ability to work on the program away from school. Lenny, for example explained, “I can do it anywhere there is Wi-Fi or internet; even at home I did some of it. So that is something that I really liked. You could do it everywhere.”
**Summary**

All students except for one in the study were all successful and earned credit for the science course they were enrolled in. There was a difference in gender regarding self-efficacy and achievement but no difference in race or ethnicity. Females had a lower science self-efficacy entering the course as compared to their male counterparts but had higher academic growth than the males in the study. Academic growth and time on task was analyzed by comparing the students who had failed the pretest and who had passed the pretest. The students who had failed the pretest initially spent more time actively working in the program as well as having more idle time. The students who initially failed the pretest were able to obtain the same posttest scores as the students who came into the program who initially passed the pretests.

The students who expressed their opinions of the e-education program were very succinct. Most students were very pleased with the e-education course and would chose to use it again. These same students also expressed their disdain for regular education science teachers and explained how they were treated in the regular science classroom. The students utilized the various aspects of the program including lectures, vocabulary, virtual labs and online activities. The idea of being successful, being able to control the course and work at their own pace was the overarching theme of all student interviews.
CHAPTER FIVE
DISCUSSION

The objective of this study was to understand more about the potential of on-line education science courses with at risk students who enrolled in a summer school credit recovery course. A variety of data sources were used in order to better understand the potential of e-education with this population of students. Due to the low number of Hispanics (4) in this study, only descriptive data will be discussed. In this chapter, the statistically significant results will be discussed as they pertain to the research questions and the theoretical framework.

Students enrolled in e-education courses

The high school students involved in the study were 59.4 % males and 40.6 % females. Of these, 56.25% were Caucasians, 43.75% were African Americans, and 12.5% were Hispanic; therefore, 87.5% were non-Hispanic. However, the county high school population, by comparison, is composed of 49% males and 51% females; 64% are Caucasian, 18% are African Americans, and 12% are Hispanic (Glimpse, 2015). Various studies have indicated that the higher percentages of male and African American students enrolled in a summer school credit recovery course are, unfortunately, to be expected. What was not expected was the similarity of percentages of the Hispanic population in this SE US county school district and the Hispanic population in the study, as a higher number of Hispanics in summer school courses has been found in other studies (Plunk, Tate, Bierut, & Grucza, 2014).

Studies have indicated that males are overrepresented in remedial programs
as was the case in this study. The literature posits that males are less engaged (Dotterer & Lowe, 2011; Roorda, Koomen, Spilt, & Oort, 2011), and more likely to be disciplined and suspended from school (Skiba, Horner, Chung, Rausch, Mays & Tobin, 2011). Females, however, are more likely to have more self-control (Duckworth et al., 2015), cause less disruptions, be overlooked by the teacher (Ceci & Williams, 2011; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012) and therefore are less likely to be suspended. Thus, the relative percentage of males (59.4%) and females (40.6%) in this study are consistent with the literature.

As with the case of males, African Americans are also overrepresented in many remedial or tutoring programs (Bowling, 2014). Many African American students are lose educational opportunities when disruptions occur in the classroom (Barbarin, 2010) and are more likely to be referred to the office for disciplinary action which can lead to failure and ultimately in remediation programs such as the summer school program that was the focus of this study.

The Hispanic population of the study and the population of the SE US county were similar. Rarely is the percentage of Hispanic students in the general population equal to the percentage of students in remedial programs. The literature posits that language can be a barrier to success (Gonzalez, 2012) as well as the Hispanic students not remaining in school (Gonzalez, 2014).

The attitudes and beliefs that students bring to the classroom will determine how they approach the material to be learned as well as how the program is utilized. In the next section, the beliefs of the students and their academic achievement will be discussed.
Students’ beliefs and academic achievement

Self-Efficacy

In the present study, females had significantly lower self-efficacy than the males. Louis & Mistele (2012) reported similar descriptive findings; the females in their study had lower science self-efficacy but not statistically significantly lower. No gender differences in science self-efficacy were reported in two additional studies (Kıran & Sungur, 2012; Tenaw, 2013).

One possible explanation for the lower self-efficacy scores in this study as compared to other published studies may have to do with females being less interested in science (Miller, Blessing & Schwartz, 2006) as well as not being exposed to efficacy building scenarios while in school (Chen & Usher, 2013). Velayutham, Aldridge, & Fraser (2012) investigated the link between self-efficacy and self-regulated learning. They discovered that girls had slightly higher self-efficacy but had lower task value scores and self-regulated learning scores when compared to their male counterparts.

Notwithstanding the lower self-efficacy scores of the females at the beginning of the study, a majority of the females indicated in the interviews that their self-efficacy had improved over the course of the study. Kate, for example, equated the science classroom with basketball, “it is more like a game; it is like playing basketball, when you do good in one game, you know you can do good on the next game.”

The self-efficacy scores of the students in this study, in general, are in agreement with other studies comparing self-efficacy of at risk students to those not considered at risk. Two studies, Dermitzaki et al. (2013) and Carroll et al. (2013) reported that at risk students had
lower self-efficacy scores than their non-at-risk counterparts. However, even with the lower science self-efficacy scores at the beginning, the overall feelings reported by the students at the end of the study indicated an increase in their self-efficacy. For example, CT stated at the end of the final interview, “I feel like I have more confidence to do what needs to be done now.”

Active learning strategies

Active learning strategies relate to students taking an active role when using a variety of strategies to construct new knowledge, based on their previous science understanding. None of the groups were statistically different from one another. The students in this study indicated that they were willing to utilize a variety of learning methods in the science classroom (mean score = 29.81). Actively engaging in various learning strategies such as using concept maps or responding to prompts will promote effective learning (Zayapragassarazan & Kumar, 2012). Active learning methods require students to utilize higher-order thinking skills such as analysis, synthesis, and evaluation (Roehl, Reddy, & Shannon, 2013). A study utilizing on-line resources to increase active learning showed promising results (Lee, 2013). Similarly, students in this study who engaged in the e-education course took an active role in their own learning. For instance, CT utilized the Power Points while listening to the lectures and stated, “I can grasp the concepts better, I can read and listen at the same time – the lectures have graphics that I can see to help me learn.” This active learning was also evidenced in classroom observations when many of the students (approximately 50%) were observed taking notes while either listening to the lectures or learning the vocabulary.
A recent study indicated that students who value science in the classroom will actively engage in science activities (Velayutham & Aldridge, 2013). This phenomenon was observed in the present study. For example, one student who was struggling with a laboratory activity never gave up but continued until he understood the concept of levers as it related to his physical science course. Students who lack self-efficacy, such as the ones in this study are likely to initiate and sustain their efforts if they value the learning activity (Schunk & Zimmerman, 2007). Another student, Kyle, when discussing the use of the laboratory investigations stated, “they (the laboratory simulations) tell you what you need to know.”

*Science learning values*

Science learning value is a score that indicates how much students value science in their everyday lives as well as acquiring the ability to solve problems. The students in this study indicated (mean score = 16.75) that they do not place much emphasis on how science relates to their everyday lives, which was consistent for all students regardless of gender of race/ethnicity. In this study, it was not necessary to relate to science in order to actively engage with science. One can value doing science without necessarily seeing its relation to one’s life.

