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Motivation and Interest in Participation in STEM Beyond the Classroom Experiences: Effects of Blended Learning Systems on High School Students

Michael Owdij

MOTIVATION AND INTEREST IN PARTICIPATION IN STEM BEYOND THE CLASSROOM EXPERIENCES: EFFECTS OF BLENDED LEARNING SYSTEMS ON HIGH SCHOOL STUDENTS

by

Michael Owdij

Bachelor of Science
Rutgers University, 2008

Masters of Education
Rutgers University, 2010

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Accepted by:

Ismahan Arslan-Ari, Major Professor

Michael Grant, Committee Member

Lucas Lima De Vasconcelos, Committee Member

Anna C. Clifford, Committee Member

Cheryl L. Addy, Interim Vice Provost and Dean of the Graduate School

DEDICATION

This study is dedicated to my loving and supportive family. They show me limitless support in my educational journey. The support they showed through this process can never be repaid in full. To Jen, Jackson, Gianna, Mom, Dad, Mae, and Dean; I love you all.

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ABSTRACT

Beyond the classroom experiences are useful learning endeavors designed to help students connect classroom learning to the real world (Kilgo et al., 2015). The purpose of this action research was to evaluate the effect of a technology-based blended learning system on student motivation and interest in participation in beyond the classroom experiences. The blended learning system was offered to STEM-focused junior and senior students who attended a New Jersey high school. The focus of the study was centered around the following questions: How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? and What is the effect of a blended learning system on students' motivation to engage in beyond the classroom experiences?

To answer the research questions, data were collected from high school students through six blended learning sessions. During the mixed methods data collection, qualitative data were collected in the form of semi-structured interviews and reflection journals and were subject to inductive analysis. Quantitative data were collected from student surveys that included Likert scales and were subject to descriptive statistics.

The data collected indicated the blended learning system caused a positive change in interest in participation in beyond the classroom experiences, as participants' scores on the student survey increased and student responses to the survey were positive. The results also indicated a mixed or neutral change in motivation for beyond the classroom experiences. The qualitative data supported a positive change in student motivation for beyond the classroom experiences whereas the quantitative data showed positive, neutral, and negative changes in student motivation for beyond the classroom experiences. This

shows that the blended learning system could be effective if the time restrictions seen by STEM focused students are considered.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

National Context

Currently, 5%–20% of the U.S. workforce consists of people who work in science, technology, engineering, and math (STEM)-focused careers (Xue & Larson, 2015). To give a general number, the National Science Board reported almost 6 million Americans were employed in a science and engineering career in 2010 (National Science Board, 2015). When applied to the current U.S. population of 327 million (U.S. Census Bureau, 2019) and the population of the U.S. workforce of 155 million (O'Neill, 2022), it can be estimated that there are between 7.75 million and 31 million STEM employees in the United States. The reason the percentage and numbers are so wide and varied is because there is a wide definition regarding the type of STEM jobs that are considered STEM careers.

In select STEM fields, there is a shortage of qualified workers (Bayer Corporation, 2014; National Science Board, 2015; Xue & Larson, 2015). Though the shortfall does not apply to every STEM-related career, many STEM professions are affected. Fields that are in particular demand are software development, mobile engineering development, data science, petroleum engineering, and more (Xue & Larson, 2015). On top of the current shortage, the demand for STEM-focused jobs is expected to increase in the future (Legend College Preparatory, 2020). This predicted shortfall may

lead to there being not enough members in the workforce who can fill the increasing number of STEM positions (Wang & Degol, 2013).

With a sizeable percentage of the current workforce working in STEM careers and with concern about filling the expected STEM workforce, Americans should invest time and resources in STEM education. It must be a focus for the nation to be able to address this issue. The United States must make a concerted effort to make changes or it will continue to lag behind other countries when it comes to supplying the workforce with STEM workers (Legend College Preparatory, 2020). Changes are needed to the national curricula to increase the number of people entering the STEM workforce.

The changes that must be made at the national level should be grounded in research. One of the most effective and researched ways to start to recruit a STEM workforce is by increasing student participation in STEM experiential learning. Austin and Rust (2015) defined experiential learning as a

> learning process that takes place beyond the traditional classroom and that enhances the personal and intellectual growth of the student. Such education can occur in a wide variety of settings, but it usually takes on a "learn-by-doing" aspect that engages the student directly in the subject, work or service involved. (p. 144)

Experiential learning is an effective strategy to combat the STEM worker shortage because it increases motivation among students to pursue STEM careers (Weinberg et al., 2011).

Engaging students in STEM-focused experiential learning often involves getting students to engage in experiences that go beyond the classroom, such as research,

internships, or service learning (Steffes, 2010). These types of beyond the classroom experiences can create positive outcomes among STEM-focused students with many styles of learning and motivation (Kilgo et al., 2015). Engaging students in the experiences that are available to them will create students who have a background in STEM careers and will encourage them to pursue STEM fields in the future.

By applying the ideas and teachings of experiential learning to a national context, students across the nation could greatly benefit. The United States may be able to address some of the STEM shortfalls that are affecting specific fields (Bayer Corporation, 2014; National Science Board, 2015; Xue & Larson, 2015) and have a set of well-trained and experienced workers for the fields that are expected to expand in the near future (Legend College Preparatory, 2020). By incorporating beyond the classroom experiential learning into the national curricula, educational leaders would be able to address the current national problems while paving the way for a strong future.

Local Context

Branchburg High School, a pseudonym for the actual high school, is a middle class to upper middle class high school located in western New Jersey. It contains roughly 1,600 students and has been repeatedly ranked in the top 50 high schools in the state (State of New Jersey, n.d.-b). The student population consists of 85.6% White students, 5.0% Hispanic students, 2.4% Black or African American students, 6.1% Asian students, and .9% students of other races. The students at Branchburg scored an average SAT score of 1212 combined math and reading and writing and an average of 26 on the Math, Reading, and Writing ACT with a 25 average on the Science ACT. Additionally, there is 57.5% participation in at least one AP level class. Branchburg also has a 97.3%

high school graduation rate among the general population and an 89.9% postsecondary enrollment rate (State of New Jersey, n.d.-a).

All of the above statistics place Branchburg High School above the state average in major educational categories. When comparing Branchburg to similar schools, educational leaders in New Jersey use the district factor group (DFG). This creates groups of high schools that compare similarly based on their sending districts in the following categories: percent of adults with no high school diploma, percent of adults with some college education, occupational status, unemployment rate, percent of individuals in poverty, and median family income (State of New Jersey Department of Education, 2019). When comparing Branchburg to its DFG, Branchburg generally rates as good or better than the other 103 schools in its DFG (State of New Jersey, n.d.-a).

Branchburg High School's mission statement is as follows:

> The Branchburg Regional High School District, a district committed to innovation, personal excellence, high achievement, and community partnership, provides all students with personalized opportunities through a broad spectrum of exemplary educational experiences to develop their fullest potential, to foster lifelong learning, and to become responsible citizens in a continually changing society. (Branchburg Regional High School District, 2012, para. 1)

The mission statement of Branchburg High School highlights the idea that district leaders are dedicated to finding ways to increase the performance and learning of their students. The goals of the district align with creating situations in which students are learning to their highest potential.

In recognition for its high-achieving status, Branchburg was named a National Blue-Ribbon School during the 2001–2002 school year by the U.S. Department of Education. This award was presented to Branchburg because of the positive educational statistics, its educational mission, and its strong focus on special education. Based on the statistics, the educational philosophy of the high school, and awards presented to the high school, it is safe to place Branchburg as a high-achieving high school. The district, the students, and the staff are all focused on the success of the students.

However, despite the high academic achievements of Branchburg students, the school does fall short in one area specific to this study. There are very few programs that are currently running in the high school to help promote beyond the classroom experiences. The number of programs that offer beyond the classroom experiences is extremely low. This problem is exacerbated due to lower school enrollment and budget cuts.

Currently, one of the only major access points to STEM beyond the classroom experiences available to Branchburg students is through school clubs. Branchburg High School only offers three clubs that can be considered part of STEM education: the Science National Honors Society, the Math National Honors Society, and the Science League (Branchburg Regional High School District, 2016). Despite being highly attended clubs, these clubs offer very limited beyond the classroom experiences. The Math and Science National Honors Societies are service clubs, and the Science League focuses on competing in science tests.

In particular, the number of STEM beyond the classroom experiences has decreased in the past 4 years. This is partly due to the fact that the school no longer funds

field trips for students. This new policy requires all field trips to be funded by the students through payments or fundraising, which has nearly eliminated all of the beyond the classroom experiences for STEM-focused students at Branchburg.

Currently, the number of students participating in beyond the classroom experiences that are rooted in experiential learning is unknown. However, many students have expressed interest in increasing the number of students participating in beyond the classroom learning. This learning method would expand the learning opportunities available at Branchburg High School.

Statement of Problem

New Jersey is a unique state due to its skilled workforce and proximity to biotech and pharmaceutical companies within the state (Saliba, 2018). Despite the opportunity for beneficial beyond the classroom experiences in those locations (Kilgo et al., 2015), students at Branchburg High School are not engaging with the STEM beyond the classroom experiences that are available to the students. To motivate students to engage in the beyond the classroom experiences that are available to them, new methods must be explored. A research gap exists when trying to understand how to motivate students to participate in beyond the classroom experiences that can change their perceptions on STEM careers (Dorsen et al., 2006).

Purpose Statement

The purpose of this action research was to evaluate the effect of a blended learning system designed to promote participation and motivation in beyond the classroom experiences for STEM-focused students at Branchburg High School in Annandale, NJ.

Research Questions

The following research questions were the focus of this mixed methods research:

1. How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?
2. What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?

Researcher Subjectivities and Positionality

Understanding oneself is an important part in a researcher understanding their research because it will affect all types of investigations (Peshkin, 1988). Therefore, it was important for me to know myself before I started conducting this research. Once I looked inward, I used this understanding to help inform my research and to understand how my points of view influenced my research.

I am a White 36-year-old male. I spent my formative years in a rural upper middle-class community that had strong ties to education and the pursuit of knowledge. During my youth, my family members all worked in computer science-related fields and placed a premium on the value of a STEM-based education. This upbringing caused me to take a great interest in the STEM fields and allowed me to understand how technology can enhance a STEM curriculum.

Though I do value the advantages of a technology-based curriculum in STEM education, I do have biases. During my years of teaching, I have noticed many of the systems I use are those with which I am comfortable. When it comes to educational technology, I have an aversion to learning and familiarizing myself with new and updated

methods. I often hate to introduce something new into my curriculum if it is replacing something I know works. This bias often leaves me evaluating other teachers' experiences with new technology before I introduce that technology to my students. During my research, my bias may have been impactful to the participants. This could lead my blended learning system omitting the newest technology or software. Additionally, my participants may not have been working with a blended learning system with the latest applications or updates. This had the potential to affect the amount of impact the blended learning system had on the participants.

The worldview that most closely relates to my own is the interpretivist worldview. The interpretivist worldview, also known as the constructivist viewpoint, is based on seeking information in the world in which we live (Creswell & Creswell, 2018). The interpretivist worldview is grounded in the real world by understanding that people draw meaning from the experiences and objects around them. This means the reality each individual experiences is socially constructed from the world around them. This worldview fits my own because it is often how I find myself looking at situations from my students' perspectives. When trying to understand how to best educate my students, I try to look at situations through their lenses and understand what may help and what may hinder their education.

My interpretivist worldview had a major impact on this study in two ways. The first was in my interpretation of the data. Because I often try to see others' viewpoints, I worked to stay objective when evaluating the data. This was important because I did not want to influence my data by misinterpreting the viewpoints of the participants or introducing my own biases into the research. The second was in the types of data

collection methods I selected for this study. In order to meet the expectations of my worldview, I made an effort to not overlook data collection methods that would not allow me to see through the lens of a participant. It was important to use a mixed methods approach that emphasized triangulation to help me overcome this bias.

My positionality can be viewed as insider research because I evaluated the outcomes of my research in my own setting, similar to an internal evaluation or study (Herr & Anderson, 2006). The major reason for this is that I studied a program I started. As an evaluator and administrator of the program, I worked with students. As students started training for, engaging in, and reflecting on beyond the classroom experiences, I worked right along with them. As I trained them, I conducted my research at the same time. This is what truly made me an insider.

As a researcher performing insider action research, I constantly reminded myself to be aware of bias. One major area of bias in my study was my vested interest in the program. As someone who started the program, I wanted it to be successful. I wanted to see students learn, reflect, and grow during the course of this study. However, there was potential for bias due to my desire to help students at my school. I needed to make sure I was looking through an objective lens. To do this, I made sure I used multiple sources of data that allowed me to be objective when I worked the results.

Definition of Terms

The following terms are defined to help the reader understand the context of each term throughout this study.

Beyond the classroom experiences: Experiential learning opportunities that are defined as "learning through action, learning by doing, learning through experience, and learning through discovery and exploration" (Boggs, 2019).

Blended learning: There is no true single definition for blended learning (Motteram & Sharma, 2009). This is a potential advantage because it allows leaders of institutions to have flexibility when creating content (Motteram & Sharma, 2009). For the purposes of this study, blended learning was defined as an integrated learning experience in which students split time between a brick-and-mortar school and an online self-guided program (Maxwell, 2016).

Experiential learning: "A process whereby the learner interacts with the world and integrates new learning into old constructs" (Eyler, 2009, p. 24). Though this definition can differ based on the source, experience and reflection are two critical aspects of any kind of experiential learning (Austin & Rust, 2015).

Motivation: Ryan and Deci (2000) defined motivation as "to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, where as someone who is energized or activated toward an end is considered motivated" (p. 54).

Participation: One of the most widely used definitions of participation was provided by Bergmark and Westman (2018), who stated participation "involves, for example, students and faculty working together in partnerships; students having an active role in co-creating curriculum with the teachers; and students acting as agents of educational change" (p. 1353).

STEM: The definition of STEM was first coined by Judith Ramaley to combine the educational fields of science, technology, engineering, and math due to their overlapping nature (Koonce et al., 2011).

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this action research was to evaluate the effect of a blended learning system designed to promote interest in participation and motivation in beyond the classroom experiences for STEM-focused students at Branchburg High School in Annandale, NJ. The following review of literature focuses on the research questions of (a) How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? and (b) What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?

Literature Review Method

I identified four major topics based on the research questions that I explored in the relevant literature: (a) increasing participation in STEM, (b) increasing motivation to engage with STEM, (c) blended learning, and (d) using experiential learning within blended learning systems. I cultivated relevant literature from a variety of resources. I searched electronic databases, such as ERIC, Education Source, and JTSOR, for published articles with combinations of the following keywords: experiential learning, experiential learning theory, motivation, blended learning, beyond the classroom learning, beyond the classroom, achievement, STEM participation, STEM motivation, and STEM. While searching, articles that were published after 2014 were given more

attention. However, seminal works from respected authors were also explored. I also searched for literature by accessing Google Scholar through the University of South Carolina virtual private network (VPN). I used similar search terms to the electronic database search keywords within the Google Scholar searches. I selected additional literature items by reviewing the bibliographies of some articles. Articles from peer-reviewed journals and action research papers were prioritized due to their similarity to this study.

Organization

The review of literature is divided into four main sections. The first section explores the importance of student participation in STEM activities. The second section focuses on student motivation to engage in STEM. The third section covers blended learning and what kind of impact it may have on students. The final section relates to the role of experiential learning within blended learning systems. All of these main sections were used to provide a fact-based road map that details the central focus of my intervention.

Student Participation in STEM

Student participation in STEM activities is a key component to their education. While participating within STEM activities, students can learn and use information provided by their teachers. This section details (a) the definition of participation, (b) STEM participation continuation, (c) the conflicting ideas behind the benefits of participation, and (d) participation within blended learning.

Definitions

Participation is a difficult topic to define. Despite decades of work and many instruments, there is no commonly accepted, metrically sound tool with which to measure participation (Whiteneck & Dijkers, 2009). This is because a person can participate in an activity in a variety of ways. A parent who attends an event for their child can become an active participant or can participate as a passive observer from a distance (Sit & Birch, 2014). Due to the different scopes of participation involved in education, a generalized definition is often used.

One of the most widely used definitions of participation was provided by Bergmark and Westman (2018) and was developed through the integration of various researchers. They stated participation "involves, for example, students and faculty working together in partnerships; students having an active role in co-creating curriculum with the teachers; and students acting as agents of educational change" (p. 1353). This definition is generalized and allows for researchers to apply it to their particular study. Therefore it was selected for this study.

STEM Participation Continuation

Many researchers describe student trajectory through STEM as a pipeline that gets narrower (Cannady et al., 2014). This metaphor is designed to show that initially, large numbers of students participate within STEM. However, as time goes on, "only a small percentage of students in the United States pursue degrees in STEM disciplines and even fewer go on to enter STEM careers" (Cannady et al., 2014, p. 444). The drop-off of students that pursue STEM disciplines is seen throughout all levels of education. As students progress further in their educational lives, smaller percentages pursue STEM.

The overall leaking pipeline is often seen as more impactful to women, as they have higher rates of attrition during this process (Blickenstaff, 2006; Resmini, 2016). This degradation of the number of students involved in STEM as their career progresses reduces the number of STEM students who are prepared for a STEM career.

Concern over the health of the nation's workforce in STEM arises from a growing consensus that economic health depends on technological innovation (Augistine, 2007). With lower numbers of available students in the pipeline, the overall U.S. workforce is affected. There are fewer career-ready participants for the future STEM workforce (Resmini, 2016). The overall impact of the leaking pipeline is detrimental to the overall economic health of the United States (Witteveen & Attewell, 2020). Keeping students participating in STEM fields is critical to creating a STEM-focused workforce.

Conflicting Ideas Behind the Benefits of Participation

Once participation is defined, researchers can start to apply the definition to their research. Webb et al. (2013) reported researchers need to have a nuanced view of participation when it comes to education. The level of detail in the participation and the amount of communication distinctly alter the effects the participation will have on the student (Webb et al., 2013). Research supports the idea that both the level and amount of communication during participation are important. Some research shows participation does not increase classroom success for students (O'Connor et al., 2017). In their study, O'Connor et al. (2017) found no link between the amount students vocally participated and their overall grade in a math class. In contrast, other research showed participation can increase classroom success for students (Eddy & Hogan, 2014). Eddy and Hogan (2014) found that when college students actively participated in class, they completed

assignments more frequently, spent more time preparing for class, and felt an increased sense of community within the class context.

Both sets of researchers attempted to study participation, but set their standards for participation on different planes. The differences between these studies can be seen in the level of participation before the intervention, the level of participation required, and the amount of communication within participation. Therefore, participation needs to be defined before a study can commence (Webb et al., 2013).

Participation Within Blended Learning

Blended learning is a type of instruction that combines face-to-face learning with online learning (Garrison & Kanuka, 2004). This definition is both good and bad due to its ill-defined nature. Because there are a wide variety of activities and educational experiences that can fit within the definition of blended learning, this definition is an advantage. However, because there is a lack of specificity, there is little direction or guidance on how to implement blended learning.

Blended learning presents unique challenges to participation due to the fact that students are asked to participate within multiple learning formats. However, online participation has been shown to have a positive effect on students. Tayebinik and Puteh (2013) found a link between students having a greater rate of participation in online systems and passing grades. This indicates increased participation in online courses is likely to lead to greater success. Additionally, a link has been found between students with a higher rate of posting in online discussion forums and greater academic success (Demosthenous et al., 2020). Therefore, students who participate will be more likely to achieve a passing grade and also be more likely to be successful. These articles show

participation in online courses can be beneficial to students who are participating in blended learning.

With this knowledge, educators can apply techniques to enhance the blended learning experience for students. By tailoring online courses to use a more personal approach, teachers can increase online participation (de Barba et al., 2016). With an increase in online participation, students will realize the full extent of blended learning courses.

Participation within the classroom is a valuable tool to increase student learning. In order for student participation to have a maximum impact, educators need to define participation. Once educators define participation, they can set the levels and amount of communication that are acceptable within their classes. If the definitions of participation are used correctly, there can be a benefit to both the traditional and blended classrooms. In order for educators to engage students in active participation, it is critical to understand student motivation.

Student Motivation in STEM

Student success within any academic endeavor is dictated by several factors. One factor that determines student success is motivation to engage in learning. This can be particularly important when applied to STEM subjects. The following sections detail (a) the definitions of motivation, (b) understanding STEM motivation for students, and (c) best practices to increase student motivation within STEM.

Definitions

There are several different ways to define motivation within an educational context. Because there is such a variety of definitions, it is important to explore them and

understand their similarities and differences. The following sections explore (a) the ARCS model of motivation and (b) self-determination theory (SDT).

ARCS Model of Motivation

The ARCS model of motivation was developed by Keller (1987) as an instructional model that can be used to increase student motivation. The model includes four major components of motivation: attention, relevance, confidence, and satisfaction (McMahon, 2014). Each category is further divided into sub categories that enable educators to build lesson plans that enhance student motivation in subject matter.

The first focus within the ARCS model is attention (Keller, 1987). This focus is rooted in grabbing the student's attention due to it being a prerequisite for learning. Several strategies can be used to grab a student's attention, including active participation, variety, humor, conflict, and real-world examples (Drew, 2020). These strategies can be used at the discretion of the educator and the classroom they are facilitating.

The second focus within the ARCS model is relevance (McMahon, 2014). Relevance draws the learners into the educational materials by allowing them to see the purpose of the learning activities in which they will be participating. There are several strategies that can be used to create relevance within the classroom. Linking to prior knowledge, linking to students' lives, showing present worth, showing future usefulness, and modeling usefulness are all ways to achieve relevance within a lesson (Drew, 2020).

The third focus within the ARCS model is confidence (McMahon, 2014). The feeling of confidence with the material gives students the feeling that they are learning and are capable of succeeding within their lessons. There are several strategies that can be used to create confidence within a student population. Creating clear objectives,

providing formative feedback, and increasing perceived control can all increase the confidence of students (Drew, 2020). Each of these strategies should be evaluated and implemented when appropriate within lessons.

The fourth and final focus within the ARCS model is satisfaction (McMahon, 2014). Student satisfaction will be achieved if a teacher has successfully achieved the first three focuses of the ARCS model. When conditions are met, there are two types of satisfaction that can be seen within the ARCS model: intrinsic satisfaction and extrinsic satisfaction (Drew, 2020). Intrinsic satisfaction is defined as, "the feeling that you have achieved something good, usually for the sake of the task itself. You didn't do it for someone else's praise or reward." (Drew, 2020) and extrinsic satisfaction is defined as, "the feeling that you have done well because someone provides a praise or reward. This can be in the form of points in a game, grades on a test, or the teacher giving you a pat on the back" (Drew, 2020). However, there can be barriers to student satisfaction if the content is not aligned with skill or if favoritism is seen within the classroom (Drew, 2020).

The ARCS model has been shown to increase student motivation in a wide variety of classroom environments. This includes the flipped classroom (Karabatak & Polat, 2019), lecture (Daugherty, 2019), and in gamification models (Su & Cheng, 2015). The impact of this model can be seen beyond the classroom as well. When used in classrooms, teachers often find they have increased their student's motivation for the topic being explored (McMahon, 2014)

Self-Determination Theory

Student motivation is a complex topic with many definitions and theories. One macro theory on motivation is self-determination theory (SDT), which is based on the idea that an individual's performance and well-being are linked by the type of motivation they have for the activities they perform (Deci et al., 2017). This theory can apply to several different types of vocations. SDT's role within education is particularly relevant. Because students are complex and individualistic, SDT is of particular importance because it can help describe a wide range of student behaviors based on their motivations (Evans, 2015). Being able to describe how and why students are motivated allows for a more comprehensive view of motivation.

SDT separates motivation into two major categories of intrinsic and extrinsic motivation. Intrinsic and extrinsic motivation have separate definitions that dictate how each individual type of motivation can be impactful for students.

Intrinsic Motivation. The first type of motivation detailed in SDT is intrinsic motivation. Intrinsic motivation has several definitions that all share the same ideals. Legault (2016) defined intrinsic motivation as "engagement in behavior that is inherently satisfying or enjoyable" (p. 1). This shares ideals with another common definition provided by Deci and Ryan (1999), who stated intrinsic motivation is the pursuit of an activity because it is interesting or enjoyable. Both definitions relate to the fact that a learner is internally motivated to participate in activities. They both describe those intrinsic activities that are directed by an internal self. I used Legault's (2016) definition due to its more open-ended nature and increased applications across different types of learning methods.

There are several ways in which intrinsic motivation can be seen in practice. Play, exploration, and curiosity activities are good representations of intrinsically motivated behaviors. This is because students are not held to external incentives, rather their own satisfaction and joy (Ryan & Deci, 2020). The locus of control for students will rest inside of their interests and pursuits. Therefore, a student's drive to continue behaviors will be drawn from internal sources. Because students can derive interest and joy from intrinsically motivated activities, this type of motivation is extremely effective in helping increase their academic success (Taylor et al., 2014). With increased internal satisfaction and academic success, this type of motivation can be very impactful on a student's educational experience.

Extrinsic Motivation. The other type of motivation detailed in SDT is extrinsic motivation. Legault (2016) provided commonly used ideas within her definition of extrinsic motivation. Legault stated extrinsic motivation is "fundamentally contingent upon the attainment of an outcome that is separable from the action itself" (p. 1). This means extrinsic motivation is directed by outside forces. Though many of the definitions of extrinsic motivation focus on the motivation being tied to a positive experience, some detail the motivation as tied to a negative experience. This type of motivation is not performed out of interest, but for the consequence to which it is thought to be instrumentally linked (Wrzesniewski et al., 2014). Both positive and negative outside forces can cause a student to be motivated to perform particular actions.

Educationally-based extrinsic motivation can come from incentives, rewards, certificates, verbal praise, punishments, and criticism (Serin, 2018). These methods can be used to increase the likelihood that students will invest greater time and energy in

tasks where there are additional tangible outcomes (Covington & Ueller, 2001). The methods and strategies used within extrinsic motivation are not the same as those used within intrinsic motivation. However, the end result of extrinsic motivation and intrinsic motivation, increased success and interest in subject matter, should be the same.

Some practitioners see extrinsic motivation within SDT as bad for education (Gerhart & Fang, 2015). However, extrinsic motivation should not be seen as good or bad. Extrinsic motivation serves different purposes than intrinsic motivation and achieves different goals (Deci et al., 2017). It is important not to think of intrinsic motivation and extrinsic motivation as oppositional forces. Instead, experts indicate they are synergistic motivational strategies that can help motivate students in different ways (Gerhart & Fang, 2015).

Understanding STEM Motivation for Students

Due to the complex nature of motivation, it is important to narrow the focus of intrinsic and extrinsic motivation to specific academic disciplines. Students who engage in STEM can have noticeable impacts on their intrinsic and extrinsic motivation. Christensen et al. (2015) found students who are provided authentic, active learning experiences often internalize STEM learning. This internalization and intrinsic motivation are linked strongly to promoting positive interest in STEM content and careers (Christensen et al., 2015). The intrinsic motivation of STEM education is synergistic with the extrinsic motivation of STEM education. Science occupations are considered high status and reward with high personal income and social prestige (Xie et al., 2015). When students are provided with active learning experiences and are

knowledgeable about the benefits of STEM, they will be able to build interest in STEM and achieve academic success.

These types of strong STEM educational experiences can lead to intrinsically and extrinsically motivated students who one day turn into highly motivated members of the workforce. Kelley and Knowles (2016) stated highly educated graduates with "quality STEM education could sustain or increase the STEM pipeline of individuals preparing for careers in these fields" (p. 2). This pipeline has an even greater effect in underrepresented communities within the STEM fields, such as scientific communities that contain larger concentrations of women and persons of color. Thiry et al. (2011) found underrepresented students who displayed motivation to participate in research were more likely to pursue a STEM career. This shows a link between STEM education and both intrinsic and extrinsic motivation.

Best Practices to Increase Student Motivation Within STEM

Researchers have found it is possible to change motivation through intervention (Rosenzweig & Wigfield, 2016). The changes that are seen are generally positive and successful (Rosenzweig & Wigfield, 2016). Therefore, many different practices have been shown to be successful in increasing motivation within STEM. In the following sections, two best practices are explored: (a) experience and (b) educator interest.

Experience

Many students who persist in science report that they showed interest in scientific careers by the age of 12 years (Maltese & Tai, 2010). Therefore, it is important for students to be given STEM-focused experiences from an early age. These STEM experiences may shape their perceptions on the nature of STEM. Master et al. (2017)

documented this when they observed an increase in the motivation of first-grade female students after exposing them to programming and robotics for a period of only 20 minutes. During these 20 minutes, there was enough exposure to STEM to lead to an increase in motivation. Their research shows even small exposures can result in increased motivation in STEM.

Experience in elementary school cannot exist in a vacuum. Students need to have their early experiences followed by persistent and engaging experiences within their STEM courses. Maltese and Tai (2010) stated, "Teachers must work to foster this interest so that it is not lost as students mature" (p. 681). Repeated exposure to STEM for students helps reinforce their motivation about STEM as they mature. At this point, motivated students will seek out ways to have more experience within STEM fields (Crowley et al., 2015). This leads to a repeating cycle of interest leading to motivation, and motivation leading to interest.

Educator Interest

Students report one of the most influential factors in STEM motivation is their teachers' interest (Crowley et al., 2015). This motivation and interest can be displayed through teachers' passion for the subject matter or through their passion for their students. L. Cheng et al. (2020) found that when teachers showed an interest in 3D printing, students' achievement and motivation for science increased. In a separate study by Maltese and Tai (2010), students reported their initial interest in science was highly influenced by their teacher's support. Through interest in STEM activities and interest in their students, teachers can foster STEM motivation within their classrooms.

Summary

Motivation is a key factor within education. With an understanding of the definitions of SDT, intrinsic motivation, and extrinsic motivation, educators can work to increase motivation among students. The increase in motivation can be targeted to STEM subjects by applying the definitions of motivation to students' benefit. Educators can maximize this benefit by focusing on increasing students' experiences with STEM and by taking an interest in students and STEM. Blended learning can be used within educational settings to help increase motivation within student populations.

Blended Learning

Blended learning systems are educational systems that combine in-person learning and remote learning. Their uses and implementations are often modified to meet the needs of both students and schools. Through the use of blended learning systems, educational leaders can create new and unique learning environments that increase learning outcomes (Seage & Türegün, 2020). By combining blended learning with beyond the classroom experiences, students can experience increased motivation and participation within STEM fields. This makes blended learning an excellent option for students. This section details (a) definitions of blended learning, (b) benefits of blended learning, and (c) the impacts of blended learning.

Definitions

There is no one true definition for blended learning (Motteram & Sharma, 2009). This is to the benefit of institutions and students as it allows them to adapt blended learning to individual student needs. Without a centralized definition, two popular definitions for blended learning appear often in the modern literature. These definitions

were offered by Graham (2006), cited 2,149 times as of 2018; and Garrison and Kanuka (2004), cited 3,116 times as of 2018 (Hrastinski, 2019). The definition offered by Graham (2006) is, "Blended learning systems combine face-to-face instruction with computer-mediated instruction" (p. 5). This definition places emphasis on the dichotomy that is seen in blended learning between the in-person learning and virtual learning provided through computers. Garrison and Kanuka (2004) also included virtual and face-to-face learning in their definition. They defined blended learning as "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (p. 96). Garrison and Kanuka purposefully highlighted the element of integrating both online and face-to-face instruction within blended learning classes.

When exploring the definitions and attempting to apply them to a real-world setting, it is important to understand the similarities and differences. The two popular definitions have several ideas in common. Both definitions include elements of a face-to-face learning and virtual learning (Hrastinski, 2019). These similarities provide the groundwork for a flexible system that takes advantages of the best practices seen within a traditional classroom and an online classroom and combines the advantage of in-person learning and the flexibility of virtual instruction (Wanner & Palmer, 2015).

Despite the similarities in the definitions by Hrastinski (2019) and Garrison and Kanuka (2004), there are three major differences: (a) the quality of preparation, (b) the difference between computer-mediated and online learning, and (c) the difference between instruction and a learning experience (Hrastinski, 2019). These differences highlight the scope of blended learning. Because there are so many different applications for blended learning, each and every situation may apply their similarities in a different

way. This makes both definitions viable based on the context of the education being provided to students.

Due to the more specific details given by Garrison and Kanuka (2004), their definition was used in the current study. This definition allowed for combining the elements of a well-defined online course with the personal interactions valued with a traditional classroom (Lloyd-Smith, 2010).

Benefits of Blended Learning

One of the positive aspects of blended learning is the ability to adapt to the needs of both students and institutions (Motteram & Sharma, 2009). This adaptability is a major strength because it allows instructors to craft learning experiences that are optimal for students. With the adaptability of Garrison and Kanuka's (2004) definition, instructors can conform to the needs of learners on an individual basis. Wanner and Palmer (2015) stated blended learning environments allow for opportunities to cater to individual's needs, which can lead to more personal instruction. With more personal instruction and increased adaptability, educators can deliver a quality learning experience to students.

Impacts of Blended Learning

Blended learning systems can have large impacts on students. Among the areas of impact, blended learning can affect (a) student motivation and (b) STEM education.

Impact on Motivation

Blended learning has been shown to influence student motivation to engage with education. In a study by Owston et al. (2013), students reported feeling increased engagement within a blended learning environment. Within that study, students reported they were more engaged and achieved more in a blended learning environment compared

to in traditional classroom settings. Blended learning also is more engaging for students when compared to a direct learning model (Islam et al., 2018). This means blended learning can positively affect the motivation levels of students who are receiving direct instruction in either a classroom or through an online format.

Due to the adaptability of blended learning courses, there is a wide amount of variability within their ability to motivate. A quality blended learning course that will help increase motivation should have face-to-face learning and online learning complement each other (Çakır & Bichelmeyer, 2013). The complementary nature will draw upon the strengths of both online and face-to-face learning (Hrastinski, 2019). Another practice that can help increase quality within a blended learning environment is to ensure a substantial amount of the content is delivered online (Allen & Seaman, 2010). Though this generally ranges between 30%–79%, it allows for more discussion and exchange of ideas during face-to-face meetings (Allen & Seaman, 2010).

The motivation to engage with learning through blended learning has been seen across all levels of education (Serrano et al., 2019). However, the levels at which students are willing to engage with learning are highest among self-motivated learners (Serrano et al., 2019). These students take the most time refining and reflecting on their coursework. Higher achieving students participate fully with online activities, compared to low achieving students (Owston et al., 2013). This demonstrates students who enter blended learning systems with high levels of intrinsic motivation are more likely to have the larger gains in motivation when compared with students who have lower intrinsic motivation.

Impact on STEM Education

Blended learning is a style of learning that can have a great impact on STEM education. One of the major ways in which blended learning affects students is through its ability to improve student achievement on projects and assessments in STEM (Seage & Türegün, 2020). Students who attend a blended learning environment outperform students who attend a traditional learning environment (Seage & Türegün, 2020). The increase in achievement on projects and assessments may be attributed to different factors. Lloyd-Smith (2010) found blended learning "offers faculty and students, the ability to teach and learn in a variety of different ways" (p. 513). With more methods of reaching students and more avenues to teach, the flexibility of a blended learning program may help students achieve more (Lloyd-Smith, 2010).

Summary

Blended learning systems are learning systems that create unique and personalized educational opportunities. They allow teachers to meet students' unique needs and adapt lessons to be more effective in certain situations. Blended learning systems also demonstrate positive outcomes for motivation and STEM learning when used properly.

With large impacts on motivation and STEM education, blended learning can have an impact on students. Within the context of blended learning, students will be able to increase their motivation for the subject they are learning and increase their STEM educational outcomes.

Using Experiential Learning Within Blended Learning

Traditional education focuses on teachers transferring knowledge to students, though there are other methods of learning that have a great educational impact. Experiential learning theory is the practice of allowing students to have concrete experiences, reflect on those experiences, and adapt to their new situations. This type of learning has been proven to affect student achievement and student motivation. When combined with a blended learning classroom, there is potential for additional student growth. The following sections detail (a) the experiential learning definition, (b) the benefits of combining blended learning and experiential learning, (c) how blended learning can fit within experiential learning, (d) concrete experience within blended learning, (e) reflective observation within blended learning, (f) abstract conceptualization within blended learning, and (g) active experimentation within blended learning.

Experiential Learning Definition

Experiential learning has a long and diverse background. When defining experiential learning, it is important to understand its history through its current applications within the modern classroom. This section details the (a) historical background of experiential learning, (b) the predominant definition of experiential learning, and (c) how experiential learning is applied.

Historical Background

The roots of experiential learning are founded in some of the seminal works of learning theory. Experiential learning was created to provide an intellectual foundation for John Dewey's call for a theory of experience to guide educational innovation (A. Y. Kolb & Kolb, 2017). Experiential learning is a synthesis of the works of the foundational

scholars of experiential learning including William James, John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, Carl Jung, Mary Parker Follett, Carl Rogers, and Paulo Freire (A. Y. Kolb & Kolb, 2017). With the synthesis of many different learning principles, experiential learning theory has foundations that reach across most of the major educational theories.