*Performance goals*

Performance goals in science relate to the student competing with fellow students and trying to gain the attention of the teacher. No significant differences were discovered between the various groups when the data was analyzed, and the performance goals for all (mean = 12.60) was low. The low scores for performance goal is not surprising when dealing
with an at risk population (Carroll et al., 2013). Based on interview data, the students in the current study had been placed in adversarial classroom situations and were not concerned with proving competence to their classmates or the teacher. For instance, Lenny, stated, “When I come to school (summer school), there is not a teacher who hates me.” However, this was not the case for all students, 20% indicated that they like having a teacher to explain and clarify, for instance, Eddie said, “At times I need a teacher to help me. I like to ask questions if I need extra help.” Ultimately, the goal orientation for the students in this study did not relate to their success in the program.

Dweck and Leggett (1988) indicated that performance goal orientation involves a chronic tendency to pursue a goal of demonstrating competence or avoiding the demonstration of incompetence to others. The students in this study indicated by their survey scores that they were less concerned with trying to impress others, but rather to blend in with the other students. Substantial research evidence indicates that performance goal orientation is detrimental for students’ positive learning outcomes (Kaplan & Maehr, 2007). Students can become so concerned with trying to prove they are more competent and when they fail to prove competence, they may give up entirely (Carroll et al., 2013). Conversely, in a recent study, Anderson, Lawton & Kaliski (2014), indicated that a performance goal orientation did not affect academic achievement. In this study, a low performance goal orientation did not affect the academic achievement of any of the students.

Achievement goal

Achievement goal subscales of the Students’ Motivation Towards Science Learning are a measure of the student’s satisfaction as they increase their competence and achievement
in the science classroom. As with the performance goal, no significant differences were discovered between the groups of students in the study. However, a majority of the students indicated that they come to the classroom with an achievement goal orientation (Mean = 18.13). The students in this study indicated their preference for a non-traditional classroom where they were allowed to work independently and not be compared to others. For instance, Allie said, “I like it (e-education) because there is no teacher and I can go at my own pace, I don’t like teachers!” Others indicated that their grades were much better in this type of learning environment. Lenny stated, for example, “My grade was about a 65 and now I have a 90 average overall that is kinda (sic) neat!” In spite of the fact that the students in this study had failed a science course, students such as Lenny were pleased about experiencing successes. In a recent study, it was discovered that students normally do not change their goal orientation once in higher education (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2012). Another study indicated that students who have achievement goal orientation in the classroom are successful and continue to be so (Logan, Medford, & Hughes, 2011). If this were to hold true for the students in this study, it seems promising that they could continue to experience more successes following this course, having had the chance to experience the feeling of success in a previously failed course.

*Learning environment stimulation*

Learning environment stimulation, the final subscale of the SMSTL involves the curriculum, teachers’ teaching and student interaction as it pertains to the students’ motivation for science learning. A statistically significant difference was found between African American (Mean = 22.0) and Caucasian students (Mean = 17.44) on this construct;
however, there was not a statistical difference in academic growth between these two groups; the difference between the pretest and posttest for Caucasians (Mean = 12.64) was similar to the African Americans difference (Mean = 13.73), t (30.73) = 0.29, p = 0.77. The African American students had a higher score on this subscale than any other group and agreed somewhat that this construct was important. The students in this study agreed slightly with the construct whereas Caucasian students essentially were neutral in their opinion of learning environment stimulation. Reyes et al. (2012) suggested in their study that African American students have less engagement with their teachers when compared to Caucasian students, which was not in agreement with this study.

Interestingly, although perhaps not surprisingly, one of the constructs in this subscale had the highest average of any other construct: *I am willing to participate in this science course because the teacher does not put a lot of pressure on me.* Many at risk students do not do well in an anxiety ridden environment. Chen and Usher (2013) indicated in their study that self-efficacy could be affected by learning environments that are high stress, which could negatively impact students’ self-efficacy; students’ motivation to do well in the classroom could also be affected. Indeed, the majority of the students in the study liked using the e-education program specifically due to lack of teacher interaction and a reduction of stress.

For instance, during one of the interviews, Jenny spoke about being not being judged by the classroom teachers during the e-education course. She said, “You don’t have to worry about people judging you – you don’t have to worry about the teacher saying you have to do better.” AJ, who was in this focus group interview agreed with his classmate, he mimicked
the sound of a cracking whip, referring to how teachers are trying to whip them into submission. He did not need to explain further; he preferred the e-education course due to the reduction of outside pressure and stress.

*Academic Success*

All but one of the thirty-two students in the study completed the summer school course and earned a unit to be used for graduation requirements. The final course average was a 79%. The reason for this grade is likely that the students knew they needed to pass, but the grade was not going to replace the grade of an F for their grade point average. That is, the students would not be rewarded for earning grades that were higher than what was needed to pass the course, which was a 70%. Passing the course would get students one step closer to graduation. In fact, one student from the study graduated at the end of the summer session.

*Academic Growth Indices*

The males in this study started with higher pretest scores as compared to the females; however the females had a higher academic growth than their male counterparts. These were the only statistically significant differences in scores. This was somewhat surprising, as the girls also began the study with lower self-efficacy score than the males. Therefore, the students with the lowest self-efficacy had the highest gains in pre to posttest scores. The lower self-efficacy and lower achievement of girls in the classroom has been reported previously by others in the literature (e.g., Alexakos & Antoine, 2003). However, their research suggested that changing the learning environment could reverse this trend if the learning environment is inquiry based and the learning is fun and enjoyable.

Findings reported by Velayutham et al. (2012) indicate that for both genders, the most
significant motivational belief in the science classroom is self-efficacy. This suggests that students who can increase their self-efficacy will have an increase in their academic achievement. By changing the learning environment from a traditional classroom to an e-education one, the females as well as the males were placed in an environment that is based on inquiry and was reported by most students, to be enjoyable to use. Both males and females indicated that their self-efficacy increased with the use of the e-education program. For example, Dee said, “When I feel good about myself, I hold on to my self-confidence, I did six pre-tests and passed all of them in two hours. I was proud of myself and I knew I could do anything!” Lenny stated in a separate interview, 

…what I would call a dashboard I think, where it says this is where you should be but this is where you are and this is where you can end because for me I got through with program, e2020 really quickly. So it would say that are supposed to be at 5 but oh look here, I was at 30 something, oh, it made me feel good about myself and then where it says you only have only 60 or 70% more to go and that number, that percentage keeps getting lower and lower and being able to see my grade throughout so I have about a 90 throughout this whole thing, …That made me more, more (sic) self-courage, more self-confidence and knowing that I can reach the goal of getting done with it.

By the end of the study, the majority of the students reported having higher self-efficacy, however, only the females showed significant academic growth. According to Schunk & Pajares (2005), students with high efficacy are more likely to expend effort towards completing tasks, evaluate their progress and apply cognitive and meta-cognitive
self-regulatory strategies.