Predominant Definition

The most referenced and most important researcher in the area of experiential learning was David Kolb. His most cited work came from his book, *Experiential Learning: Experience as the Source of Learning and Development*¸ written in 1984. In the first edition, D. A. Kolb (1984) wrote, "Learning is the process whereby knowledge is created through the transformation of experience" (p. 38). D. A. Kolb elaborated on this idea by detailing that experiential learning is not a third learning theory, competing with cognitive and behavioral learning theories. Experiential learning can be worked holistically within other learning theories to combine experience, perception, cognition, and behavior (D. A. Kolb, 1984).

How Experiential Learning is Applied

D. A. Kolb's (1984) model for experiential learning is based on four major steps: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, and (d) active experimentation. Figure 2.1 displays the cycle of learning within Kolb's experiential learning model.

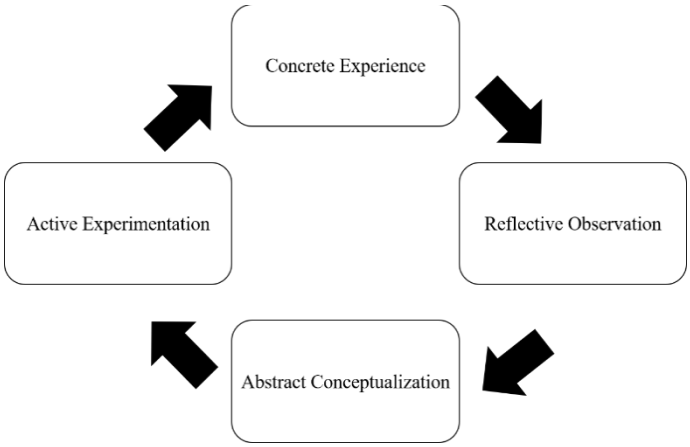


Figure 2.1. Kolb's model of experiential learning.

These four steps combine to create a cycle of learning that allows for each step within the cycle to create learning and alter information that has been acquired. Students should be exposed to all for major steps. When all four steps are used and students balance their focus across all aspects, optimal learning can be achieved (Wyrick & Hilsen, 2002). Students can use all of these steps to create powerful learning experiences.

Benefits of Combining Blended Learning and Experiential Learning

When combining blended learning and experiential learning, there are multiple benefits. The two major benefits are (a) positive student experience and (b) increased student learning.

Positive Student Experience

David Kolb's (1984) model of experiential learning can be used within different methods of instruction. One of the ways in which educators synergize experiential learning is to use it in tandem with blended learning. One major benefit to creating a combined blended learning and experiential model is student satisfaction. When a combined model is used, blended learning and experiential learning have the ability to enhance student engagement (Beckem & Watkins, 2012). With a great ability to enhance

student engagement, the combined model allows for positive experiences for students and superior confidence in skills. Maier and Thomas (2013) found that when using a blended experiential learning model, students reacted positively. Students in their study reported developing a deeper comprehension of real-life scenarios, having a more interesting and real-life learning experiences, and experiencing higher confidence within real life scenarios (Maier & Thomas, 2013).

Increased Student Learning

Another benefit of the combined model of blended learning and experiential learning is the ability for students to increase their retention and application of information and skills. Murphy et al. (2019) found that when students used a combined model, they retained the knowledge necessary to evaluate skeletal radiographs. Their work demonstrated students who are subjected to a combined learning model can be successful at the goals of the learning. When compared to other methods of experiential learning, including study abroad, traditional classroom, and telecommunication, students who participated in a combined learning model compared favorably (Moreno-López et al., 2017).

Concrete Experience Within Blended Learning

Concrete experiences are often the entry point for students who are using experiential learning. These types of experiences are important because they place the student within a powerful learning environment that will lead to the next steps within experiential learning. The experiences students have will provide the opportunity to view the subject from different perspectives and approaches (Giac et al., 2017). Students should be able to learn from the experiences in unique ways that benefit them. Komarraju

et al. (2014) exposed students to research opportunities and found personal visits to research labs seemed to provide a tangible context for research experience. Students could approach their classroom knowledge and view it from the lens of a researcher. This demonstrated what it is like to be part of a research lab and the different types of experiences students could gain by becoming a research assistant (Komarraju et al., 2014).

When it comes to the combined model of blended learning and experiential learning, concrete experiences often take the form of beyond the classroom experiences. (Falk & Dierking, 2010) stated beyond the classroom experiences, or informal learning experiences, happen outside of the classroom. Beyond the classroom experiences can also be referred to as "free choice learning" and "out-of-school-time learning." Boggs (2019) defined beyond the classroom experiences as "learning through action, learning by doing, learning through experience, and learning through discovery and exploration." These experiences are powerful opportunities for students and teachers to access resources that are not available to them within the classroom (Kisiel, 2013). These environments allow students to access resources and bring those experiences back to the face-to-face or online aspects of blended learning. When done correctly, students can take information from inside of the classroom and expand upon it through discussion, group work, hands-on participation, and applying information beyond the classroom (Talafian et al., 2019).

Reflective Observation Within Blended Learning

Reflective observation is the act of reviewing concrete experiences in an organized manner. This proves to be a powerful tool that can enhance the student learning experience. Careful objective reflection from multiple perspectives helps

learners dissect their experiences into further stages of learning (Young, 2002). Students can use reflective observation for important learning experiences. During this time, students can optimize their learning by reflecting on their experiences and linking information to their experiences (Halpin et al., 2020). By forming a bridge between the classroom and their experiences, students can apply textbook knowledge to the real world. Students who take time doing reflective observation internalize and integrate their learning in new ways that strengthen the whole learning process by connecting it to the students' experiences within the classroom (Starr & Minchella, 2016). This process is so vital to experiential learning that students may not view their subject in the correct context without reflective observation (S. C. Cheng et al., 2019).

During the blended learning process, reflective observation is often performed during the face-to-face learning sessions. During the face-to-face classroom experiences, group discussions and report writing can help students reflect more and achieve higher scores on learning outcomes (Yen & Lee, 2011). The face-to-face sessions where students can reflect on shared experiences have a lasting impact on education. De Oliveira et al. (2015) found that even after reflective sessions ended, students continued to think about the topic, fostering increased learning.

Abstract Conceptualization Within Blended Learning

Abstract conceptualization is the process of making sense of experiences and linking relationships between the real world and the classroom. In order for students to make sense of abstract conceptualization, they need to have previous theoretical knowledge and concrete experience (Alkan, 2016). Background theoretical knowledge combined with real-world experiences enables students to integrate a new working

understanding of the content. Giac et al. (2017) stated that during abstract conceptualization, the student generalizes the experience into reasoning. Educators can use modeling activities, group discussions, and collaborative projects to help enhance this process.

Inside of a blended learning environment, abstract conceptualization is often implemented during the online learning component. This time is unique for students and allows for connections during personalized and flexible learning experiences (Wanner & Palmer, 2015). Educators can use the flexibility to tailor learning and assessments to each student's experiences. Their ability to use the strengths of different modes of delivery enhances learning (Serrano et al., 2019). The strong links that are created during abstract conceptualization are enhanced by the strengths of blended learning.

Active Experimentation Within Blended Learning

The process of active experimentation uses the other three stages of experiential learning: concrete experience, reflective observation, and abstract conceptualization. The learner has to implement the knowledge base they built through the other stages of experiential learning to understand their concrete experiences (Alkan, 2016). Students can then use the conclusions they created for the next set of experiences. Students can turn their conclusions into hypotheses that will be used during the next concrete experience (Giac et al., 2017). By actively experimenting, students will be completing a full cycle of experimental learning.

During blended learning, active experimentation often happens during face-to-face classroom time. Using the face-to-face nature of classroom time, students can embrace active experimentation with peers. During face-to-face time students

demonstrate higher and more effective levels of active experimentation (Konak et al., 2014). One effective method of active experimentation within a blended learning environment is simulation. This provides students the ability to use their gained knowledge and skills in simulated scenarios. De Oliveira et al. (2015) found that active experimentation through the use of simulation was a rich and appropriate process for training professionals to develop creative and critical-reflexive skills. Students within that study were able to able to combine theory and practice to help develop the skills necessary to perform a nursing consultation (de Oliveira et al., 2015).

When designing blended experiential learning and blended learning systems, educators can create positive learning outcomes for students by incorporating the strengths from blended learning and the strengths from experiential learning. Blended systems allow for Kolb's theory of experiential learning to be applied and personally focused to meet student needs. Within the blended system, students can apply the four stages of experiential learning to the advantageous scenarios that are created within a blended learning system. The overall outcome for students is a blended learning system that allows for student growth and learning.

Summary

This review explored the links among the roles of motivation, participation, blended learning, and experiential learning. Within the literature, strong connections can be found between these interrelated topics. Through the use of a blended learning and experiential learning system, educators have the tools they need to increase student participation and motivation in STEM fields.

Educators have the ability to increase the participation and motivation of their students if they implement a combined experiential learning and blended learning system within their classrooms. Focusing on the definitions and the goals of participation and motivation go a long way in increasing positive outcomes within students. Once a definition has been used, educators can implement experiences and structured blended learning to help maximize the participation and motivation of their students.

By implementing a blended learning and experiential learning model, educators have all the tools they need to increase motivation and participation from students in a variety of subjects. However, these increases can be particularly effective in STEM fields. This is due to the fact that a wide array of concrete experiences can be used to begin the experiential learning cycle.

Based on this literature review, more research could be performed on the combined experiential and blended learning model. This model is used in many different classrooms, though there is not an abundance of research on its effects. This study would help support the research questions from this study: (a) How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? and (b) What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?

CHAPTER 3

METHOD

The purpose of this action research was to evaluate the effect of a blended learning system designed to promote interest in participation and motivation to participate in beyond the classroom experiences for STEM-focused students at Branchburg High School in Annandale, NJ. The following research questions were explored:

1. How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?
2. What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?

This chapter provides details of the research design, setting and participants, action and innovation, data collection methods and sources, data analysis, procedures and timeline, the rigor and trustworthiness of this research, and the plan for sharing and communicating findings. By the conclusion of this chapter, a clear outline for the research will have been presented.

Research Design

I used action research during the course of my study to gain insight into my research questions. Action research was defined by Mills (2003) as

> any systematic inquiry conducted by teachers, administrators, counselors, or others with a vested interest in the teaching and learning process or environment for the purpose of gathering information about how their particular schools operate, how they teach, and how their students learn. (p. 4)

As a member of the Branchburg High School community, I conducted my research with the students of Branchburg. As I am a working teacher within the school I researched, my vested interest in the educational outcomes for students, the operation of the school, and the education happening within the Careers in STEM Club aligned this study with action research. This made action research an important component of this study.

Action research gave me the ability to improve my own practices and to be able to contribute to my learning community. Action research differs from traditional educational research in that it involves working directly with the subjects of the research (Mertler, 2020). Traditional research "is typically conducted by researchers who are somewhat removed from the environment they are studying" (Mertler, 2020, p. 9).

The highlight of this action research was the direct focus on my local learning community. Mertler (2020) stated action research "focuses specifically on the unique characteristics of the population with whom a practice is employed or with whom some action must be taken" (p. 31). Because the focus of my research questions was on the students who attend my high school, I was able to gain greater insight into the population with which I work every day. This led to increased utility and effectiveness for me, the practitioner (Parsons & Brown, 2002). Action research also allowed me to apply and solve problems within my own educational environment. This led to data that related to both my research questions and my local educational context.

I designed this action research study to use a mixed methods approach. A mixed methods approach "involves combining or integration of qualitative and quantitative research and data in research study" (Creswell & Creswell, 2018, p. 14). By combining the ideas from both quantitative and qualitative research, I was able to gain a better understanding of the research problem. Using a mixed methods approach enabled me to ask open-ended and closed-ended questions, draw on all possibilities from multiple forms of data, have access to both statistical and text analysis, and interpret across databases (Creswell & Creswell, 2018). These actions provided a comprehensive and through understanding of my findings.

While using mixed methods research, I triangulated the data and put emphasis on both quantitative and qualitative data (Mertler, 2020; Noble & Heale, 2019). Both methods of data collection were given representation within this study. In order to represent both quantitative and qualitative data, both types of data were collected and evaluated at the same time.

To obtain quantitative data, I used student surveys that included questions designed to gain insight into my research questions. To obtain qualitative data, I had students using reflective journals and I conducted interviews after the course of my intervention. At the end of my action research, I compared the data to see if they yielded similar results (Mertler, 2020; Noble & Heale, 2019). If the results of quantitative and qualitative compared similarly, it would increase the credibility of my results (Mertler, 2020; Noble & Heale, 2019). If the results of the quantitative and qualitative data contradicted, it would give my research a foundation for further investigation (Creswell & Creswell, 2018).

Setting and Participants

I conducted my study within the Careers in STEM Club at Branchburg High School, a voluntary club offered to juniors and seniors. The main goal of this club aligned with this study—to promote beyond the classroom experiences for students at Branchburg High School. I used the study as an effective way to evaluate student motivation and interest in participation in beyond the classroom experiences within the Careers in STEM Club. I also used the study to understand the participants' experiences within the club.

The Careers in STEM Club was managed by two different parties. I facilitated the large majority of the meetings of the club as well as the rollout of the blended learning system, the classroom-based lessons, the web-based lessons, and the quantitative and qualitative research that happened within the club. A member of the guidance staff helped with coordinating beyond the classroom experiences and enhancing the lessons. She helped address any legal, student, and communication issues that arose during the club.

We implemented blended learning within the Careers in STEM Club for multiple reasons. The first reason for the selection of blended learning is its proven effectiveness in terms of increasing student motivation (Owston et al., 2013). With research supporting the effectiveness of blended learning to increase student motivation, blended learning was helpful in creating a system that was viable in evaluating the research questions of this study. The second reason for the selection of blended learning is the strong links between blended learning and STEM education. Blended learning has proven to be effective in terms of the achievement of students who are studying STEM-related topics (Seage & Türegün, 2020). With a focus on STEM-related career education, the Careers in STEM

Club can take advantage of blended learning. With this study's research questions focused on the effectiveness of a learning system, blended learning offered students a research-based approach to increase their achievement.

The final reason I selected blended learning for this study is the flexibility it offers as a learning platform. With the split between in-person and online learning that is available in blended learning, I was able to structure the Careers in STEM Club activities to take advantage of each method of instruction. Activities that involve direct instruction and in-person collaboration were scheduled during the in-person meetings. Activities that involved students using skills, time investment, and did not involve a strict time schedule were done online. The flexibility provided allowed busy students to work with the material on their own time and allowed for maximum instruction in the relatively small amount of in-person time available.

Students were notified of the Careers in STEM Club through announcements, classroom visits, and word of mouth. The club met on average twice a month after school for 45 minutes. Students were required to attend at least 66% of the meetings to stay eligible to participate in the research study. Students who participated in the research and students who only participated in the club were not treated differently. Of the qualifying population in the Careers in STEM Club, 100% of the population was involved in this research study.

Meetings occurred in the STEM classroom "S251" at Branchburg High School. This classroom has resources that are advantageous to blended STEM career learning, such as seating for 36, a full laboratory set of instruments and safety equipment, Wi-Fi

capability, a full projector setup, and a print station. All of these materials maximized the efficiency of the blended learning system.

I gathered participants for this study from a purposeful sample (Creswell & Creswell, 2018) of the students who elected to participate in the extracurricular Careers in STEM Club. The students who participated in this study were junior and senior (Grade 11 and 12) students who volunteered to participate. The date of the bimonthly meetings was selected by the group of students to fit into maximum number of student schedules.

The reason for the age restriction of 11th- and 12th-grade students, was to maximize the number of beyond the classroom experiences available to the students. There were three main reasons for this decision. First, younger students may not possess the knowledge they need to maximize their beyond the classroom learning. Second, there are transportation issues that may limit students who do not possess their own car. Finally, many STEM companies have an age restriction of 18 years.

The participating 11th-grade students had taken a freshman biology course, a sophomore chemistry course, at least 2 years of high school math, and needed to be undertaking a junior physics course and a junior-level math course. The participating 12th-grade students had taken the 11th-grade coursework and additionally were enrolled in at least one elective science-based course and one senior-level mathematics course. Students in the sample were those who elected to spend their time after school in the Careers in STEM Club. This implies these students were interested in STEM career fields and had a desire to participate in STEM beyond the classroom experiences. These students should be considered as having been previously interested in STEM career opportunities and previously motivated to have STEM career experiences.

Though numbers for the club were difficult to predict at the start, an anticipated five to 20 students were expected for the club. In the end, 14 students attended at least one meeting and eight students met the qualifications of attending at least 66% of the meetings. The eight students met the study qualifications. Of these eight students, seven participated in the student survey and six participated in the semi-structured interviews. Each participant is described in detail below in Table 3.1 and the individual student profiles.

Table 3.1 *Participants Information*

Participant Pseudonym	Age	Gender	Previous Beyond the Classroom Experience
Tiffany	18 – Senior	Female	None
Jordan	17 – Senior	Female	Worked with Father in archeology
Emma	17 – Senior	Female	Engineering competitions
Carla	18 - Senior	Female	EMS experience
Fiona	18 – Senior	Female	Worked in pharmacy
Ana	16 – Junior	Female	Volunteers in a science museum
Lydia	18 – Senior	Female	None
Grace	17 - Senior	Female	Internship at dermatologist

Tiffany

Tiffany was a female senior student who was 18 years old at the start of the study. She had no previous beyond the classroom experiences before the club. Tiffany initially

joined the club because she was interested in beyond the classroom experiences and the opportunities they offered.

Jordan

Jordan was a female senior student who was 17 years old at the start of the study. She had limited beyond the classroom experiences before the club, all relating to working with her father who was an archeology professor. Jordan initially joined the club because she was very interested in archeology and wanted to explore the science behind how researchers explored ancient cultures.

Emma

Emma was a female senior student who was 17 years old at the start of the study. She had limited beyond the classroom experiences that all related to engineering competitions and events in New Jersey and New York. Emma initially joined the club because she was interested in exploring engineering.

Carla

Carla was a female senior student who was 18 years old at the start of the study. She had large amounts of beyond the classroom experiences at the onset of the club due to the fact that she was an EMS ambulance rider. Carla joined the club because she wanted to see whether there was more she could be doing to explore her passion for medicine.

Fiona

Fiona was a female senior student who was 18 years old at the start of the study. She had large amounts of beyond the classroom experiences at the onset of the club due to the fact that she had started working for her pharmacist mother when the COVID-19

vaccine was introduced. Fiona joined the club because she was interested in engineering, and wanted to see whether there were ways to explore engineering while still helping her mother.

Ana

Ana was a female junior student who was 16 years old at the start of the study. She had limited beyond the classroom experiences at the onset of the club that all related to her volunteer position at a New Jersey-based museum. Ana joined the club because she wanted to be a research biologist and become familiar with the laboratory setting.

Lydia

Lydia was a female senior student who was 17 years old at the start of the study. She had no beyond the classroom experiences at the start of the club. Lydia joined the club because her best friend, Grace, and neighbor, Ana, were both participating and Lydia was going to major in science in college.

Grace

Grace was a female senior student who was 18 years old at the start of the study. She had extensive beyond the classroom experiences that were related to her internship at a dermatologist office. She joined the club because her internship was so impactful to her chosen career path that she wanted to explore more beyond the classroom experiences.

Action and Intervention

The students involved in the Careers in STEM Club were exposed to a blended learning system that promoted experiential learning (Abdulwahed & Nagy, 2009). The blended learning classroom setup was intended to educate students on the beyond the classroom opportunities that were available to them and methods to secure these

opportunities. The goal of the blended learning system was to increase student motivation and interest in participation in beyond the classroom experiences.

The topics of beyond the classroom experiences and experiential learning have been studied by many parties. Much of the research on the topic was started by David Kolb (A. Y. Kolb & Kolb, 2012). The Kolb model indicates there are four major aspects to the theory of experiential learning (Chan, 2012). To summarize Kolb's theory on experiential learning, students use an experiential learning experience, reflect upon that experience, draw conclusions from that experience, and then test or try out new skills or knowledge in the next beyond the classroom experience (D. A. Kolb, 1984; McLeod, 2017; Stroller & Calvin, n.d.). This model creates situations in which students are constantly experiencing, reflecting, and adapting to new experiences (Alkan, 2016), which creates a cycle of learning where students are learning new skills and connecting them to classroom experiences. These four major aspects of Kolb's theory were woven into the blended learning system. Foundational lessons fostered concrete experiences, reflective observation was achieved by discussing the lessons, abstract conceptualization was achieved by having students attempt new activities at home, and applying their skills to real-world scenarios fostered active experimentation (see Table 3.1).

Reflective observation involved having students reflect on their experiences preparing for beyond the classroom experiences in their reflection journals. Students had the freedom to write about their concrete experiences. In doing so, students reflected upon how concrete experiences affected them personally and related to their STEM career goals. By practicing reflective observation, students were able to create links to concrete experiences.

Abstract conceptualization happened as students were asked to work in small groups to discuss their concrete experiences and how they were affected by them. These types of guided and freeform discussions gave students the ability to further reflect upon their ideas, listen to other perspectives of the concrete experiences, and build new ways to approach concrete experiences in the future.

Students were asked to actively experiment by putting their acquired knowledge to real-world tasks. The students were able to actively experiment with new tasks by completing subsequent activities of the Careers in STEM Club and by using their acquired skills to apply for beyond the classroom experiences. Each activity provided a framework for the next activity that allowed students to practice the skills they learned. In addition, the final activity involved students using all of the skills they learned, allowing them to apply for a beyond the classroom experience.

Table 3.2 *Stages of Experiential Learning Alignment*

Experiential learning stage	Activity
Concrete experience	Careers in STEM Club activities
Reflective observation	Reflection journals
Abstract conceptualization	Beginning of meeting discussions, group discussions, end of meeting wrap up
Active experimentation	At home activities, Careers in STEM Club activities

This intervention was unique from previous research due to the lack of studies that utilized a experiential learning based blended learning system with high school students. Students that are of this age group have adapted to a post COVID-19 world and the perception of blended learning experiences has changed. Being able to adapt the blended learning system to students that were more attuned to online learning and have

had experience linking classroom learning to online learning offered unique advantages and challenges.

The blended learning system was a computer-based system that allowed students to gain access to different concrete learning experiences. The blended resources contained electronic resources on how to write a resume, practice interviews for STEM careers, examples of what to expect from their concrete experiences, ways to electronically communicate with beyond the classroom site contacts, and a communication system where students could ask questions to the advisors of the Careers in STEM Club.

Specific learning experiences were aligned to the ARCS model of motivation (Table 3.3). This ensured that each activity had the best ability to influence student motivation. The introduction activity was designed to address attention and get them interested in the Careers in STEM club. The What is Out There, What Do I Need, and Focusing Your Search activities were designed to address relevance by connecting content learned in this club to real world experiences. The Applying and Interviewing activities were designed ot address confidence by giving students skills and experience in particular skills.

Table 3.3 *Careers in STEM Activity Alignment Table*

Attention	Relevance	Confidence	Satisfaction
1. Introduction	1. What is Out There? 2. What Do I Need? 3. Focusing Your Search	1. Applying 2. Interviewing	None

The blended learning system was based on a Google Classroom setup due to Branchburg's implementation of the Google Suite for each student Chromebook. The

Google Classroom contained four major sections: a classroom stream, a class materials section, a student directory, and a shared classroom Google Drive. These sections were available to all students who signed up for the Careers in STEM Club.

The Careers in STEM Club was run by me, Michael Owdij, and a member of the guidance staff. A two-leader approach was used due to the complementary skills of each of the club leaders. I provided the participants in the Careers in STEM Club with information about STEM-related beyond the classroom activities and designed the blended learning system. The other leader of the club is a member of the guidance staff who has additional experience in job application skills, including resumes, interviews, and more. Additionally, she has access to many local STEM contacts students may use. Her role was that of an observer when it came to any data collection for the survey. Her role was focused on the Careers in STEM Club.

The classroom stream was a location where researchers/instructors and students could post messages to the club. This area was used to help remind students about meetings, provide information about upcoming assignments, and communicate shared goals. The classroom materials section was used to provide group and individual resources. Students could access shared class materials and researchers/instructors could provide individualize feedback for students on assignments. The student directory was a location for student information, including name, status within the club, and email address. Finally, the group drive was a location where students could create individualized or group resources based on the needs of the club.

The blended learning system involved a 12-week action research study during which the club had in-person meetings six separate times. Each meeting was themed

around one major topic. The six major topics in order were as follows: Introduction; What is Out There?; What Do I Need?; Applying; My First Day; and Practicing Skills. These topics were elaborated on with lectures (Appendix B) and skills development (Appendix C) on what can be done to help students become involved in beyond the classroom experiences.

After students participated in the in-person meetings, they were asked to complete Kolb's cycle of experiential learning at home. First, students were asked to work with reflection journals that were themed around the lesson from the previous meeting (Appendix D). Then students were asked to work on an at-home assignment. These assignments were used to help enhance students' knowledge of the major topics introduced during the in-person meetings. The six major assignments (Appendix E) also served as a way for students to explore options and create documents that could be used during beyond the classroom experience applications.

Data Collection

To answer the research questions, I used a mixed methods approach. This mixed methods approach allowed for data collected from both qualitative and quantitative sources to be used. As shown in Table 3.2, I used three methods in this study: (a) student surveys, (b) participant interviews, and (c) reflection journals.

Table 3.4 *Data Sources Alignment*

Research question	Method	Data collection instrument
1. How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?	Quantitative Qualitative	Student survey Reflection journals

2. What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?	Quantitative Qualitative	Student survey Interviews Reflection journals

Student Survey

I used pre/post surveys that contained Likert scale questions to collect data to understand how the blended learning system changed student motivation and participation in STEM beyond the classroom experiences. Likert scale questions are designed to have equal denominations between the choices (Adams & Lawrence, 2019). These types of questions allow researchers to perform statistical analysis on the values that are provided as data (Adams & Lawrence, 2019). By analyzing the responses the students provided, I was able to reveal the participants' attitudes toward the issues of motivation and interest in participation (Joshi et al., 2015).

The student surveys included two major sections. The first section reflected the student's motivation for STEM beyond the classroom experiences. The second section included questions about the student's interest to participate in beyond the classroom experiences. The survey contained two different types of Likert scales. The section on motivation had 7-point Likert scale questions labeled with options from 1 (*Not At All True of Me*) to 7 (*Very True of Me*). The section on interest in participation had 5-point Likert scale questions labeled with options of 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

Before administering the survey to students, it was important to assess its validity. Reliability was defined by Mertler (2020) as "an essential quality in quantitative research data and has to do with whether the data are, in fact, what they are believed or purported

to be" (p. 155). To assess the reliability of the survey, it was important to use evidence of validity based on the instrument content. This source of evidence of validity was based on the relationship between the content within the Likert scales and the construct it was designed to measure (Mertler, 2020).

The instrument that provided statements for Research Question 1 was the STEM Career Interest Survey (STEM-CIS; Kier et al., 2014). This instrument provided five questions to assess interest in participation in STEM beyond the classroom experiences (see Table 3.3). The instrument that provided statements for Research Question 2 was the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). This instrument provided 11 questions that were able to gauge motivation pertaining to STEM beyond the classroom experiences (see Table 3.3); however, not every question from the instrument was included. Due to the specific nature of this action research, not all questions within this instrument were relevant to this study's research questions.

Table 3.5 *Student Survey Question Alignment*

Research question	Student survey question
1. How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?	1. I will work hard in beyond the classroom experiences that involve STEM. 2. I am interested in beyond the classroom experiences that use science. 3. I am interested in beyond the classroom experiences that use technology. 4. I am interested in beyond the classroom experiences that use math. 5. I am interested in beyond the classroom experiences that use engineering.

Research question	Student survey question
2. What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?	1. In a beyond the classroom experience, I prefer material that really challenges me so I can learn new things. 2. In a beyond the classroom experience, I prefer material that arouses my curiosity, even if it is difficult to learn. 3. The most satisfying thing for me in a beyond the classroom experience is trying to understand the experience as thoroughly as possible. 4. When I have the opportunity in a beyond the classroom experience, I choose experiences that I can learn from even if they don't guarantee an external reward (money, credits, resume building elements, etc.). 5. Getting an external reward (money, credits, resume building elements, etc.) in a beyond the classroom experience is the most satisfying thing for me right now. I want to do well in beyond the classroom experiences because it is important to show my ability to my family, friends, employer, or others. 6. I think I will be able to use what I learn in beyond the classroom experiences in other school related areas. 7. I am very interested in beyond the classroom experiences. 8. I like beyond the classroom experiences. 9. It is important for me to learn the material from a beyond the classroom experience. 10. I think the materials from beyond the classroom experiences are useful for me to learn.

Some of the statements that were included in the student survey were slightly altered to fit the specific nature of this study. The statements that were altered are

included in Table 3.5 to show both their original versions and the versions that appeared on the student survey.

Table 3.6 *Student Survey Modification Table*

Original survey question	Modified survey question
1. I will work hard in my science classes.	1. I will work hard in my science classes.
2. I am interested in careers that use science.	2. I am interested in beyond the classroom experiences that use science.
3. I am interested in careers that use technology.	3. I am interested in beyond the classroom experiences that use technology.
4. I am interested in careers that use math.	4. I am interested in beyond the classroom experiences that use math.
5. I am interested in careers that use engineering.	5. I am interested in beyond the classroom experiences that use engineering.
1. In a class like this, I prefer course material that really challenges me so I can learn new things.	1. In a beyond the classroom experience, I prefer material that really challenges me so I can learn new things
2. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.	2. In a beyond the classroom experience, I prefer material that arouses my curiosity, even if it is difficult to learn.
3. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.	3. The most satisfying thing for me in a beyond the classroom experience is trying to understand the experience as thoroughly as possible.
4. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.	4. When I have the opportunity in a beyond the classroom experience, I choose experiences that I can learn from even if they don't guarantee an external reward (money, credits, resume building elements, etc.).
5. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.	5. Getting an external reward (money, credits, resume building elements, etc.) in a beyond the classroom experience is the most satisfying thing for me right now.
6. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	6. I want to do well in beyond the classroom experiences because it is

Original survey question	Modified survey question
	important to show my ability to my family, friends, employer, or others.
7. I think I will be able to use what I learn in this course in other courses.	7. I think I will be able to use what I learn in beyond the classroom experiences in other school related areas.
8. I am very interested in the content area of this course.	8. I am very interested in beyond the classroom experiences.
9. I like the subject matter of this course.	9. I like beyond the classroom experiences.
10. It is important for me to learn the course material in this class.	10. It is important for me to learn the material from a beyond the classroom experience.
11. I think the course material in this class is useful for me to learn.	11. I think the materials from beyond the classroom experiences are useful for me to learn.

The students who participated in the Careers in STEM Club were considered highly motivated and highly interested in participating in STEM career beyond the classroom experiences. This was because these students were volunteering their time and energy to focus on STEM career beyond the classroom experiences. Special care was taken with the qualitative data from the surveys due to the fact that students might have responded with very high or maximum marks on the pre-survey. With responses that were higher to start, special care was given to make sense of the data. With this data group, proving statistical significance was difficult.

In the event that large amounts, or all, of the data gathered were not statistically significant, I collected qualitative data to help support the quantitative data. Because there was no way of knowing the quality of quantitative data before the study, it was important to build other methods of data collection into this study. Due to the mixed methods

design of this study, alternative data could ensure conclusions could be drawn at the end of the study.

Semi-Structured Interviews

I conducted semi-structured interviews (Appendix G) to collect qualitative data. Semi-structured interviews are an important method to understand participant experiences. They allow researchers to understand how participants order and interpret their experiences in the outside world (Macqueen et al., 2005). Because the interview is given in a setting that allows participants their own voice, they are able to elaborate on the connections they see among events, phenomena, and beliefs (Macqueen et al., 2005). The purpose of semi-structured interviews in this action research study was to further understand participants' motivation for STEM beyond the classroom experiences and their interest in participation in beyond the classroom experiences.

I conducted interviews with a voluntary response sample of students who participated in the club. Interviews were conducted with students who had dropped out of the program or attended less than 66% of the meetings. The participant interviews followed an interview protocol. This meant both myself and the participant were fully aware of the purpose of the interview, the format of the interview, the anonymous nature, and the type of data collection before the interview started. Then the interview proceeded with scripted questions that encouraged free responses by the participants. The interview aim was to be 20 minutes in length; however, the length did vary based on the responses of the participants. The interviews were recorded and later transcribed. The transcriptions were combined with field notes to allow for maximum data to be drawn from them.

Interviews were conducted six participants. This means 75% of the active members of the Careers in STEM Club were interviewed (Table 3.5).

Table 3.7 *Semi-Structured Interview Question Alignment*

Research question	Student survey question
How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?	Can you describe your current interest in participation in beyond the classroom experiences? Probe: Why do you feel this way? Probe: What do you think are the major factors that make you feel this way? How has this club changed your interest in participation in STEM beyond the classroom experiences? Probe: Has this change in interest in participation made you more likely to seek out beyond the classroom experiences? Why or why not. Probe: How much has your interest in participation changed since the start of the club? How has this club increased or decreased your interest in participation in beyond the classroom experiences? Probe: Are there methods or activities that caused a large increase or decrease in interest in participation? Probe: Are there other ways to affect interest in participation that were not represented in the club?

Research question	Student survey question
What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?	Before joining the Careers in STEM Club, how would you describe your motivation for STEM beyond the classroom experiences? Probe: Why do you think that this was your motivation? Probe: What were major factors that influenced your motivation? Probe: Did your motivation to participate in the beyond the classroom experiences ever change? If so, why? How has this club changed your motivation for STEM beyond the classroom experiences? Probe: Has this change in motivation made you more likely to seek out beyond the classroom experiences? Why or why not. Probe: How much has your motivation changed since the start of the club? How has this club increased or decreased your motivation for experiencing beyond the classroom experiences? Probe: Are there methods or activities that caused a large increase or decrease in motivation? Probe: Are there other ways to affect motivation that were not represented in the club?

Reflection Journals

Experiential learning requires that learners participate in active reflection (Stroller & Calvin, n.d.). This means students need structured ways to link experiences to their classroom learning. Reflecting on experiences provides students methods to think about the concrete experiences they have had in the past (A. Y. Kolb & Kolb, 2012). The

reflection journals were a method for students to process their experiences and give them a physical copy of information that could be used for later stages of experiential learning in the future.

The reflection journals used in the Careers in STEM Club were written by the students and were focused on the activities of the blended learning system. Students were asked to document their interactions with the blended learning system through questions and prompts. They were asked to explain their answers in detail. Guidance was given to students about the type of information that would be useful inside of the reflection journal. However, the sections were open for students to be able to record any information that they feel is important.

The reflection journals were assessed at the end of the 12-week period. Inductive analysis was used to assess the major themes that related to motivation and participation in beyond the classroom experiences.

Data Analysis

Data generated from this study came from both quantitative and qualitative sources. A summary of the research questions, data sources and methods of analysis can be seen in Table 3.8.

Table 3.8 *Data Analysis Alignment*

Research question	Data sources	Methods of analysis
1. How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system?	Student survey Reflection journals	Descriptive statistics Inductive analysis
2. What is the effect of a blended learning system on STEM-focused high school students' motivation to	Student survey Student interviews	Descriptive statistics

engage in beyond the classroom experiences?	Reflection journals	Inductive analysis

Quantitative Analysis

The quantitative data for this research entailed a student survey that contained two major sections: motivation to participate in beyond the classroom experiences and interest in participating in beyond the classroom experiences. Inside of the survey were 11 Likert scale statements related to motivation to participate in beyond the classroom experiences. These statements were linked to researched and reviewed scales taken from relevant scholarly sources. There were also five Likert-type scale statements related to participation in beyond the classroom experiences. These statements were also linked to researched and reviewed scales taken from relevant scholarly sources

The student survey was given as a pretest–posttest. A computer-based statistics program, JASP, was used to help organize and analyze data provided from the student survey. Descriptive statistics were generated based on the data collected. Means and standard deviations were calculated for each statement from the survey. These descriptive statistics were used to help present the findings and describe the data collected during the study. Due to the small sample size, inferential statistics were not run for this data set.

Qualitative Analysis

In this research, qualitative data were used in conjunction with the quantitative data to further understand the research questions. These data sets included participant interviews and reflection journals that provided information that related to student motivation and interest in participation. All qualitative data were transcribed into a digital format to help organize the data across all qualitative collection methods. These data sets also provided further insight into student motivation and participation. Inductive

reasoning was used to analyze the qualitative data from this study (Moghaddam, 2006). This type of analysis allowed me to condense the data into a brief summary format, establish clear links between research objectives and findings, and develop a model or theory of the raw data (Thomas, 2006). Through this, I was able to then study the data and put them back together in thematic groups that helped me identify patterns.