Students were given a pretest prior to the beginning of each assigned lesson. 34% (11) of the students were able to bypass a significant portion of the course; the remaining 66% (20) of the students had to complete more of the coursework to earn credit. Students who passed the pretest initially (Mean = 78.47) did not show significant academic growth, t(10) = -1.14, p = 0.2816; whereas the students who had not passed the pretest initially (Mean = 60.31) did show significant academic growth, t(19) = -13.10, p = 0.0000. The results indicate that fully one-third of the students who were enrolled in summer school for remediation of a failed science course were able to pass the pretest for the summer school course. Additionally, these students did not demonstrate growth on the posttest. Therefore, 11 students were enrolled in the course who knew enough of the material to pass the pretest and, in spending six weeks in summer school, they did not benefit from this investment of time and energy in terms of academic growth. It is possible that the low academic growth could have been related to the district policy of not changing the student’s grade, regardless of what they earned in the summer school course. That is, why try to earn an A or a B if the failing mark will not be removed and the cumulative average will also not be improved. The students will be given a credit for the summer school course and a note will be added to the students’ cumulative folder to indicate that a graduation credit was earned. One study suggests that to make students sit in a remedial program such as summer school amounts to punishment (Cranton, 2002).

Roger, a student in the study, who had initially passed a majority of the pretests, had to remain in summer school in order to ‘pay back’ the time he was absent from his
regular school. The county policy where this study took place is such that on the ninth unexcused absence, students automatically fail the course, even if they can show proficiency. The findings from this study indicate that requiring at risk students to enroll in summer school when they have demonstrated competence, especially when it will not result in a grade change, will not promote student learning student learning. Educational programs, such as the Regents College Preparatory Examination courses are pushing for real learning and not just students sitting in a chair (Bishop, Moriarty, & Mane, 2000; Isaacs, 2014).

There is a culture of at risk students being punished for their behavior with academic consequences. Students who are removed from the classroom for disruptive behavior are in danger of falling behind in their subject. Some students who feel that they cannot regain what was lost academically due to their absences will sometimes opt to drop out of high school (Baker et al., 2001) The authors suggest that school structure contributes to students dropping out of school. The students’ sense of self-determination is closely tied to school engagement and ultimately academic success or lack thereof (Baker et al., 2001).

Students who are in violation of Board of Education statutes, law violations, and retention rate were characteristics associated with schools reporting low academic achievement, high suspension rates, and high dropout rates (Christle, Jolivette, & Nelson, 2005). The authors relate that at risk schools can have undesirable physical condition of the schools, infrequent adult–student interactions, and few instructional strategies used by teachers (Christle et al., 2005)

Ultimately, students need to remain in school in order to earn a diploma. If students are not engaged in school, they may very well decide that the culture of school they find
themselves in is not suitable for them. Teachers, principals and students must decide what steps to take in order to increase engagement and decrease the number of students leaving school (Archambault, Janosz, Fallu, & Pagani, 2009).

Analyses of Time-on-Task

A Spearman’s Correlation was performed to determine if a relationship existed between Time-on-Task and final grade for all groups in the study. Females had the lowest Time-on-Task (Mean = 74.96) but not the lowest final e-grade (Mean = 79.82), \( r_s = 0.64, p = 0.0191 \). Although no significance difference was discovered between the percentage time on task and the final e-grade, further analyses were conducted on group idle and active time in hours of students to uncover any trends. Students who initially failed the pretest spent more time in the coursework than that the students who initially passed the pretest. As previously discussed; students who entered the course with a good understanding of the coursework showed no significant academic growth.

A majority of the males (61%) passed the pretest initially which is in agreement with males having higher self-efficacy and higher pretest scores. All of the females in the study (100%) failed the pretest initially which again is in general agreement with earlier findings of at risk students in educational programs, not necessarily summer school programs (Alexakos & Antoine, 2003; Louis & Mistele, 2012). Statistically significant differences were discovered between the idle times of the students who initially passed the pretest (Mean = 9.58) and the students who initially failed the pretest (Mean = 18.54), \( t(30.97) = 3.79, p = 0.00142 \). Similar statistically significant differences were noted between the active times for both groups of students \( t(27.85) = 2.60, p = 0.0007 \). Students who came into the summer
school program at a lower achievement level needed more time to acquire the knowledge (Scherer, Greiff, & Hautamäki, 2015) whereas the students who understood the material did not need as much time to complete the program. Attendance is mandatory for many school districts around the country and excessive absences will result in failure (NCDPI, 2015, VDOE, 2012). Many students believe that summer school is a punishment and not a learning experience. For example, Roger, who admits to being lazy, had to attend summer school for failure due to lack of engagement in school. However, once he began summer school, he became engaged with the program. He said, “I completed the course in three days, I am done.” He clearly understood the biological concepts and was deemed proficient in the subject matter by obtaining a passing score on the Biology EOC as well as obtaining a final grade of 88.65 from the e-science program. In the subject matter. School systems have become aware of the discrepancies; while not being able to change state policy, they are trying to improve the summer school experience with the use of new learning parameters, one of which is e-education (Smink, 2012). In the school district for this study, successfully completing the program was sufficient to earn a graduation credit.

The students expressed their opinions of the e-education eloquently during the course of the study. The students described the impacts that their face-to-face teachers had on their academic career, the various types of activities provided by the program, as well as the idea of having autonomy in the classroom. The students also expressed their negative and positive emotions regarding the use of the program and if they would continue utilizing this type of program if offered. The next section will delve into experiences.
Students’ Experience of a Science e-education course

The qualitative data collected throughout the study will be discussed in the context of the theoretical framework of Artino (2010). Artino’s framework was modified slightly to include an additional heading, ‘Prior to e-learning experience’, which was added to capture the students’ descriptions of their prior school experiences and to contextualize the present study. Most of these at risk students entered summer school with many antagonistic views of the traditional classroom, where their experiences had led to course failure; the majority of students, while not happy to be in summer school, reported that they appreciated being in a learning environment that did not have a face-to-face teacher.

The positive and negative interactions between students and teachers have been identified as predictive of student behavior, psychosocial functioning, and academic performance. The influence of school climate on student outcomes may be direct as well as indirect, mediated through feelings of efficacy on the part of school staff to make a difference in the lives of students (Gary L Bowen, Rose, & Ware, 2006). The at risk students in this study have had antagonistic interactions with their teachers and as such, their self-efficacy has been negatively affected.

To counteract the negative interactions with teachers and to increase science self-efficacy, e-education programs have been put into place. The e-education programs have pre-recorded lectures that do not allow for any personal interactions. Some students, such as Brandon, who have said, ‘the lectures are boring,’ are not chastised by the e-program for not being totally engaged with the subject matter. That was not the case for Brandon’s experience with the moderator in his classroom. Field notes indicated that while observing
Brandon, the facilitator, who had never worked with Brandon before, began telling him that he needed to pay attention to the lecture, whether it was boring or not, and that he would just have to learn to deal with all types of instruction in the classroom. He stated that Brandon would not be able to pick and choose which types of teachers he had, he had just better get used to learning how his teachers taught.