Inductive analysis is a bottom-up approach where reason begins with specific observations and concludes with broader generalizations (Mertler, 2020). In order for this study to follow inductive analysis, I sorted the qualitative data were into major themes that were represented within the data. The themes were derived without preconceived notions as to what may have been within the data. Once major themes appeared, I then labeled them with codes. These codes allowed me to be able to identify similar concepts and ideas that were present within the data set.

Upon completion of inductive analysis, I took time to reflect on the qualitative data generated. This reflection period involved reflecting upon the codes, categories, and themes that were generated through the data. I compared the categories and themes to the existing qualitative data to ensure alignment and to understand how they applied to the study. This allowed for a more complete understanding of the data and a more complete understanding of the themes that emerge from the data.

Finally, data were presented. Qualitative data were presented through narrative text that had thick and rich description. The narrative text focused on the themes that emerged from the qualitative data set.

Procedures and Timeline

This action research study involved five major phases: preparation, recruitment, initial data collection, data collection, and data analysis. Each phase had distinct roles for both the participants and myself as the researcher that are detailed in Table 3.7 and outlined below.

Table 3.9 *Timeline of the Five Phases*

Phase	Goals/Expectations	Timeframe
Preparation	• Gaining approvals	4 weeks
	• Course development	5 weeks
	• Resource gathering	5 weeks
Recruitment	• Morning announcements message	1 week
	• Posters hung in school halls and stairwells	
	• Face-to-face presentations in science and math classrooms	
Initial data collection	• Hold the initial Careers in STEM Club meeting	1 day
	• Give the initial data survey	
	• Deliver the consent form	
	• Explain the consent form	
Data collection	• Deliver blended content that was developed in the preparation phase	12 weeks
	• Conduct 10-minute interviews	
	• Provide reflection journal space	
	• Hold meetings twice a month	
Data analysis	• Transcription, analysis, and coding of student interviews	5 weeks
	• Coding and analysis of reflection journals	

- Data entry and statistics of survey results

Phase 1: Preparation

The preparation phase commenced at the beginning of the fall semester of the 2021–2022 Branchburg Voorhees school year. During this phase, three distinct goals were implemented: gaining approvals, course development, and resource gathering.

Gaining the proper approvals and consent necessary for the Careers in STEM Club to be a sanctioned Branchburg club was the first goal of phase 1. To have an officially sanctioned club, a new club proposal was submitted to the Student Activities Director at Branchburg High School. The proposal was reviewed by Branchburg administration and the Board of Education to determine whether it was in the best interest of the students (Appendix G). When the club was given approval by all parties, development of the blended learning system began.

Another major step in the preparation phase was to gain Institutional Review Board (IRB) approval (Appendix H). This process involved undergoing human subjects testing research through CITI program, research setting approvals, and an IRB application submission. These tasks were submitted no later than December 13, 2021, and were reviewed by the IRB. Approval by the IRB was given for the study to commence.

In order to have a blended learning system, both an online component and a face-to-face component needed to be developed. This took place between the approval phase and the implementation phase. A Google Classroom was developed and proofread by both students and advisory faculty from the University of South Carolina. The face-to-face components were worked on in conjunction with the Google Classroom.

Phase 2: Recruitment

During the second phase, recruitment, students were notified of the Careers in STEM Club. This phase started in early December 2021 and concluded with the start of the initial meeting of the Careers in STEM Club.

To ensure students were aware of the club, several methods of recruitment were used. A message was played during the morning announcements, signs and posters were displayed in the school hallways, and in-class presentations were made in science and math classes to help recruit students. The main goal of all of the types of recruitment was to notify students of the club, identify the meeting dates, and let students know the goals of the club.

Phase 3: Initial Data Collection

The inaugural meeting of the Careers in STEM Club took place during the second week in January. During this meeting, students were informed of the goals and direction of the Careers in STEM Club. Students also were made aware of the action research that would take place during blended instruction. Students were provided an electronic assent form that needed to be returned before the second meeting began (Appendix D). Parents of participating students also were provided an electronic consent form that needed to be completed before the second meeting began.

At the beginning of the initial club meeting (or before a student's first meeting if they joined late), members of the Careers in STEM Club were asked to take an online survey that contained Likert scale questions. This survey served the purpose of providing initial data that reflected the two research questions within this study. The initial survey

took students approximately 15 minutes to complete. The statements on the survey were used in the data analysis phase.

Phase 4: Data Collection

During the data collection phase, students met for blended instruction twice a month in January, February, and March for a total of six meetings in 12 weeks. In between face-to-face meetings, students were assigned online tasks designed to fulfill the online component of blended learning.

During this phase, students were asked to keep a reflection journal that was part of their online component. Students were asked to make a journal entry of their experiences once a week, allowing for them to reflect upon their experiences.

Students were interviewed during this phase of the study after the completion of the intervention. Interviews were conducted with six members of the Careers in STEM Club. Each in-person interview consisted of open-ended questions and was around 15–20 minutes in length. Each interview was recorded for transcription, which began at the conclusion of each interview.

The final data collection method was a post intervention student survey. This survey was a copy of the student survey given during the initial data collection phase. Results provided information about the growth students achieved during their time in the Careers in STEM Club.

Phase 5: Data Analysis

The data analysis phase of this research entailed quantitative and qualitative data analysis methods to qualify the mixed methods research. This phase commenced as soon as the final meeting of the Careers in STEM Club was finished, and took approximately 7

weeks. All students who participated in the pre/post student survey and the semi-structured interviews were provided an identification number and pseudonym to protect the identities of all participating students.

Data analysis of the interviews involved transcription of the recording and coding of the transcription. Major themes and concepts were then pulled from the coding to help understand the open-ended responses. Coding began at the start of the data analysis phase.

The data analysis of the reflection journals followed a similar qualitative path. Reflection journals were accessible by the researcher and were coded to identify any major themes and concepts within.

The data from the surveys were collected and entered into the JASP software package. Descriptive statistics were used to help the researcher understand the data.

Rigor and Trustworthiness

I used a variety of methods to ensure the study was both rigorous and trustworthy. The main methods were methodological triangulation, member checking, and an audit trail.

Triangulation

One of the strongest methods used to achieve this goal was triangulation. Triangulation refers to using multiple sources of evidence to build a coherent justification for themes (Creswell & Creswell, 2018). Triangulation is often associated with mixed methods research designs, which tend to be more closely aligned with action research studies (Mertler, 2020). This method of research allowed this action research-oriented

study to include multiple layers of data. These layers increased the confidence in the data by supporting them with multiple sources of evidence.

Methodological triangulation is used to increase rigor and trustworthiness by combining different methods of data collection within one study (Murry, 1999). In this study, I incorporated data from semi-structured interviews, student surveys, and reflection journals. I then evaluated the data uncovered by these different quantitative and qualitative measures for common themes. If common themes appeared across multiple evaluative instruments, then there would be increased confidence in the data.

Member Checking

During a study, it is important to ensure the qualitative findings are accurate according to the participants (Creswell & Creswell, 2018). In order to achieve this, member checking was a an important aspect of this study. Member checking was defined by Mertler (2020) as the "procedure involving the sharing of interview transcripts, analytical thoughts (such as observational notes with observer comments), and drafts with the participant of the study in order to help ensure the quality of data" (p. 312). During the study, I shared the quantitative and qualitative findings with the participants. These included the survey results, reflection journals, and interview transcripts. Participants were then asked to review these items and comment on their accuracy. Participants reviewed the documents and data sources and confirmed their accuracy.

Audit Trail

Finally, I used an audit trail to increase rigor and trustworthiness. An audit trail is described as "the systematic recording and presentation of information about the material gathered and the processes involved in a qualitative research project" (Bowen, 2009, p.

307). Audit trails offer advantages in ensuring a study is rigorous and trustworthy by allowing other viewers and researchers of the study to follow the logic and decisions made during the research process (Bowen, 2009). This helps others know the findings of the research are reflective of the data, and not the worldview or theoretical proclivities of the researcher (Bowen, 2009). As part of the audit trail, several measures were taken: a living document with all notes and changes specific to the blended learning system was created, all notes and memos from individual interviews and the blended learning system were supplied with those sources of qualitative data, and a researcher reflection journal was updated throughout the entire study.

Peer Debriefing

Peer debriefing occurs when a peer researcher is asked to assess and review documents, themes, or findings of a given study. In this study, the dissertation chair, Dr. Ismahan Arslan-Ari, acted as the peer researcher who was able to assess and review documents from this study. An arranged and standing meeting was scheduled every other week to discuss the various aspects of this study and review the documents, procedures, and data collection methods.

Plan for Sharing and Communicating Findings

Sharing the findings of this study is important for me as the researcher and the community that will benefit from this research. By sharing the findings, improvements can be made to the Careers in STEM Club and students may understand more about their beyond the classroom experiences. In order to share findings, results will be communicated to all parties who have a stake in the research.

The results of this action research about the blended learning system will be made available to several parties to investigate. The data and results garnered from my action research will be immediately shared with the participants, any other teachers who are helping with the Careers in STEM Club, any interested parties in the Science department at Branchburg High School, the administration of Branchburg High School, and the district office of the Branchburg High School District. The data and results will be summarized in an informational document and accompanying PowerPoint presentation. The results will be emailed with all listed parties with the names of students adjusted to numbers to protect their identities. Meetings will be held with any stakeholders listed above who have questions or comments about the results. Additional meetings to discuss the findings can be held at the request of any stakeholders within the study.

The recommendations made from the results will be presented in a formal manner to the administration of Branchburg High School and the district office of the combined Branchburg High School District. Though the parameters of the meeting to discuss recommendations are unclear at this time, a formal meeting will be held to help further beyond the classroom participation of students within the district.

Further sharing of this study may be expanded to local or national contexts. This may include local, national, or international conferences.

CHAPTER 4

ANALYSIS AND FINDINGS

The purpose of this action research study was to evaluate the effects of a blended learning system on the motivation and interest of participation in beyond the classroom experiences for students at Branchburg High School. I collected both quantitative and qualitative data to evaluate the following research questions: How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? and What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences? This chapter includes (a) qualitative findings and (b) qualitative findings.

Quantitative Findings

The subsequent section is a report of the methods of quantitative analysis used in this action research study. The only quantitative data source for this study was a pre/post student survey (Appendix F) given to members of the Careers in STEM Club. Descriptive statistics were calculated for each statement for both the motivation and interest in participation sections.

Overview of Student Survey

The student survey was a source of quantitative data for this action research study. The 16 statements were all aligned to the two research questions involved in this study.

To ensure the validity of the survey, it was reviewed by the dissertation advisor, Dr. Arslan-Ari.

The student survey was created in Google Forms and given to the students to fill out two separate times. The initial student survey was given to students after the first meeting, and they had 2 weeks to complete it on their own time. The second student survey was given at the conclusion of the sixth meeting, and participants had 2 weeks to complete it on their own time.

The student survey contained three sections: demographics, motivation, and interest in participation. The motivation section contained 11 Likert scale statements relating to motivation to participate in beyond the classroom experiences and had a range from 1 (*Not at All True of Me*) to 7 (*Very True of Me*). The interest in participation section had five Likert scale statements relating to interest in participation in beyond the classroom experiences with a range from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). At the end of the club, seven students completed both the initial and the second student surveys. Because the sample size for the student survey was low, reliability analysis was not run.

Motivation Descriptive Statistics

Data collected from the pre/post student surveys were downloaded from Google Forms. The raw data were formatted and entered into JASP analytic software. Means and standard deviations for both sections from the pre/post student surveys were calculated (Figure 4.1, Figure 4.2, and Figure 4.3) as were individual participant means and standard deviations (Table 4.1 and Table 4.2).

The mean of the student pre-survey motivation statements was 6.13 with a standard deviation of 0.96 (Table 4.1), and the mean of the student post-survey motivation statements was 6.01 with a standard deviation of 0.90. On nine of 11 the statements for motivation, the group responded with a score of 6 or 7 on a scale of 1 to 7. The only exceptions to this were pre motivation statement 4, “When I have the opportunity in a beyond the classroom experience, I choose experiences that I can learn from even if they don’t guarantee an external reward (money, credits, resume building elements, etc.)” and pre motivation statement 5, “Getting an external reward (money, credits, resume building elements, etc.) in a beyond the classroom experience is the most satisfying thing for me right now.”

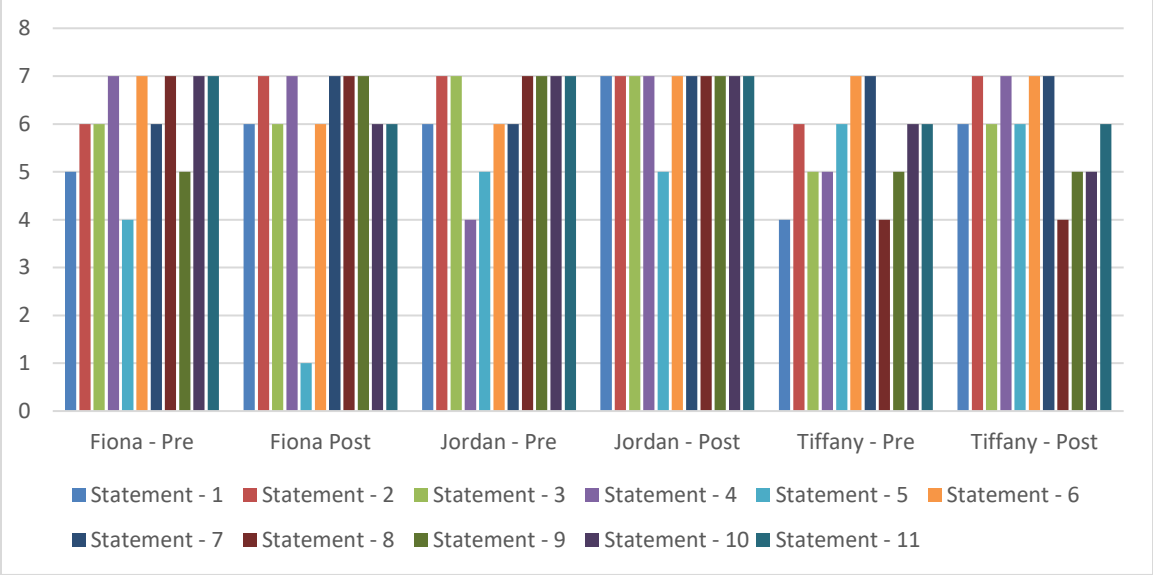


Figure 4.1 Fiona, Jordan, and Tiffany student survey responses – motivation

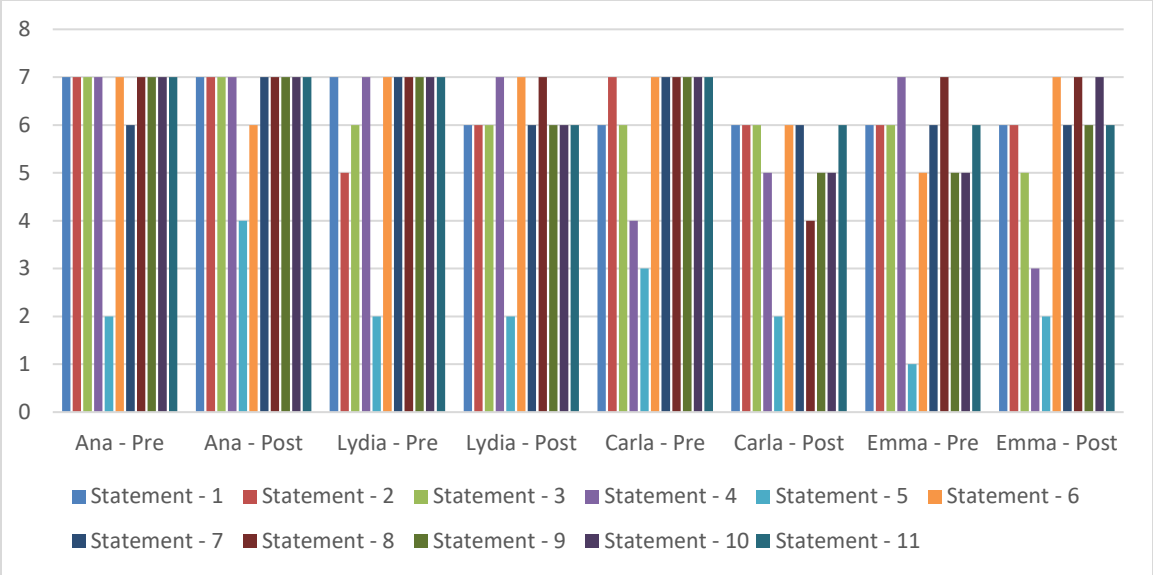


Figure 4.2 Ana, Lydia, Carla, and Emma student survey responses – motivation

Individual Descriptive Statistics. Due to the low number of participants, deeper reflection into individual participant scores was possible. Individual analysis of each participant highlights the key aspects of each participant's response. Increased analysis can be seen in Table 4.1.

Table 4.1 *Individual Student Means and Standard Deviations –Motivation*

Pseudonym	$M_{Pre\ Survey}$ (*SD*)	$M_{Post\ Survey}$ (*SD*)	$M_{Difference}$ (*SD*)
Fiona	6.09 (1.04)	6.00 (1.73)	-.09 (0.69)
Jordan	6.27 (1.01)	6.82 (0.60)	0.55 (-0.41)
Tiffany	5.55 (1.03)	6.00 (1.00)	0.45 (-0.03)
Ana	6.45 (1.50)	6.64 (0.92)	0.19 (-0.58)
Lydia	6.27 (1.55)	5.91 (1.38)	-0.36 (-0.17)
Carla	6.18	5.55	-0.63

	(1.40)	(1.63)	(0.23)
Emma	5.45 (1.63)	5.18 (1.25)	-0.27 (-0.38)
Average	6.03 (1.31)	6.01 (1.22)	-0.02 (-0.09)

***Fiona*.** Fiona is a senior who displayed a decrease in mean motivation score across the pre/post student survey (M_{Pre} = 6.09, M_{Post} = 6.00, d = -0.09). The difference in post motivation was greatly influenced by post motivation statement 5, "Getting an external reward (money, credits, resume building elements, etc.) in a beyond the classroom experience is the most satisfying thing for me right now" with a minimum score. This was the only statement with a response of "Not at All True of Me" across both pre/post surveys for Fiona.

***Jordan*.** Jordan is a senior who displayed an increase in mean motivation score across the pre/post student survey (M_{Pre} = 6.25, M_{Post} = 6.87, d = 0.55). Jordan completed the post student survey with 10 out of 11 statements at the maximum score.