The at risk students in the study held a low opinion of the teachers and of the face-to-face classrooms where they previously met with failure. The majority of the students were quick to point out perceived deficiencies of their former science teachers as well as not following the prescribed guidelines for test taking. Jenny, one of the participants, was quite expressive when discussing her previous education setting in a traditional classroom.

…this [e-education] helps a lot because to me, face to face to me feels crushing [she put her hands over her head to show how she felt. She brought her hands up over head and had her fingertips touch over her head.] Yet it feels like you are in a caved in [place] and you are not able to move around and when you are on the computer – e2020 - you are able to explore and you are able to be free. You don’t have a teacher hovering over you saying do this, do this [she pushed her finger into the table several time to indicate pressure.] With e2020, you can just lay it all out and do it however you feel…. [not] the teacher going down your throat because you did not pass the test… well, OK, I am able to make it up and I say can I make it up, they say ‘no, you should have studied’ and all that. I do study but I never pass my tests in science.

Elias (2009) asserts that schools need to have caring, sustainable relationships
between students and teachers, reachable goals and pathways to obtain those goals, and engaging schools. The environment that the students came from did not meet any of these guidelines. They felt pressured and unsuccessful. This is similar to the experiences of many at risk student. Students feeling disenfranchised from school is a major problem facing the at risk students today (Wald & Losen, 2003).

Learning Environment

The learning environment included task characteristics and instructional resources. The students in the study discussed the aspects of the e-program which allowed them to manipulate and direct their own learning. For many students, being able to direct their own learning and follow their own pace was enlightening. With no face-to-face teacher telling them what to do, they were still able to successfully complete the coursework.

Many of the students (20) in the study were motivated and engaged with the e-science program, these students were able to demonstrate academic growth. Martin (2006) posits that motivation and engagement of both teacher and student play a significant role in academic success of students. His findings of students and teachers working well together to promote success were in stark contrast to the opinions of the at risk students in this study, whose experiences had been primarily negative and unsuccessful.

In classrooms, similar to the ones in which the summer school students were previously enrolled, feelings of mistrust between students and teachers ensued. Teachers also exhibited their frustrations and disrespected their students, which was how Jenny described her teacher, he would “bang his head on the board when the kids do not get the topic he is teaching – but he will go up and hit a student’s desk hard if their head is on the
table just for a minute.” In this classroom, there was no engagement and ultimately, for Jenny, little or no academic growth in her science classroom. (Reyes et al., 2012) in her study described classrooms much like Jenny’s, where this is little engagement there is also very low academic achievement. Lenny compared his educational experience with face-to-face teachers and the e-education program in this way; “When I come to [summer] school, there is not a teacher who hates me.”

Conversely to the traditional classroom experiences of these at risk students, the summer school program that the students were engaged in allowed them to direct their own learning. Studies have shown that when students are in a positive learning environment, they can have academic success (Reyes et al., 2012). The students in the study equated having autonomy in the classroom with academic achievement, which is in agreement with a study of non at risk students. (Reeve, 2005). The students in this study increased their self-efficacy with the use of a program that promoted autonomy. For example, Nick said, “… you can go at your own pace…It is self-paced, it doesn’t seem to be as much pressure.” Dee explained that the program allowed her to move at her own pace and she was able to complete more work successfully in the e-education classroom than in a traditional classroom. Bob related how he was making “40’s [percent] in the classroom but am making better grades here. [79% on the module observed and recoded in field notes.]

Autonomy

Autonomy is the inner indorsement of one’s actions and involves internal locus of control, the volition to choose what to study, for how long and at what depth (Reeve, Nix, & Hamm, 2003). Having a sense of high autonomy increases engagement in the classroom,
creates a positive learning environment, and students can have higher academic achievement. At risk students benefit from having autonomy in the classroom (Reeve, 2005). Students who have high autonomy also have high self-esteem as well as higher academic growth. Students with low autonomy report lower self-esteem and lower academic growth (Jang, Reeve, Ryan, & Kim, 2009). The results from the study of Jang et al., (2009) are similar to what the at risk students experienced in either their face-to-face environments or in the science on line environment. The students from this study in their face-to-face environment had very low autonomy, low self-efficacy and little academic growth, as demonstrated by the self-efficacy survey results and the course failures that led them to be in summer school. Conversely, the students from the study had high autonomy, an increase in self-efficacy, and a significant academic growth, as demonstrated by the student interviews and final e-grades provided by the e-program.

*Personal Factors*

Using Artino’s (2010) framework, the large category ‘Personal Factors’ housed students’ motivational beliefs and achievement emotions. Students utilized the e-program to gain a better understanding of science, were confident that they could complete the tasks assigned, and despite low self-efficacy scores by the females on the SMSTL, which was administered at the start of the summer school course, interview data indicated that all of the students who were actively using the e-program expressed efficacy in their ability to learn science. The students’ engagement of the e-science program seemed to be associated with an increase in science self-efficacy. Engagement in the classroom is associated with
increased self-efficacy and academic achievement (Appleton et al., 2008; Oyserman, 2013; Schunk, 2003). Many of the students experienced success for the first time in a science course and expressed their beliefs about the e-education course in this way, “I understood the course.” Another stated, “When I feel good about myself, I hold on to my self-confidence …I was proud of myself and I knew I could do anything!” CT explained her feelings regarding science in this way, “I feel like I have more confidence to do what needs to be done now.” A typical response from the students when discussing the program was expressed by Jenny when asked if she liked utilizing the program to learn science. “This is better…here I study and I end up passing it.” The same attitudes and willingness to become engaged with an on line program that were observed in this study have been reported in studies of on line education. Various online activities and tools such as multimedia and discussion boards may be important ways to increase student engagement in an online learning environment; with an increase in engagement, achievement is also increased (Huang, Lin, & Huang, 2012; Sun & Rueda, 2012).

The majority of the students in this study agreed that the tasks that were associated with the e-education program were worthwhile and added to their understanding of science. Being willing to utilize the various tools of the program led to higher engagement (Huang et al., 2012). Lenny said, “I like the fact that there is a pretest before the lesson. You don’t have to waste your time with something you know already. You don’t have to relearn it.” Patty added to the understanding by her explanation below,

I learned more with the computer, it is very compact and it tells you what you have to know. The teacher makes you write down notes that you will never use, I just get
confused. But I think I can take what I have learned from here – taking notes on what is important and I think I could apply it to the other courses I have to take in science. The e-program gave the flexibility for the student to focus on the parts of the lesson that they found useful. The majority of the students described their participation in the e-education program positively, whereas only a few students had negative feelings associated with their summer school e-experience. Not all students are comfortable with technology and some students, at risk as well as non at risk prefer to work with other students and teachers instead of just a computer program (Concannon, Flynn, & Campbell, 2005; Song, Singleton, Hill, & Koh, 2004).

**Academic Outcomes**

The students in this study expressed contentment with the results of their academic achievement and had positive feelings toward the e-education program they were enrolled in for the summer. The students utilized the word ‘like’ to express their feelings of contentment with the program. Having passing grades in a science classroom was a new experience for many of the students in the study and expressed a willingness to continue to work to maintain their newfound success in the classroom when they return to their face-to-face science classrooms.

The students in this study were pleased with their academic achievement. Many of the students had been told either explicitly or inexplicitly that they were unable to do the work in the science classroom. In a study comparing self-efficacy of at risk students to non at risk students, Carroll, et al., (2013) determined that non at risk students had higher self-efficacy and also had higher academic growth. The results from this study were in
disagreement with the study reported by Carrol, et al. (2013). The at risk students in this study had an increase in self-efficacy and a majority reported academic growth. So when they received high grades from the e-program, they were more than happy to tell the researcher and to see the results on the dashboard. Lenny explained that he was very pleased with his progress in the program. He reported that he appreciated knowing how much he had accomplished while enrolled in the e-program.

The majority of the students expressed an achievement goal orientation, although just slightly. This type of orientation is more concerned with the students’ own competence and less concerned with being compared to other students. The e-education program is tied more closely to an achievement goal orientation due to the fact that the students are working independently and not working in groups. At risk students are more likely to work independently if they have an achievement goal orientation. One student, Jenny, recommended that all teachers use this program to promote achievement in the classroom.

[A]ll the teachers need to use it. I know some kids that will be in the classroom, they are smart, just not classroom smart, but when they get on the computer, they are learning [she snapped her fingers] like crazy. This would actually help them; this would help a lot of kids who are trying to graduate early. It would help them graduate. I find it useful; I find it very useful for kids to use it now.

Many at risk students do not want to be singled out, conversely, though, at risk students will cause disruptions to be removed from the classroom (Carroll et al., 2013). The disruptive behavior that leads to expulsion from the classroom may be the result of the at risk student being embarrassed that they feel that they do not have the same understanding of the
concepts that have been taught. Kate explained how disruptions can affect not only the person that has caused the disruption but also the entire class, “If you mess up, you are sent out and you miss the entire lesson, with this program, if you get sidetracked, you can go back and listen to it again, you don’t miss anything.” When students are removed from the classroom due to disruptive behavior, the teacher must stop teaching and have the student removed from the classroom. A simple disruption by one student can rob the entire classroom of valuable teaching time. When the child who disrupted the classroom is allowed to return, they must make up the work, either on their own or with the help of the teacher.

A high percentage of the students in the study were pleased with the various strategies that the e-program employed. Being able to decide what to do and how long to spend on each activity was a new experience for many of these students in the study. For example, Bob utilized the close captioning provided by the program instead of having to listen to the lecture, “By just looking at the notes, [transcript of lecture] you can learn enough to pass the course.” For other students, the visual and auditory aspects of the program worked hand in hand, CT explained, “I can read and listen at the same time – the lectures have graphics that I can see to help me learn.” Yet others, such as Dave, liked the ability stop and start the lectures, “I can rewind the video, I can go back over it, the lecture, like when you don’t understand it, and the teacher explains it.”

One aspect of the program that was only discussed by several students was the ability to work on the program away from school. Lenny, for example explained, “I can do it anywhere there is Wi-Fi or internet; even at home I did some of it. So that is something that I really liked. You could do it everywhere.” The program was successful for all the students
in the study who completed the course, even if they did not like all aspects of the program.

Summary

All students except for one in the study were all successful and earned credit for the science course they were enrolled in. Gender was significantly different when science self-efficacy and academic achievement were examined. Females entered the summer session with lower self-efficacy and lower academic achievement, however ended the program with a higher academic achievement when compared to the males in the study. All students who completed the course were successful and earned a graduation credit. The students were aware that their GPA would not be affected by a passing summer school science course grade. Students were assigned a pretest to determine if they were competent in particular aspects of the course. A majority of the males in the study were able to bypass 40% of the lessons whereas very few of the females were able to bypass as many lessons due to their failing pretest grades. However, all students, whether they passed or failed the pretest initially ended the course with roughly the same passing average.

Utility of the Theoretical Framework

The undergraduate service academy students that were involved in Artino’s study were not considered to be at risk but rather considered to be high ability. The students in Artino’s study utilized an e-education course of their own volition, the students were given the choice to be in a face-to-face environment or an on line environment. The students in this study were not given the choice of educational format, the only program available for summer school was an on line course. Even though the subjects in the studies were dissimilar, the socio-cognitive framework of academic achievement and emotion utilized by
Artino (2010) was useful and helped to explain how at risk students utilized an e-education course to earn back credits from failing science.

Artino (2010) reported that the students’ future use of on line courses was tied closely to their self-efficacy beliefs and overall satisfaction with their previous on line course. Similar results were seen in this study, a majority of the students in the present study also connected satisfaction and an increase of self-efficacy with a desire to take other on line courses. Artino utilized only three components of the model to predict future use of on line resources, motivational beliefs, achievement emotions and satisfaction, a category of Academic Outcomes. His study did not include the Learning Environment and only one category of Academic Outcomes. The present study utilized the entire framework as well as adding an additional component, ‘prior to e-learning experience.’

The additional component, ‘prior to e-learning experience’ was added in order to better understand the experiences of the at risk students in a face-to-face environment. Students discussed their previous face-to-face teachers as well as the climate of the classroom in this section of the framework.

The Learning Environment section of the framework was not utilized by Artino (2010) but was used extensively to understand how the at risk students interacted with the e-education program. Learning environment stimulation (a construct of the Students’ Motivation Towards Science Learning (SMTSL) (Tuan et al., 2005)), autonomy, e-classroom characteristics, no face-to-face teacher and pace were placed within the Learning Environment section. Artino’s section of the framework included task characteristics, instructional resources and socio-cultural influences.
Artino’s Personal Factors included Motivational Beliefs and Academic Emotions. The majority of Artino’s research was derived from this section of the framework. The constructs found within this section of Artino’s framework included task value belief, self-efficacy beliefs, positive and negative emotions regarding e-education. The section of the framework was also crucial for this study in the understanding of the at risk students. The constructs found within the modified framework included Science learning value (SMSTL), self-efficacy (SMSTL) improved or no change, task value beliefs, and positive and negative emotions regarding e-education.

The final section of Artino’s framework, Academic Outcomes, included use of learning strategies, achievement, satisfaction, and instructional choices. As indicated earlier, only satisfaction was employed by Artino in this section of his framework. The categories active learning strategies (SMTSL), satisfaction (bifurcated into ‘would use e-education again’ and ‘would not use e-education again’), achievement goal (SMTSL) and performance goal (SMTSL) were found within the modified framework. This section of the modified framework while important provided less information than the other parts of the framework.

The modified framework based on Artino’s framework was able to help explain how at risk students utilized an e-education program. The modified framework also gave insight into how at risk students may be better served in future classes that offer e-education.
CHAPTER SIX
CONCLUSION AND IMPLICATIONS

Introduction

The present study was focused on at risk students in one SE US school district where e-education was used during the summer school session. The students were allowed to re-take the science class they had failed in order to earn a graduation credit. The study consisted of 32 students who differed in gender, race/ethnicity, grade level in school, and the science course that they were retaking. All students except for one, who dropped out after one week, were successful in their attempt to regain their credit.