***Tiffany*.** Tiffany is a senior who displayed an increase in mean motivation score across the pre/post student survey (M_{Pre} = 5.55, M_{Post} = 6.00, d = 0.45). During the post student survey, Tiffany increased her score on four of the statements, decreased her score on one statement, and responded with the same score on six of the statements.

***Ana*.** Ana is a junior who displayed an increase in mean motivation score across the pre/post student survey (M_{Pre} = 6.45, M_{Post} = 6.64, d = 0.19). The range of responses for Ana changed from 2 to 7 in the pre student survey to 4 to 7 in the post student survey. Additionally, Ana responded with a maximum interval value for nine of 11 statements in the post student survey.

Lydia. Lydia is a senior who displayed a decrease in mean motivation score across the pre/post student survey (M_{Pre} = 6.27, M_{Post} = 5.91, d = -0.36). The decrease in value was greatly influenced by the fact that in the post student survey, she decreased her score by 1 point for five statements.

Carla. Carla is a senior who displayed a decrease in mean motivation score across the pre/post student survey (M_{Pre} = 6.18, M_{Post} = 5.55, d = -0.63). This section decreased in part because Carla did not increase any of her interval values in her post student survey. From the pre student survey to the post student survey, seven statement interval values decreased and four statement interval values stayed the same.

Emma. Emma is a senior who displayed a decrease in mean motivation score across the pre/post student survey (M_{Pre} = 5.45, M_{Post} = 5.18, d = -0.27). In the post survey, Emma did not respond with any maximum interval values of 7, despite having two maximum interval values in the pre student survey.

Interest in Participation Descriptive Statistics

The mean of the pretest interest in participation statements was 4.08 with a standard deviation of 1.08, compared to a posttest mean of 4.17 with a standard deviation of 0.93 (Figure 4.3). The participants demonstrated an increase in mean interest in participation in four statements. The largest increase (d = 0.15) came from interest in participation question 1, “I will work hard in beyond the classroom experiences that involve STEM.” Only one statement indicated a decrease in mean interest in participation. This statement was interest in participation statement 3 (d = -0.15), “I am interested in beyond the classroom experiences that use technology.” Additionally, the

mean standard deviation in interest in participation statements decreased (d = -0.15), indicating a narrowing of the interval values submitted by participants.

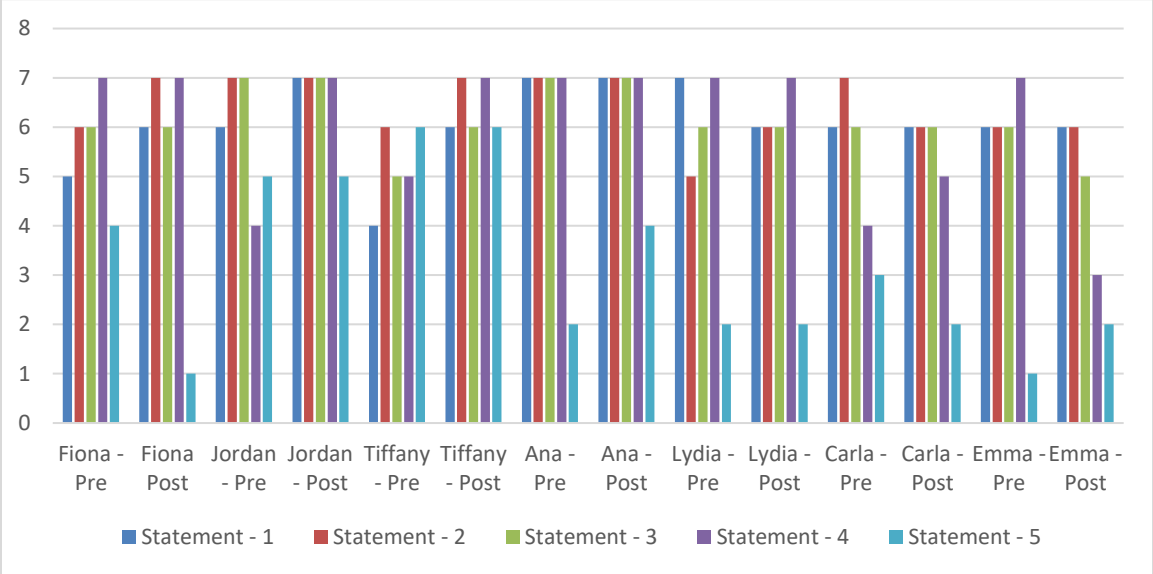


Figure 4.3. Participant student survey responses – interest in participation

Due to the low number of participants, deeper reflection into individual participant scores was possible. Individual analysis of each participant highlights the key aspects of each participant's response. Increased analysis can be seen in Table 4.2.

Table 4.2 *Individual Student Means and Standard Deviations–Interest in Participation*

Pseudonym	$M_{Pre\ Survey}$ (SD)	$M_{Post\ Survey}$ (SD)	$M_{Difference}$ (SD)
Fiona	3.60 (0.54)	4.60 (0.54)	1.00 (0.0)
Jordan	3.80 (0.84)	3.40 (0.54)	-.4 (-.3)
Tiffany	5.00 (0)	5.00 (0)	0.00 (0.0)
Ana	4.60 (0.55)	4.00 (1.00)	-.6 (.45)
Lydia	2.80 (2.85)	3.00 (1.87)	.2 (-.98)

Carla	4.20 (0.84)	4.80 (0.44)	.6 (-.4)
Emma	4.60 (0.89)	4.40 (0.89)	-.2 (0.0)
Average	4.08 (0.93)	4.17 (0.75)	0.09 (-.18)

Fiona. Fiona displayed an increase in interest in participation (d = 1.00) across the pre/post student survey. Her post interest in participation scores included three maximum scores (5 of 5) and two scores that were 1 point shy of the maximum value (4 of 5).

Jordan. Jordan displayed a decrease in mean interest in participation (d = -0.4). She responded with no maximum scores (5 out of 5) for on post survey. This is a decrease from the pre student survey where she responded with one maximum value.

Tiffany. Tiffany displayed no difference in mean interest in participation. This is due to the fact that Tiffany responded with the maximum value of 5 of 5 on every single statement in this section in both the pre student survey and the post student survey.

Ana. Ana displayed a decrease in mean interest in participation (d = -0.6). This section decreased due to Ana responding with two median scores (3 out of 5) in the post student survey. Initially, Ana had no scores lower than 4 out of 5 on the pre student survey.

Lydia. Lydia displayed an increase in mean interest in participation (d = 0.2). The number of maximum scores (5 out of 5) stayed the same across the pre/post student surveys for this section; however, the number of minimum scores (1 out of 5) decreased by one in the post student survey.

Carla. Carla displayed an increase in mean interest in participation (d = 0.6). She had no scores decrease in the post student survey. In this section, two of her scores increased from the pre student survey to the post student survey, whereas three of the scores remained the same from the pre student survey to the post student survey.

Emma. Emma displayed a decrease in mean interest in participation (d = -0.2). This decrease was the result of only one score for one question being decreased by one unit. The statement that changed value was interest in participation statement 2, "I am interested in beyond the classroom experiences that use science."

Qualitative Findings

The subsequent section is a report on the qualitative data collected in this action research study. There were two sources of qualitative data: reflection journals submitted by participants of the Careers in STEM Club after each blended learning lesson and semi-structured interviews with participants of the Careers in STEM Club that occurred after the conclusion of the Careers in STEM Club. Grounded theory was used to analyze the data collected. First and second cycle coding were used to generate categories, which were, in turn, synthesized into five major themes.

Semi-Structured Interviews

The semi-structured interviews were conducted in person during students' convenience. This included off periods, before school, and after school. Six semi-structured interviews were completed within 5 days of the end of the club. Interviews ranged from 11 minutes to 21 minutes based on student responses. These interviews were audio recorded and transcribed verbatim. This allowed me to capture the students' language and intentions for further analysis.

Reflection Journals

The reflection journals were part of the at-home assignments for participants in the Careers in STEM Club. These journals were spaces for students to record their thoughts in a prearranged Google Doc assignment. The topic of each reflection journal reflected the topic of the previous in-person lesson from the Careers in STEM Club. Each member was encouraged to submit one reflection journal after each lesson; however, participation was not mandatory. A log of the number of reflection journals compiled is provided in Table 4.3 to help organize the reflection journals. At the conclusion of the club, all submitted refection journals were downloaded and reviewed.

Table 4.3 *Summary of Reflection Journal Submissions*

Reflection journal – Assigned week	Total number of sources
Week 1	0
Week 2	7
Week 3	4
Week 4	4
Week 5	2
Week 6	0
Totals	17

There were two weeks when no reflection journals were turned in via the Google Classroom. Zero reflection journals were turned in for week one due to emphasis being placed on turning in all consent, assent, student survey, and Google Classroom information. Zero reflection journals were turned in for week six for unknown reasons. Possible reasons for the absence of reflection journals included the upcoming end of

school, possible conflicts with other clubs, and the presence of AP testing during that week.

Table 4.4 is a summary of the quantity of qualitative data sources and the number of codes generated from these data sources. This table highlights the richness of the qualitative data captured within this data set.

Table 4.4 *Summary of Qualitative Data Sources*

Type of qualitative data	Total number of sources	Total number of codes
Semi-structured interviews	6	892
Reflection journals	14	137
Totals	20	1,029

Analysis of Qualitative Data

Inductive analysis is is a method of analyzing data in order. This leads to identifying and organizing the data in important patterns and themes (Mertler, 2020), was used when analyzing this data set. The first step I used to analyze the qualitative data was to transcribe the semi-structured interviews into Microsoft Word transcripts. I then checked the transcribed interviews for accuracy by comparing them to the original audio files. I presented a printed version of each transcription to the participants for verification, which ensured even more accuracy. I then downloaded and formatted the reflection journals in separate Microsoft Word files.

First Cycle Coding

As codes emerged from the transcripts, I recorded them in pencil on the side of transcripts and journals. However, this was a messy process that created difficulty in code retrieval for the next steps of inductive analysis. Therefore, I imported the transcripts and

journals into Delve, an online qualitative analysis software program (Figure 4.1 and 4.2). Within that program, all of the journals and transcripts were recoded.

I used multiple methods of coding in this study. First cycle coding started with two rounds, in vivo and descriptive coding. The first cycle of coding happened on printed out transcripts and journal entries. I began the analysis with in vivo coding, which involves assigning codes as a word or a short phrase from the language found in the data record (Saldaña, 2021). The purpose of this type of coding is to "deepen an adult's understanding of their [students'] discourses, cultures, and worldviews" (Saldaña, 2021, p. 138). Examples of in vivo codes that were captured include "pushed me," "not able to keep up," and "outside of my comfort zone."

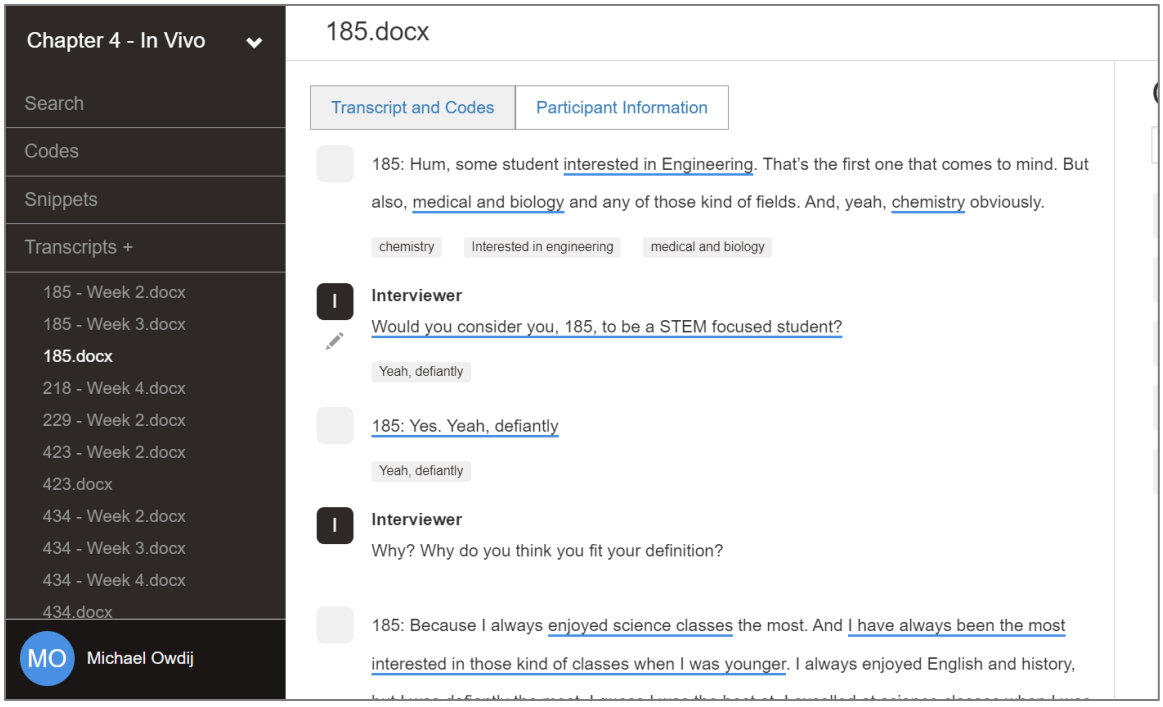


Figure 4.4. In vivo first cycle coding in Delve.

After in vivo coding, I performed another round of first cycle coding. During this second round of coding, I used descriptive coding. Saldaña (2021) stated descriptive

coding summarizes in a word or short phrase the basic topic of a passage. I used this method of coding to help understand frequencies within my codes (Saldaña, 2021). Examples of descriptive codes that were captured include “internship,” “college,” and “networking.”

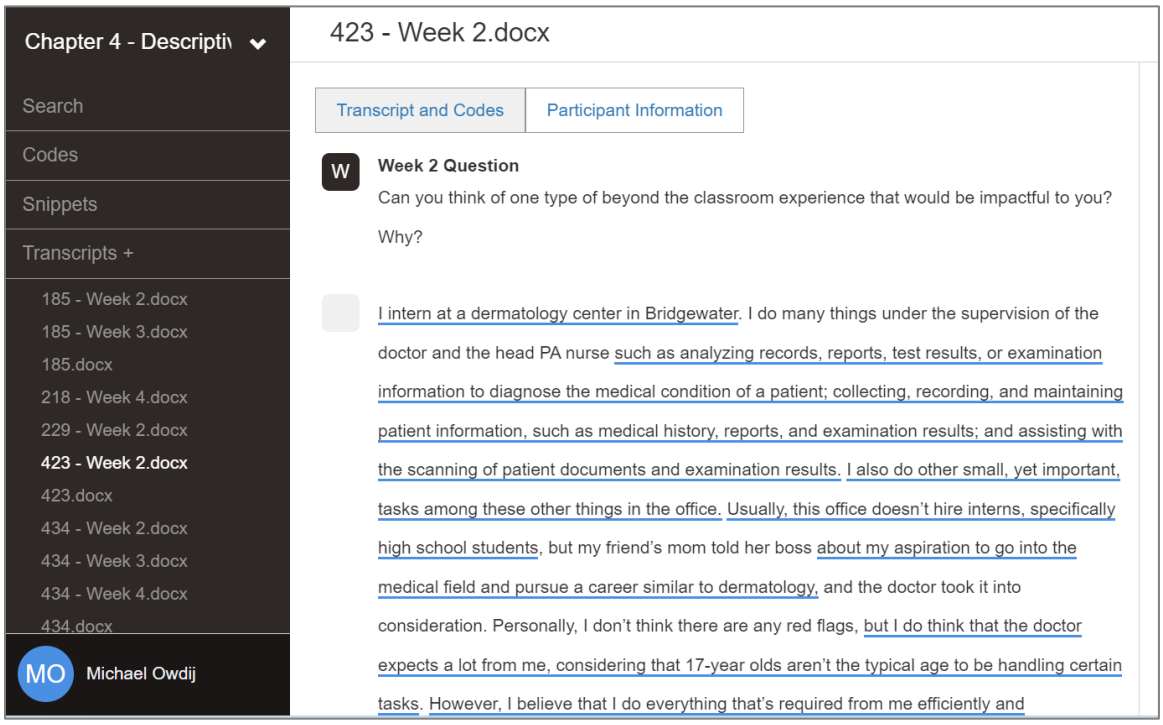
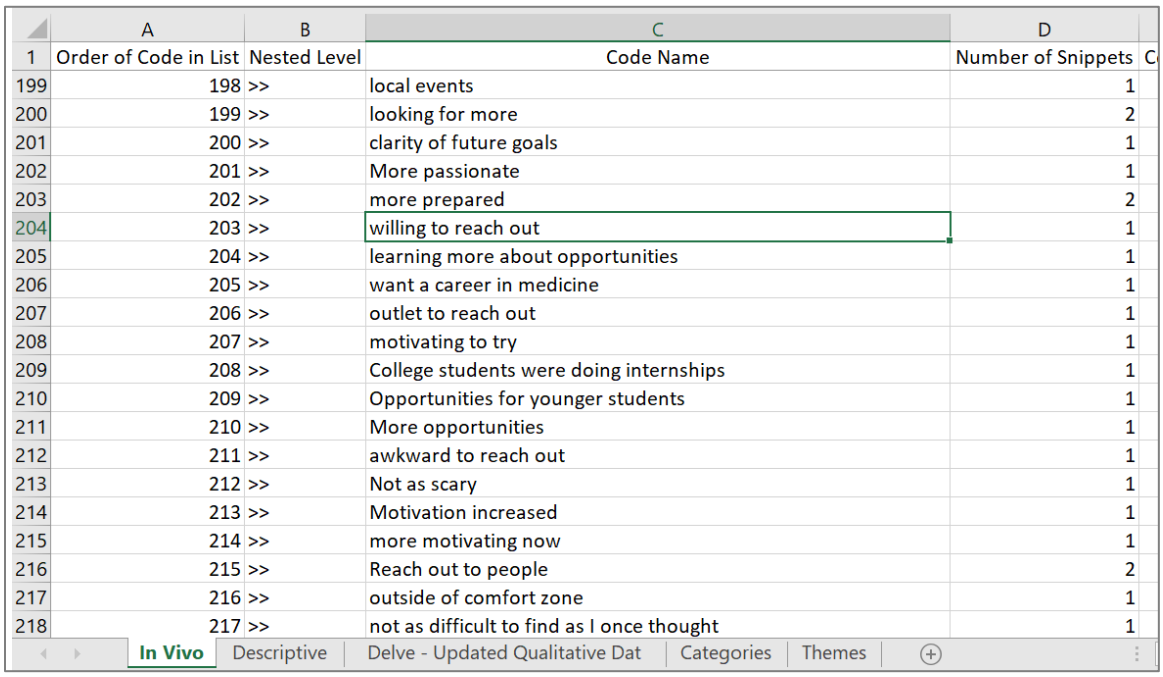


Figure 4.5. Descriptive first cycle coding in Delve.