Key Findings

First, there were considerable differences found between the self-efficacy and academic growth in males and female students. Females entered the program with significantly lower science self-efficacy than their male counterparts. Interestingly, the females had higher academic growth than the males. The program is designed so that the students work individually, work at their own pace, and students are not in direct competition with other students. Despite the lack of pre/post quantitative data on self-efficacy, interview data indicated that the majority of the students’ self-efficacy had improved due to the use of their respective science e-education programs. Many students were successful for the first time in a high school science class and expressed that they would carry this success with them in the future science classes.

Second, the majority of these at risk students had an achievement goal orientation, which indicates that they were more concerned with their own competence and less...
concerned with being compared to others. The students maintained this goal orientation throughout the program.

Third, the statement “I am willing to participate in a science course if the teacher does not put a lot of pressure on me” earned the highest average of any statement on the SMTSL survey in the ‘Learning Environment Stimulation’ Subscale. African American students had a significantly higher average score on this subcategory than their Caucasian counterparts. When discussing the past experiences of their face-to-face teachers, many of the students indicated that their teachers had exacerbated stress in the classroom, rather than taking steps to alleviate it. The at risk students generally did not like teachers and most preferred to work with a computer, which they perceived to have no conflict association.

Fourth, every student who participated fully in the course was successful and earned a graduation credit. In spite of the grade point average of the students not being affected by the passing grade they earned, they completed the course successfully and earned a credit toward high school graduation.

Fifth, the students who came into the program with less knowledge of the subject had a significantly higher academic gain than the students entering the program with more knowledge of the subject matter. Specifically, 11 of the students, all of whom were male, scored a passing grade on their pretest for the summer science course. These students had no academic gains by the end of the course and spent the least amount of time on task and idle. The rest of the students who failed the pretest had significantly higher time on task and idle time than the other students, and scored the same on the final exam as the students who initially passed the pretest.
Finally, although there were limited complaints about the e-program, such as lectures that were too long or boring, students’ liking the program was not a prerequisite for successfully using the program. The at risk students overwhelmingly liked the e-program and most of the aspects of it, especially the ability to direct their own learning.

**Implications and Recommendations**

While at a recent workshop in study district, a former principal and now cabinet level officer discussed her own children’s education to the 100 attendees of the workshop, and her perception of the lack of equal opportunities for all students in the district, echoing the sentiments of the at risk students in this study. Although teachers in the workshop seemed to be uncomfortable with her assertion, it highlights how her view of the workings of the school district when she became a parent in addition to being an administrator.

**Implications**

There are a number of implications resulting from this study. Students who are not proficient in the course content knowledge will benefit the most academically from the e-education program. In contrast, students who already know the content will not receive measurable academic benefits from completing the e-education program. Second, an e-education program helps to mitigate at risk students’ negative perceptions of school, by eliminating interactions with face-to-face teachers, which have predominantly been negative. Third, the e-education program is a vehicle to help failing students earns graduation credit hours. Fourth, at risk students who participate in e-education courses will respond positively to the course, due to such aspects as their ability to determine their own pace and make choices, which relates to a sense of autonomy.
Policy Implications and Recommendations

The findings of this study suggest a number of implications and recommendations for those who work with at risk students, including superintendents, schools board members, principals, and teachers.

Supintendents/School Board Members

Attendance policies and course credit policies that have been proposed by superintendents and adopted by school boards need to be revisited. Many attendance policies mandate that students who have missed a certain number of unexcused days from school will automatically fail. This is regardless of whether students can prove mastery. By definition, at risk students have attendance issues, but not necessarily academic issues. The findings of this study imply that it is not academically beneficial for students who have mastered the material to re-take the course during summer school. Therefore, it is recommended that this policy be rewritten with the emphasis on course mastery and less emphasis on attendance.

Districts ought to consider the value of e-education and the purchase of quality e-education access for at risk students. Although e-education can be expensive, the relative cost of failing students can be far more costly than a timely intervention.

A policy that does not allow for an increase of the grade point average when a failing course is repeated and passed ought to be reconsidered. This study implies that students who had proven mastery by passing the pretests were not motivated to improve their overall grade and learn more, because doing so would not improve their grade point average (GPA). This leads to two recommendations. One recommendation is to replace the failing grade with the passing grade from the remediated course, which could then lead to an increase in the
students’ GPA, and increase the likely success of that at risk student. An alternative recommendation is to average the student’s failing grade with the passing grade, which may lead to an increase in the student’s GPA. It is anticipated that students would put forth more effort in the course if they would be rewarded with a change in their grade, and therefore their GPA, rather than simply receiving course credit toward graduation.

In summary, it is recommended that school boards revisit current policies regarding course failure and allow at risk students to be given credit for course material that they have mastered, thus incentivizing the future work of at risk students.

Principals

Principals are tasked with providing educational guidance for their schools as well as having the right to give course credit for the various classes in which their students are enrolled. By virtue of the directives of the school board, the principal has the ability to grant a student credit for a course, even if all requirements are not met. The principal must decide if the student has done enough to actually earn a course credit. If a student can prove mastery of the course material, it is recommended that the student be given course credit. Principals who promote policies that fail students for lack of attendance, regardless of academic mastery of course material, ought to consider allowing failing students to begin a new course or to be able to do such alternative options as an in-depth study of a relevant topic. In this way, the students will be required to make up the school days they have missed, but will not waste academic time in remediation for a course that they have mastered.

Teachers

Classroom teachers ought to be professional development in the use of e-education,
its value to some students, and how to best implement it for the benefit of students. Teachers who understand this value may be less likely to fear the use of e-education in place of teachers, and see it as a benefit for some students, especially those who are most at risk for failing and dropping out of students. Additionally, teachers could become aware of the benefits of allowing more autonomy for students, and the oppression many students feel in stressful classroom situations.

Teachers who receive this training then ought to be given the authority to make recommendations for the use of e-education to meet the needs of at risk students. Caring and informed teachers at risk students sometimes understand their students and how best to serve them, especially following teacher professional development. If a student is falling behind, it is imperative that something be done sooner rather than later. Teachers who work with at risk students ought to receive sufficient training and support, and be sufficiently interested in the success of these students. Assigning new teachers or poor teachers to the most vulnerable students is not a way to ensure the success of at risk students. These students who are vulnerable to failure may need more help or need individual attention that is not easily given in a large classroom. If the teacher is given the opportunity and authority to place an at risk student in an e-education course, the student may very well ‘catch up’ with their peers and be able to be integrated back into the classroom with success.

Limitations

The present study was limited in several ways. The study involved at risk students in one school district in a particular part of the US. Also, too few Hispanics were involved in the study to conduct quantitative analyses on their results. It also was not possible to
determine which students were included in the Exceptional Children’s program in the school
district in which the study took place, which could have helped the researcher to gain a more
complete understanding of the students in the study. Additionally, the study took place for a
short duration, during a summer remediation session, rather than during the school year.
These limitations may limit the ability to extrapolate the findings to other settings and with
other populations, and we advise the reader to use caution in so doing.