After entering the first cycle coding data into Delve, I engaged in peer debriefing with my dissertation chair, Dr. Ismahan Arslan-Ari, to ensure the study was trustworthy and rigorous. During the peer debriefing, changes were made to the ways the in vivo codes were applied, the wording of in vivo codes were altered, additional codes were included during the descriptive coding process, and the categorization of descriptive codes was altered.

First cycle coding resulted in 1,029 individual codes. In order to efficiently group codes, I imported the codes into Microsoft Excel (Figure 4.6). Within spreadsheets, the codes could be arranged, separated, quantified, and evaluated in multiple formats.



	A	B	C	D
1	Order of Code in List	Nested Level	Code Name	Number of Snippets
199	198	>>	local events	1
200	199	>>	looking for more	2
201	200	>>	clarity of future goals	1
202	201	>>	More passionate	1
203	202	>>	more prepared	2
204	203	>>	willing to reach out	1
205	204	>>	learning more about opportunities	1
206	205	>>	want a career in medicine	1
207	206	>>	outlet to reach out	1
208	207	>>	motivating to try	1
209	208	>>	College students were doing internships	1
210	209	>>	Opportunities for younger students	1
211	210	>>	More opportunities	1
212	211	>>	awkward to reach out	1
213	212	>>	Not as scary	1
214	213	>>	Motivation increased	1
215	214	>>	more motivating now	1
216	215	>>	Reach out to people	2
217	216	>>	outside of comfort zone	1
218	217	>>	not as difficult to find as I once thought	1

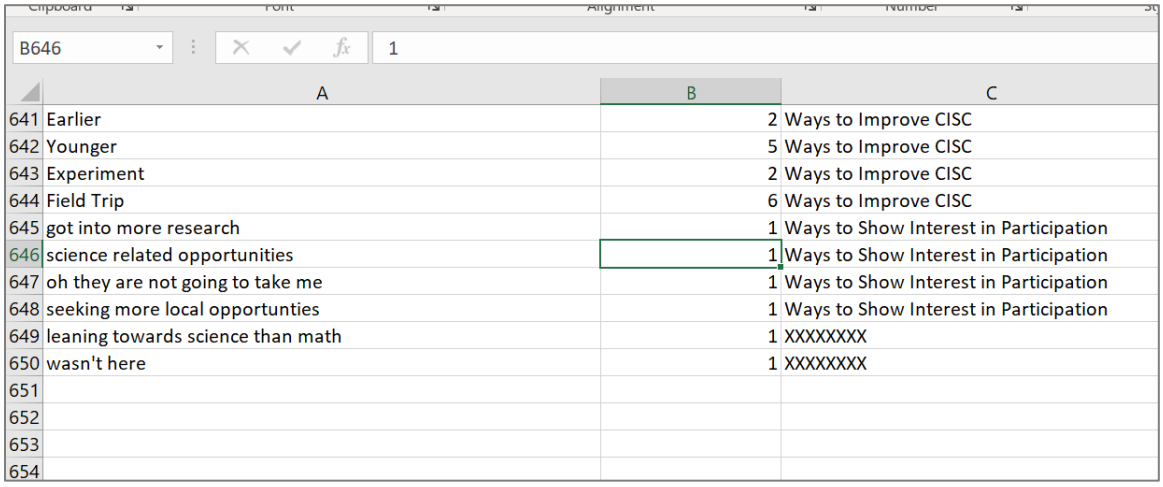
In Vivo | Descriptive | Delve - Updated Qualitative Dat | Categories | Themes

Figure 4.6. Excel transfer from Delve.

Second Cycle Coding

With the help of Excel (Figure 4.4), the codes were arranged into groupings. This was when I employed pattern coding. Saldaña (2021) described pattern coding as a method of grouping codes into smaller numbers of condensed categories, themes, or concepts. This style of coding is useful because it "pull[s] together a lot of material from the first cycle coding into more meaningful and parsimonious units of analysis" (Saldaña, 2021, p. 322). Pattern coding revealed 29 patterns emerged from the first cycle coding data. During this process, three patterns were removed from the data due to their failure to describe information that related to the research questions. Also, during this process

seven patterns were combined due to their commonalities to other patterns. The end result was 19 categories of codes that were relevant to this research study (Table 4.7).



B646 | 1

	A	B	C
641	Earlier	2	Ways to Improve CISC
642	Younger	5	Ways to Improve CISC
643	Experiment	2	Ways to Improve CISC
644	Field Trip	6	Ways to Improve CISC
645	got into more research	1	Ways to Show Interest in Participation
646	science related opportunities	1	Ways to Show Interest in Participation
647	oh they are not going to take me	1	Ways to Show Interest in Participation
648	seeking more local opportunties	1	Ways to Show Interest in Participation
649	leaning towards science than math	1	XXXXXXXX
650	wasn't here	1	XXXXXXXX
651			
652			
653			
654			

Figure 4.7. Excel pattern coding.

Table 4.1 *Category Alignment Table*

Category	Sample of relevant codes
STEM student qualities	• Interest in STEM • Passionate about what they want to study • Enjoy math and science
Self-identified as STEM-focused student	• Try really hard in science and math • Excelled at science classes • Put in effort to understand
Benefits of beyond the classroom experiences	• Loved doing it and giving people access to STEM • More opportunities more freedom • Trying to figure out major
Portfolio building	• Being able to prepare • Nowhere near perfect, could be written more professionally • Updating my resume is next
Beneficial networking	• Brought together with STEM • Discuss with like-minded students • Seeing where other people fall
New experiences	• Nice to open up to more things • Search for what I am looking for

Category	Sample of relevant codes
	• Reach out to local businesses
Confidence before Careers in STEM Club	• Start of the club I was hesitant • I did not know how • Focus has changed
Activities that increased interest in participation	• That has increased my participation • More interest in talking to people • Liked how we did the career quiz
Activities that increased motivation	• Didn't think they wanted a high school student • Not as difficult to find as I once thought • Interview increased motivation
Enjoyment of Careers in STEM Club increase learning	• Insightful and light • It was well put together • Atmosphere of the club
Time barriers	• I am very busy • If it fits around my schedule • Don't think I can dedicate time
Senior/Summer barriers	• I am going away soon • School is a bit crazy • Harder with college
Increase in motivation	• More motivation to apply • Increased by a lot • Major shift in motivation
Barriers to participation	• Not a lot of things to do here in New Jersey • Hard for high schoolers • How do I find the opportunity?
STEM career focus	• I know I am interested in engineering • Want a career in medicine • Major in electrical engineering
Increase in interest in participation	• Interest is higher because motivation is higher • Opportunity has increased interest • Made me more interested
Doing more over the summer	• I wanted to spend my summer hanging out • I got an internship

Category	Sample of relevant codes
Seeking college beyond the classroom experiences	• Look in college • Look into more riding • More on campus next year
Same level of interest in participation	• About the same level of interest

At this point, I engaged in another peer debriefing period with the members of my writing group and my dissertation chair. This was performed for two reasons: to ensure the quality of my coding methods and to gain additional perspectives on the qualitative data analysis process. Insight from peer debriefing was given about the creation of categories from both groups involved. After peer debriefing, several categories were changed, which resulted in the realignment of codes within those categories.

In synthesizing the information that emerged from the data in the first and second cycle coding and the perspectives that were added from peer debriefing, codes were arranged into categories. Saldaña (2021) stated coding creates categories that share some characteristic and represent the beginning of a pattern. Within the information that had been imported to Excel, 19 categories (Table 4.7) were synthesized into themes (Figure 4.8). These categories represent codes that were grouped due to their similarity.

	A	B	C	D	E	F	G
1	Category	Weight			Total	929	
2	**Activities that Increased Interest in Participation**	40					
3	**Activities that Increased Motivation**	87					
4	**Beneficial Networking**	49					
5	**Benefits of BTCE**	119					
6	**Doing More Over the Summer**	7					
7	**Enjoyment of CISC Increase Learning**	17					
8	**Increase in Interest in Participation**	41					
9	**Increase in Motivation**	63					
10	**Limited Options**	46					
11	**New Expereinces**	54					
12	**Portfolio Building**	69					
13	**Same Level of Interest In Participation**	1					
14	**Seeking College BTCE**	10					
15	**Self Identified as STEM Focused Student**	30					
16	**Senior/Summer Barriers**	39					
17	**STEM Career Focus**	93					
18	**STEM Student Qualities**	52					
19	**Time Barriers**	71					
20	**Unsure/Hesitant Before CISC**	41					
21							

Figure 4.8. Categories within qualitative data.

Using the codes and categories that arose from the data, I identified five distinct themes: impressions of a STEM-focused student, benefits of beyond the classroom experiences, benefits of blended learning, positive and negative changes in motivation, and positive and neutral changes in interest in participation (Table 4.8). Themes were grouped based on commonalities and cohesion to major ideas. I researched these themes to see if they connected to existing research within the educational research community. Credible links were then formed between this action research and the wider community.

Table 4.6 *Theme Alignment Table*

Theme	Categories
Impressions of a STEM-focused student	• STEM student qualities • Self-identified as STEM-focused student
Benefits of beyond the classroom experiences	• Benefits of beyond the classroom experiences
Benefits of blended learning	• Portfolio building • Beneficial networking • New experiences • Confidence before the Careers in STEM Club • Activities that increased interest in participation • Activities that increased motivation • Enjoyment of Careers in STEM Club increased learning
Positive and negative changes in motivation	• Time barriers • Senior/Summer barriers • Increase in motivation • Barriers to participation • STEM career focus
Positive and neutral changes in interest in participation	• Increase in interest in participation • Doing more over the summer • Seeking college beyond the classroom experiences • Same level of interest in participation

Presentation of Findings

Five themes were identified within the qualitative data collected (Table 4.8): (a) benefits of blended learning, (b) positive and neutral changes in interest in participation, (c) positive and negative changes in motivation, (d) impressions of a STEM-focused student, and (e) benefits of beyond the classroom experiences.

Benefits of Blended Learning

Within the qualitative data, many students stated there were benefits to the blended learning nature of the Careers in STEM Club. Students listed a variety of reasons why the blended learning nature of the Careers in STEM Club was a benefit to them on several different levels. These benefits were described by all six of the interviewed students. Students described the benefits of blended learning through (a) portfolio building, (b) beneficial networking, (c) new experiences, (d) activities that increased interest in participation, (e) activities that increased motivation, (f) enjoyment of the Careers in STEM Club increasing learning, and (g) unsure/hesitant before the Careers in STEM Club.

Portfolio Building. During the Careers in STEM Club, students had the opportunity to create documents and build skills that would be important to obtaining a beyond the classroom experience. These documents and skills included resumes, career search websites, and interview skills. These things were commonly referred to as a portfolio by the participants of the Careers in STEM Club.

One of the major hurdles to participating in a beyond the classroom experience has been the lack of job skills high schoolers possess (Krahn et al., 2002). Many students are not prepared with job search skills and portfolios. Job search skills and portfolios are the items, behaviors, techniques, and attitudes needed to successfully obtain employment (McCorkle et al., 2016). Blended learning was designed for students to get guided instruction during face-to-face portions of class. It also allowed students time to develop their own job search materials on their own time. By doing this, club participants had the opportunity to build their job search portfolio.

All six participants identified that the ability to build a career portfolio of resources and skills to help them acquire a beyond the classroom experience was beneficial. This was expressed by Emma:

> I feel like doing the resume or doing the interview skills is something very important that we don't usually get exposed to. I feel like having those skills, like me included, like, being able to practice would make me more likely to try something beyond the classroom.

Emma expressed the connection that happens when students refine and prepare a job search portfolio. By using this blended learning system, students have the opportunity to create and refine portfolio materials. This will lead to students being more confident and more likely to use their portfolio by applying for beyond the classroom experiences.

The blended learning model gives students the ability to not only build their portfolios, it gives them a chance to refine their portfolios. This gives students who may have a basic portfolio a chance to improve the items within the portfolio. Carla expressed this benefit when she stated, "I haven't had much experience and I think seeing where other people fall, and they are not sure about their resumes. And we are all just fine." She stated that even if she had a basic portfolio, the blended learning model gave her an opportunity to refine her resume with partners. This advantage allowed her to be more confident in her portfolio.

Beneficial Networking. Students that participated in the careers in STEM club had the opportunity to meet with other likeminded students. This gave them oppertunities to discuss new ideas, and see things from new perspectives. These face-to-face experiences are situations where students can benefit from interactions with peers and

teachers. In situations where peers interact, it can be an advantage for students to talk to like-minded peers. During this study, the Careers in STEM Club allowed STEM-focused students to interact and share their experiences.

One student who expressed that the blended learning approach to the Careers in STEM Club allowed for positive interaction was Tiffany. She stated, “So, um, hearing other kids’ advice and their experiences too. That also helps a lot with my interest with other experiences.” Tiffany expressed that simply by being able to relate to other participants, she could build interest in other beyond the classroom experiences. This viewpoint was shared by Emma, who stated, “I feel like being able to discuss with likeminded students, is good [because], you can help brainstorm new ideas I would have never thought of.” These statements show the advantage of blended learning allowing students to expand their experiences by synthesizing new information from others with their past experiences.

Another benefit of the blended learning model mentioned by the participants is that students can bond during face-to-face instruction. Students expressed that this was a large positive because it allowed them to genuinely enjoy their time in the Careers in STEM Club. Fiona stated:

> And I also like the getting together, that time when a lot of people were here, and we were just looking at stuff. [Because], it was kind of nice to [career search] a group, because it was more motivating to see what other people are finding and what you are finding. You know?

The added comradery attained though blended learning was beneficial to Fiona. The blended learning model allowed her to expand her ideas and enjoy the experience. Carla

echoed this idea when she said, “and like finding I guess people around me that were also interested [in STEM]. Like kind of brought together with STEM. Which is a very cool thing.” She enjoyed being able to discuss STEM topics with like-minded students. As with Fiona, it created a sense of community with similar-minded STEM students.

New Experiences. Another benefit of the Careers in STEM Club was that that it allowed time for flexibility in lessons and activities. This flexibility is a benefit to all blended learning systems (Hrastinski, 2019; Wanner & Palmer, 2015). This flexibility allows access to lessons and activities that are not available to traditional high school students. Examples used in the Careers in STEM Club were career surveys, resume building workshops, peer socialization, and editing of peer portfolio documents within the Google Suite. These new activities and experiences that were opened up with the blended learning model were a highlight for many students.

One student who highlighted the new experiences that she had access to using the blended learning model was Carla. She stated:

> I think that finding a new experience was really exciting for me. Like, meeting new people, seeing a lot of new, different things. Um, I had never seen anything before and it’s like a whole different field. It like a whole different field. Like completely crazy.

The blended learning model opened up Carla to new experiences and methods of learning. With interactions and lessons that might not be available to traditional classroom students, she was excited by the new STEM experiences she could explore. Fiona echoed this when she said, “Yeah, but. I have only seen how two people work in STEM fields. So, I try to understand how other people might, what options are out there.”

She showed how the blended learning model of the Careers in STEM Club helped her expand her scope to see new experiences beyond her own family.

Activities That Increased Interest in Participation. Within the six meetings of the Careers in STEM Club, there were many different lessons. These lessons centered around the goal of finding beyond the classroom experiences. However, each lesson contained different activities to increase students' knowledge and skills regarding obtaining beyond the classroom experiences. Participants who were interviewed had direct opinions about activities within the blended learning model that affected their interest in participation:

> Fiona: I think, again, where we looked up the stuff, that definitely piqued my interest. [Because], again, it like, I realized that there were all of these things that are near me in Branchburg that I didn't realize were there. You just have to reach out to them.
>
> Ana: Just being around my friends and other people who had similar interests was kind of interesting to me.
>
> Emma: I really liked the resume practice. Like, having also Mrs. Baratta here, because she is a guidance counselor. I thought that was interesting to have her opinion. And what I heard from all the students yesterday about other teachers. Differing levels of intimidation. That seemed pretty interesting to me.

All of the participants attached specific activities or practices within the Careers in STEM Club that were helpful to their interest in participation. The benefit of the blended learning system was students could use in-person and online methods to help increase their interest in participation. This created a varied and diverse set of activities for

students to use. Because there was such a wide range of activities, students were able to gravitate to lessons that changed their interest in participation the most.

Activities That Increased Motivation. Participants who were interviewed had direct opinions about activities within the blended learning model that affected their motivation for beyond the classroom experiences. These activities included the resume building activity, the career survey activity, and the practice interview activity. They also had detailed opinions about the activities that increased their motivation for beyond the classroom experiences.

> Fiona: Well, I guess the interviewing was a little bit scary at first. But like, I am glad that I did it. Because once I sat down, and started talking, it definitely felt more casual. My nerves went down. So, I think that was like a really big part of it. And I also like the getting together, that time when a lot of people were here, and we were just looking at stuff. [Because], it was kind of nice to do that as a group, because it was more motivating to see what other people are finding and what you are finding. You know?
>
> Tiffany: Um, I feel like doing the interview, kind of like, increased my motivation. [Because], I feel like it made it, I don't know, easier to see what it would be like.
>
> Emma: Um, I really liked the resumes. I was really sad I missed out on the interview, which was like yesterday, the interview practices. I heard from people that it was great, a lot of fun. So, I am actually disappointed I missed out on that.

Each participant identified activities that were available due to the Careers in STEM Club's blended learning model. These activities were identified as causing a direct

increase in motivation for beyond the classroom experiences. Their answers highlight how much can be accomplished in a relatively small and flexible window with blended learning. The cycling of face-to-face and online learning can help students be more prepared for club activities and building on experiences at home.

Several participants identified the mock interview as being particularly impactful. This is a key example of how blended learning can benefit students. For the mock interview, students were given information to review on their own time during an online section. Once students came in for face-to-face club time, they were allowed to build upon information and practice their skills in mock interview situations. Finally, students were then asked to reflect upon that information in their next online section. This approach allowed students to experience the mock interview in multiple ways, increasing their knowledge and skill with interviews.

Enjoyment of the Careers in STEM Club Increases Learning. The Careers in STEM Club was well received by many students. During the interviews and the student surveys, participants responded that they enjoyed the activities and the direction of the club. A student's interest in a club's theme and the activities done in the club are important. However, another important factor in a student's engagement and learning within the club is their overall enjoyment. During the semi-structured interviews, many of the participants included information about how they enjoyed the club and its atmosphere.