Future Studies

The current study included only four Hispanic students. The number of Hispanics
who are not completing high school is on the rise, it is recommended that future studies
include this group of students, many of whom are at risk.

The female students in this study benefitted substantially from an e-education science
course. The specific reasons for this success are unclear. Therefore, it is recommended that
more attention is given to understanding underlying factors that may differentially impact
male and female at risk students.

The present study only dealt with at risk students. Future studies that involve
populations of both at risk and non-at risk students could assist in delineating differences in
their receptivity to e-education. Finally, a study could be conducted to determine the relative
impact of an e-education program versus those classroom practices that allow more student
autonomy, and more specifically what successful strategies could be shared across both
settings to assist at risk students to succeed Through more research, the needs of at risk
students could be better understood and then addressed, leading to more success for the
students, our public schools, and the nation.
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From: Debra Paxton, IRB Administrator
North Carolina State University
Institutional Review Board

Date: May 12, 2014

Project Title: How does the use of on-line science programs benefit at-risk youth?

IRB#: 3989

Dear Pamela Phillips,

The project listed above has been reviewed by the NC State Institutional Review Board for the Use of Human Subjects in Research, and is approved for one year. **This protocol will expire on 5/9/2015 and will need continuing review before that date.**

NOTE:

1. You must use the attached consent forms which have the approval and expiration dates of your study.

2. This board complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU the Assurance Number is: FWA00003429.

3. Any changes to the protocol and supporting documents must be submitted and approved by the IRB prior to implementation.

4. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days by completing and submitting the unanticipated problem form on the IRB website.

5. Your approval for this study lasts for one year from the review date. If your study extends beyond that time, including data analysis, you must obtain continuing review from the IRB.

Sincerely,

Debra Paxton
NC State IRB
Appendix B

North Carolina State University
Institutional Review Board for the Use of Human Subjects in Research
SUBMISSION FOR NEW STUDIES

GENERAL INFORMATION

1. Date Submitted:  
2. Title of Project: How does the use of online science programs benefit at-risk youth?  
3. Principal Investigator: Pamela Phillips  
4. Principal Investigator Email: apphillis@ncsu.edu  
5. Department: Mathematics, Science & Technology Education  
6. Campus Box Number:  
7. Phone Number: 919-567-2419  
8. Faculty Sponsor Name: Meg Blanchard  
9. Faculty Sponsor Email Address: Meg_Blanchard@ncsu.edu  
10. Source of Funding (Sponsor, Federal, External, etc):  
   If externally funded, include sponsor name and university account number.  

RANK:  
Faculty: [ ] Student: [ ] Undergraduate [ ] Masters [ ] PhD; Other: Graduate Student – Ph.D.

As the principal investigator, my signature testifies that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted exactly as outlined in the Proposal Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.

*Electronic submissions to the IRB are considered signed via an electronic signature*

Principal Investigator:

Pamela Prevotto Phillips  
(type/printed name)  
April 17, 2014  
(signed)  
(date)

As the faculty sponsor, my signature (or electronic submission) testifies that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the principal investigator of record.

Faculty Sponsor:

Margaret R. Blanchard  
(type/printed name)  
April 17, 2014  
(signed)  
(date)

PLEASE COMPLETE AND E-MAIL TO: irb-coordinator@ncsu.edu

Please include consent forms and other study documents with your application and submit as one document. *Electronic submissions to the IRB are considered signed via an electronic signature. For student submissions, this means that the faculty sponsor has reviewed the proposal prior to it being submitted and is copied on the submission.*

******************************************************************************************************************************************

For SPARCS offer we only:
Reviewer Decision (Expedited or Exempt Review)

☐ Exempt
☑ Approved
☐ Approved pending modifications
☐ Table

Expedited Review Category:  
☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 8a  ☐ 8b  ☐ 8c  ☐ 9

Approved uninal w/ note by T. Richard on 5/5/14

Reviewer Name  
Signature  
Date

NOTE: Date 5/9/14

165
166

Revised January 14, 2013

North Carolina State University
Institutional Review Board for the Use of Human Subjects in Research
GUIDELINES FOR A PROPOSAL NARRATIVE

In your narrative, address each of the topics outlined below. Every application for IRB review must contain a proposal narrative, and failure to follow these directions will result in delays in reviewing/processing the protocol.

A. INTRODUCTION

1. Briefly describe in lay language the purpose of the proposed research and why it is important.

   The purpose of the research is to address the Science academic needs of students who are currently identified as At-Risk students in Johnston County. Many of the students who are labeled At-Risk have not had a successful high school career and it is imperative that this trend be reversed. At present, there are several on-line courses available to these youth. It is hoped by studying students who are involved in these courses, I can gain a better understanding of how best to teach these students and other similar students to enhance retention and increase graduation rates.

2. If student research, indicate whether for a course, thesis, dissertation, or independent research.

   The research will be in partial fulfillment of my doctoral studies at NCSU. This research will encompass my dissertation research for my doctoral degree.

B. SUBJECT POPULATION

1. How many subjects will be involved in the research?

   Approximately 100 science students who are enrolled in the Johnston County 2014 Summer Academy. These students will be enrolled in on-line online educational course hosted by e2020 (http://www.e2020inc.com/doccenter/files/Foundations.pdf). Johnston County utilizes this program for the Summer Academy in order for students to receive credit for a class that has been previously failed. The program was purchased by the school district in order to meet the needs of students who were or are at-risk of dropping out of school.

2. Describe how subjects will be recruited. Please provide the IRB with any recruitment materials that will be used.

   Students who are enrolled in the 2014 past will receive an invitation to be interviewed so as to better understand how the program is helping them to remain in school or to be able to graduate from high school. The students will be enrolled in the Johnston County 2014 Summer Academy that utilizes e2020 for credit recovery.

3. List specific eligibility requirements for subjects (or describe screening procedures), including those criteria that would exclude otherwise acceptable subjects.

   Any science student that is enrolled in the Johnston County 2014 Summer Academy will be eligible to participate in the research.

4. Explain any sampling procedure that might exclude specific populations.

   No populations will be excluded from the study.

5. Disclose any relationship between researcher and subjects - such as, teacher/student; employer/employee.

   I am an employee of Johnston County. I currently teach Science at an alternative school in Johnston County. I will not be the teacher of record for the science students in the Johnston County 2014 Summer Academy.

6. Check any vulnerable populations included in study:

   ☑ minors (under age 18) - if so, have you included a line on the consent form for the parent/guardian signature
   (Yes, the signature line is on the second page - I will make the font smaller so that only one page is utilized.)
   ☐ fetuses
   ☐ pregnant women
   ☐ persons with mental, psychiatric or emotional disabilities
   ☐ persons with physical disabilities
C. PROCEDURES TO BE FOLLOWED

1. In lay language, describe completely all procedures to be followed during the course of the experimentation. Provide sufficient detail so that the Committee is able to assess potential risks to human subjects. In order for the IRB to completely understand the experience of the subjects in your project, please provide a detailed outline of everything subjects will experience as a result of participating in your project. Please be specific and include information on all aspects of the research, through subject recruitment and ending when the subject's role in the project is complete. All descriptions should include the informed consent process, interactions between the subjects and the researcher, and any tasks, tests, etc. that involve subjects. If the project involves more than one group of subjects (e.g., teachers and students, employees and supervisors), please make sure to provide descriptions for each subject group.

All students who choose to participate in the research will be given a survey utilizing the Qualtrics® program provided by NCSU. Students who choose to participate in the research will also be invited to be interviewed twice during the Johnston County 2014 Summer Academy. The purpose of the Interviews is to learn more about students' perceptions of e2020® and the impact of the program on their learning and school experience.

The students who choose to participate in the study will use e2020® as prescribed by the Johnston County 2014 Summer Academy. Their grades will not be affected if they choose to participate or if they choose not to participate in this study.

The students who will be interviewed will meet with the researcher twice during the Johnston County 2014 Summer Academy. The interviews are scheduled to last ten - fifteen minutes. The first interview will consist of information gathering and the students' perceptions of e2020. The interview sessions will be audio taped in order to review students' responses in order to clarify any issues on the subsequent meetings. The first set of questions to be asked is attached as are the follow up questions. The final interview will start with the same questions to see how things are going with the summer school science term and also to follow up on any issues that have been brought up by the previous interview as well as the surveys that were taken prior to the first interview.

The surveys that the students were given prior to the first set of interviews will indicate the student's perceptions of achievement. The surveys will be delivered to the e-mail address provided by Johnston County. The students will record their responses via the Qualtrics® program provided by NCSU. The scores from the surveys will be recorded and stored on the password protected external hard drive which will be stored in a locked office. The scores from the survey will be connected to the participant's pseudonym for the duration of the study. The surveys should give some insight to the how well motivated the students are in school as well as to the motivation to complete the course work on e2020®.

The students who are currently enrolled in the Johnston 2014 Summer Academy utilizing the e2020® science program and who chose to participate in the study will be interviewed at the completion of the Summer Academy. At this time, the students will be able to discuss what they felt was the best part of the on-line experience as well as the worst aspects of the experience. Students who participated in the interviews will be asked to volunteer their final grade in their science course. The de-briefing will allow the facilitators of e2020® to better help the At-Risk youth in Johnston County.

2. How much time will be required of each subject?
APPENDIX C

Students’ Motivation Towards Science Learning

Question: Read each question and circle the appropriate statement to answer each question:

1. If you strongly disagree with the statement
2. If you disagree with the statement
3. If you neither agree or disagree with the statement
4. If you agree with the statement
5. If you strongly agree with the statement

<table>
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<tr>
<th>Question</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
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</table>

Self-Efficacy (1 – 7)

1. Whether the science content is difficult or easy, I am sure that I can understand it.
   - 1
   - 2
   - 3
   - 4
   - 5

2. I am not confident about understanding difficult science concepts.*
   - 1
   - 2
   - 3
   - 4
   - 5

3. I am sure that I can do well on science tests.
   - 1
   - 2
   - 3
   - 4
   - 5

4. No matter how much effort I put in, I cannot learn science.*
   - 1
   - 2
   - 3
   - 4
   - 5

5. When science activities are too difficult, I give up or do just the easy parts.*
   - 1
   - 2
   - 3
   - 4
   - 5
During science activities, I prefer to ask other people for the answer rather than think for myself. *

When I find science content too difficult, I do not try to learn it. *

Active Learning Strategies (8 – 15)

When learning new science concepts, I attempt to understand them.

When learning new science concepts, I connect them to my previous experiences.

When I do not understand a science concept, I find relevant resources that can help me.

When I do not understand a science concept, I would discuss with the teacher or other students to clarify my understanding.

During the learning processes, I attempt to make connections between the concepts that I learn.

When I make a mistake, I try to find out why.

When I am introduced to science concepts that I do not understand, I will try to learn them.
When new science concepts that I have learned conflict with my previous understanding, I try to understand why.

**Science Learning Value (16 – 20)**

16 I think that learning science is important because I can use it in my daily life.

17 I think that learning science is important because it stimulates my thinking.

18 In science, I think that it is important to learn to solve problems.

19 In science, I think it is important to participate in inquiry activities.

20 It is important to have the opportunity to satisfy my own curiosity when learning science.

**Performance Goal (21 – 24)**

21 I participate in science courses to get a good grade. *

22 I participate in science courses to perform better than other students. *

23 I participate in science courses so that other students think that I am smart. *
24. I participate in science courses so that the teacher pays attention to me. *

**Achievement Goal (25 – 29)**

25. During a science course, I feel most fulfilled when I earn a good score in a test.

26. I feel most fulfilled when I feel confident about the content in a science course.

27. During a science course, I feel most fulfilled when I am able to solve a difficult problem.

28. During a science course, I feel most fulfilled when the teacher accepts my ideas.

29. During a science course, I feel most fulfilled when other students accept my ideas.

**Learning Environment Stimulation (30 – 35)**

30. I am willing to participate in this science course because the content is exciting and always changing.

31. I am willing to participate in this science course because the teacher uses a variety of teaching methods.
32 I am willing to participate in this science course because the teacher does not put a lot of pressure on me.

33 I am willing to participate in this science course because the teacher pays attention to me.

34 I am willing to participate in this science course because it is challenging.

35 I am willing to participate in this science course because the students are involved in diss.

* Scores with an asterisk are reverse scored.
APPENDIX D

Initial Interview Questions

1. Have you used an e-education program before? (If yes, when? Which one?)

2. If so, did you enjoy learning in that manner?

3. Can you tell me why you failed either the final exam or the science course that you are repeating at this time?

Second Interview Questions

1. Would you rather use e2020® for your classes or would you rather be taught by a teacher in a traditional classroom? Please explain your answer.

2. Do you feel as if you have more control over your education with e2020® or in a regular science classroom?

3. What are your opinions about the lab simulations found in e2020®? Were there any that you would like to talk about?

5. Has the e2020® program helped you to be successful or not helped you? Are you thinking of any modules in particular??

6. If you had a friend that was struggling with science, what would you say to your friend about e2020®?

7. What do you think about using e2020® science program? (Is this the same or different than you used to feel about science?)

8. What else would you like to tell me about e2020 or science or anything?
APPENDIX E

Timeline

SMTSL survey: June 2014  
Pretest: June 2014

e2020® science course  
(Summer Academy)

Posttest: August 2014

QUAN
SMTSL* prior to course  
e2020® pretest

INTRODUCTION
E2020 science course

QUAN
Time-on-Task  
e2020 posttest  
e2020 e-exam

QUAL
1st interview with  
selected students

QUAL
2nd and 3rd interviews  
with selected students

Analysis
SMTSL  
e2020®

Analysis
Thematic analysis

Integrate  
QUAN data with  
QUAL data

Analysis
Students paired  
t-tests, Welch's  
unpaired t-tests

Use of NVivo  
software to link  
QUAL data with  
QUAN results for  
student interviews

* SMTSL: Students’ Motivation Towards Science Learning