Many of the things the participants liked about the Careers in STEM Club were direct results of the blended learning system. The club was truly shaped by its online and face-to-face aspects. It allowed ample time for students to explore and relate to material

within the club. Grace emphasized this when she said, “I think, just, the atmosphere of the club too. It was really insightful, but also really, like, light. And like, not so much playful, but open.” She showed how blended learning can use flexibility to create a good atmosphere in the club. This allowed students to feel welcomed and confident within the club.

Confidence Before the Careers in STEM Club. One thing that surprised me during the interviews was how many students stated the Careers in STEM Club changed their confidence levels with regard to beyond the classroom experiences. Participants overwhelmingly praised the club and said it made them more knowledgeable and confident when it came to beyond the classroom experiences. Their answers showed how this was a result of the blended learning model of the Careers in STEM Club.

Grace was one participant who expressed that she was initially hesitant of beyond the classroom experiences: “Um, I feel like in the start of the club, I was a little, like, not hesitant, but I was unsure of what would go on.” Her hesitation was simply due to the fact that she did not have experience in the various aspects of finding and securing beyond the classroom experiences. As the club went on, Grace found her confidence growing: “But I feel like, as the meetings kept happening, as it got, like, more specific, I feel like I participated a lot more. There was always a sense of direction, there was always a goal.” The blended learning model allowed for clear goals and direction. That benefit enabled Grace to increase her participation within the club and increase her confidence within beyond the classroom experiences.

Ana helped emphasize this point by expressing, “I feel this club really helped me narrow down what I want to do in the future.” The benefits of the blended learning

system were impactful in changing Ana's confidence level in her future. Similar to Grace's experience, the blended learning system was able to provide focus on her ideas of her future.

Positive and Negative Changes in Motivation

How motivation changes in students is a complex topic. There are many factors that affect motivation with students (Keller, 1987; McMahon, 2014; Ryan & Deci, 2000). This means interventions that change students' environments can have complex outcomes. Students within the Careers in STEM Club had complex changes to their motivation at the conclusion of the club. The changes in motivation were things that were identified while working within the blended learning system. Within this study, all six students described positive and negative changes to their motivation for beyond the classroom experiences through (a) time barriers, (b) senior/summer barriers, (c) barriers to participation, (d) STEM career focus, and (e) increases to motivation.

Time Barriers. Because the Careers in STEM Club was a late addition to many students' roster of activities, most students expressed that a lack of time was a major factor in their motivation for beyond the classroom experiences. The time barriers that stood in the way of beyond the classroom experiences were significant to many of the students because they inhibited them from taking advantage of every opportunity from the club. With previous commitments, students had less ability to apply skills that were learned within the Careers in STEM club.

Student motivation to participate in beyond the classroom experiences can be greatly influenced by the amount of time available. This is because one of the factors in demotivation is demands outside of class (Gorham & Millette, 2009). When there are a

large number of factors that are taking up a student's time, their motivation for school-related functions decreases.

This category was clearly articulated by Emma. She first listed the long list of activities she participated in, and then related that she had no time to try beyond the classroom experiences:

> Emma: Oh, um. For me, I am very involved in many of our clubs. Like, our service clubs, interact and Relay for Life. I am on the executive committee for those. As of senior year, I'm on multiple honors societies. Including being the president of National Honors Society. Those take up most of my time senior year.
>
> Interviewer: And you're an athlete.
>
> Emma. Yes, and I do sports. Both for school and travel clubs. So, I am pretty busy. I do not have a job. So, I have no time. But, um I feel senior year would have been the year I would have wanted to do something STEM-related outside of the classroom.

Emma added, "Um, I feel like I was motivated to try different things outside of the classroom. But like due to the lack of time commitment, like, I have not been able to do much in my high school career." This clearly shows Emma's motivation was affected by time barriers. Her lack of time to commit to beyond the classroom experiences hampered her motivation change.

Fiona also expressed that time barriers were a factor in her motivation for beyond the classroom experiences:

> I think I wanted them, like when I had the time. I definitely, like over the summer especially. [Because], that is when I started working at that one job. Like, when I

have the time to do those kind of things [beyond the classroom experiences]. But, it is always hard.

Her motivation for beyond the classroom experiences was related to her ability to commit time. She later referenced that it was more than just the beyond the classroom experience that was the time barrier, "But, it is always hard. How do I get there? Like, how do I find that opportunity? So, I think that the motivation was there, but I did not know how." Aspects other than the experience itself, such as application and transportation, were also factored in as time barriers.

Senior/Summer Barriers. The Careers in STEM Club was initially designed as a club for juniors and seniors. This decision was made due to the age and knowledge restrictions present in many beyond the classroom experiences. Younger students may not have the knowledge or qualifications needed to apply for many beyond the classroom experiences. This left the club populated by nine seniors and two juniors. An interesting subset of time barriers was revealed within the semi-structured interviews. Many of the seniors related that the summer of their senior year was a unique timer barrier that factored into their motivation for beyond the classroom experiences. An example was Fiona:

> Fiona: Only because of, like the senior thing. Like, just [because] I am going away soon and I don't want to dedicate like *[long pause]* I don't know *[long pause]* I feel bad…. Dedicate my interest in those things without being able to stay and give my enough to those programs. If I could like do something for 1 day, or go see an architecture firm near here, I would definitely do that for sure.

Her motivation was affected by her time barriers as a senior. Without the proper amount of time to commit to beyond the classroom experiences, she was unsure whether she should even start them. This greatly affected her motivation for beyond the classroom experiences.

Another participant who expressed that senior year was a unique time barrier was Carla:

> Carla: I tell you, it's a little hard to say. Like, specifically . . . as a senior . . . it's getting a little…. It's a little difficult to stay on top of everything. I think . . . if I am going to be completely honest.

Carla expressed that her motivation was linked to the difficulty of balancing her time barriers as a senior. She expressed that the difficulty in becoming more motivated for beyond the classroom experiences was related to the time commitment of being a senior in high school.

Interestingly, the senior and summer barriers were not present for the only junior student who was interviewed. Ana expressed that the Careers in STEM Club increased her motivation for beyond the classroom experiences in the summer: "I think, just, it gave me more motivation to apply for stuff this summer especially, I mean, I really want to be in the lab, so hopefully it works out." This was in direct contrast to the seniors who expressed the opposite viewpoint. With a perception that she would have time over the summer, Ana expressed that she would be more motivated to seek beyond the classroom experiences.

Barriers to Participation. The last major set of barriers that affected participants' motivation were barriers to participation. There were two major barriers to

participation mentioned by the participants. The first barrier to participation was the ability to find beyond the classroom experiences. The second barrier to participation was the inaccessibility of field trips.

According to SDT, autonomy can increase a student's intrinsic motivation (Ryan & Deci, 2000). In theory, this should fit in with New Jersey beyond the classroom experiences. New Jersey is home to a workforce of over 116,000 biopharma employees (Terry, 2022) and houses 14 of the top 20 worldwide companies (Pharmapproach, 2020). There should be ample opportunity for students to find and apply to beyond the classroom experiences in New Jersey. However, in practice the result is quite different. Some students who were interviewed stated their motivation was affected by limited local options. The participants had a perception that New Jersey does not have options for students in their situation.

One participant who expressed this opinion very clearly was Tiffany. She simply and clearly stated how her motivation was linked to her perceived limited options:

> Tiffany: Um, I wasn't really that motivated, honestly. Because, I just feel like, um, it's just hard to find…. Yeah, like, for high schoolers.

Tiffany expressed that it was not only hard to find these options within New Jersey, they were even harder to find for students her age. Though research shows there are options out there (*Lists of Pharmaceutical Companies In New Jersey*, 2020), some students were not making that connection before or after the intervention.

Another example of this idea was Fiona. She stated, "But, it is always hard. How do I get there? Like, how do I find that opportunity? So, I think that the motivation was there, but I did not know how." Fiona's motivation was affected and limited by the

options she felt she was presented with. Fiona had the feeling that there was not a lot of opportunity with the limited options. Her age, location, and ability created a situation where she was not able to find beyond the classroom experiences.

Finally, this was expanded upon by Carla: “Um, I think it has been nice to open up to more things. Because no one really helps facilitate it. And, trying to do a lot of stuff, but, it’s really hard to find where to do it.” Carla explained that her motivation was affected because it was hard to find beyond the classroom experiences.

Another major barrier to participation that affected motivation was school promotion of field trips. Emma, Tiffany, and Fiona all mentioned that field trips were linked to their motivation:

> Emma: One specific type of experience that would be particularly useful would be getting to experience engineering in the real world whether it was going on a field trip somewhere or getting to do an experiment.
>
> Tiffany: Um, maybe if we like took a field trip somewhere.
>
> Fiona: I wish I was able to go on more, as like field trips.

Also, the barrier to participation was mentioned by Fiona. This particular barrier was based off of Branchburg field trip policy that requires all field trips to be self-funded. She stated:

> Fiona: I feel we did a lot, not a lot, but more definitely in middle school. Like field trips I guess, I know high school doesn’t do field trips that often…. No, but *[long pause]* yeah they are always fun when we do them. Sometimes stressful.

Therefore, Branchburg's policy of not funding field trips was a barrier to participation. This barrier directly and indirectly affected the motivation of multiple participants by making field trips more rare.

STEM Career Focus. The students who attended the Careers in STEM Club do not represent a typical student at Branchburg High School. These students take time out of their self-identified busy schedules to come to a club after school that is focused on STEM beyond the classroom experiences. Students in this club also self-identify as STEM-focused students. Because these students are focused on STEM, they have aspirations to continue to study STEM as they progress to higher education and the workforce. This career STEM focus was something students identified as a major motivational factor.

One example of how the participants' career focus affected their motivation was displayed by Emma. She stated:

> I am going to major in electrical engineering. Um, but like my fear is that I am going to get there and I am going to absolutely hate that kind of engineering. Because I have had no exposure to it before.

Fiona used the club as a way to explore her STEM career focus. Her ability to learn more about beyond the classroom experiences was motivating to her because it allowed her to avoid some of her fears about a STEM career focus. This was also seen in Tiffany's interview:

> Definitely, the fact that I want a career in the medical field, but also um, in college I plan on majoring in Bio. So, I think maybe learning a little bit more

about opportunities and careers that could focus around that could really be a big factor that influences me.

Tiffany wanted an opportunity to explore the STEM career on which she was focused. By attending the Careers in STEM Club, she was able to explore her STEM career focus and become more motivated.

Increases in Motivation. There were many ways in which motivation for beyond the classroom experiences was affected during the course of the Careers in STEM Club. The previously listed categories all had negative and mixed responses. However, when directly asked whether the Careers in STEM club positively or negatively affected their motivation, participants indicated it had a positive effect:

> Ana: Um, initially I was going to kind of spend the summer relaxing, I guess. Because it is the last summer before college. But, like, being part of the club, I guess, like, I kind of started to look for more research opportunities, and that is how I got into applying for those, like, Liberty Science Center ones, and that kind of stuff.
>
> Grace: Um, I'd say, like, a lot. Um, because like before, like I said, I was really hesitant. But I think this really helped me gear towards being more prepared. That was like a major shift in my motivation.
>
> Fiona: Probably somewhere in between a little and a lot. It is definitely encouraging to know like, it is not as scary as I once though it is. But it still is a little awkward to reach out to those people. But I definitely increased it.

The positive responses to motivation for beyond the classroom experiences were seen across all participants interviewed. This indicates participants were motivated by the blended learning system despite the other outside influences that affect students.

Positive and Neutral Changes in Interest in Participation

Beyond the classroom experiences are an excellent resource for students. However, for students to be fully rewarded by the benefits of a beyond the classroom experience, students need to actively participate. Building interest in participation in STEM requires affecting science identity and interest levels in STEM (Baker, 2013). By having students learn more about the roles they fit within the STEM community and giving them new pathways to explore, students can increase their interest in participation.

All six participants within this study expressed an increased level of interest in participation or a neutral level of interest in participation by discussing (a) doing more over the summer, (b) seeking college beyond the classroom experiences, (c) same level of interest in participation, and (d) increase in interest in participation.

Doing More Over the Summer. A very clear indication of students having an increased level of interest in participation is planning a future beyond the classroom experience. Several students used the skills they learned within the classroom to plan future beyond the classroom experiences. These students used the opportunity of the freedom of the summer to explore their options and apply to beyond the classroom experiences.

One student who was interested in summer beyond the classroom experiences was Tiffany. In her reflection journal, Tiffany wrote,

> A beyond the classroom experience that would be impactful to me would be some sort of internship or summer program for engineering. A program over the summer would be most ideal because I would be more available during that time.

Tiffany aligned the benefits of the freedom of the summer with her interest in engineering. Her recognition that she could gain the most from a summer beyond the classroom experience during that time showed a level of increased interest and planning.

A student who showed they increased their interest in participation, particularly over the summer, was Ana. In the beginning of her interview, Ana stated, "Um, initially I was going to kind of spend the summer relaxing, I guess." Later in the interview, Ana expanded, "Like I said before, kind of, I wanted to spend my summer just, like, hanging out. And now, I am kind of more motivated to get up and actually, like, participating more. Like, science-related opportunities. So . . ." Ana changed her position from spending her summer relaxing to spending her summer exploring beyond the classroom experiences because of the Careers in STEM Club.

Seeking College Beyond the Classroom Experiences. Another indicator of interest in participation in beyond the classroom experiences was the willingness to seek them out in the future. Students who showed interest in finding these experiences in the future demonstrated that they wanted to seek out positions beyond the classroom and were willing to use the skills they acquired in the Careers in STEM Club. One participant expressed their interest in finding beyond the classroom experiences in their next step in education in detail. Carla explained that the Careers in STEM Club pushed her to find college beyond the classroom experiences:

> Carla: But I know that I will try to apply, maybe, for like the riding company in Vermont, where I go…. Yeah. I asked about it when I went last time. And I will be going back tomorrow to, inquire more.

This clearly shows Carla was interested in participating in beyond the classroom experiences, as she was seeking them out at her upcoming university. Carla continued, "I definitely got into more research like finding out how I can participate with more on-campus stuff next year. Like, involving my interest, of like EMS." The Careers in STEM Club caused her to be more interested in participating in EMS at a new school, and positively affected how she approached beyond the classroom experiences in her college experience.

Same Level of Interest in Participation. When directly asked whether the Careers in STEM Club affected their interest in participation in beyond the classroom experiences, one participant out of six expressed the same level of interest. However, Fiona did not directly express that the Careers in STEM Club was the direct reason for the same level of interest:

> Fiona: No, my interest is the same. Only because of, like the senior thing. Like, just [because] I am going away soon and I don't want to dedicate like *[long pause]* I don't know *[long pause]* I feel bad…. Dedicate my interest in those things without being able to stay and give my enough to those programs. If I could like do something for one day, or go see an architecture firm near here, I would definitely do that for sure.

Fiona expressed that her interest did not increase due to time issues. This was similar to the ways that time barriers, summer barriers, and senior barriers affected motivation for

many participants. Fiona was not interested in finding experiences that may be time consuming with college looming on the horizon. This only left her with smaller and shorter beyond the classroom experiences. With a lack of availability, her interest did not increase or decrease.

Increase in Interest in Participation. When directly asked whether the Careers in STEM Club affected their interest in participation in beyond the classroom experiences, five of the six participants expressed that it increased their level of interest:

> Emma: Um, I think this has increased my interest a good bit. Because, obviously you like, you know, I feel like as a senior that, oh you should do internships and try to actually get do stuff in your field. But I think that having the opportunity to do this, has increased my interest in actually thinking about it. Oh, like, it's not too soon. I should go out and do new things.
>
> Carla: Oh, it definitely increased. Um, I think, same with like the finding, how I wanted to participate, and like finding I guess people around me that were also interested. Like kind of brought together with STEM. Which is a very cool thing.
>
> Grace: Yeah, definitely, like I said before . . . Um, yeah, no. I think it really has. Because, um, I am really interested in STEM. And so, I feel like any opportunity that I have, even if it is not related to the medical field, even if it is something like, I don't know, data analysis, or something like, simple like that, I think that can also help a lot. I feel like I would get more experiences of what I want to do in the future. And maybe just, maybe it can also change my idea of what I want.

All five participants were effusive that their interest increased. Many of the responses indicated several specific aspects of the club that helped increase their interest. Emma

identified that the club made her realize opportunities existed, Carla indicated the club drew together like-minded students, Ana showed how the club made her find new experiences, and Grace stated more experiences in her chosen field could help her future career. These specific aspects of the club were instrumental in creating a positive change in their interest in participation.

Impressions of a STEM-Focused Student

Students who place focus on STEM classes will by definition develop a relationship with STEM curricula that may lead to increased motivation and interest in participation within STEM beyond the classroom experiences. This is supported by research that shows students who display interest in a subject matter will have increased motivation within that subject matter (Bye et al., 2016; Reeve, 1989). This topic becomes important to understand due to the STEM focus that was the foundation of the Careers in STEM Club. Within this study, all six participants explored their personal beliefs of (a) STEM-focused student qualities and (b) self-identification as a STEM-focused student.

STEM-Focused Student Qualities. Every student who was interviewed had beliefs about the qualities a STEM-focused student possesses. During the semi-structured interviews, students were asked to explain their own personal definition of a STEM-focused student. Each student gave a different answer, though many of the answers contained the same content. Commonalities between answers were that STEM-focused students showed interest, passion, and drive for STEM classes or subject matter.

This information aligns with previous research that showed students will assign more importance to academic tasks that can differentiate themselves from their peers, or

tasks that will relate them to their peers (Gray, 2014). Therefore, students who are focused on the STEM fields will be placing more importance and focus on these subjects.

Emma expressed this when she stated a STEM-focused student is "someone that has an interest in science, technology, engineering or math and is willing to take those courses on their own free will. It's not just part of the curriculum." Her inclusion that STEM-focused students place more importance on STEM classes by seeking them out. The motivation is not just as a requirement. Another example of a participant who shared the belief about increased importance was Ana. Ana expressed that a STEM-focused student is "Um, somebody who is like, self-driven to get into the science field. Gets hands-on experience." This shows Ana believes STEM-focused students place enough importance on STEM that they are willing to go out and seek hands-on experience. This is the weight they place on STEM subjects.

Self-Identification as a STEM-Focused Student. During each semi-structured interview, students were asked whether they believed they were a STEM-focused student. Every participant responded that they self-identified as a STEM-focused student. Additionally, each student was asked to describe why they self-identified as a STEM-focused student. The answers from each student contained varied information about why they self-identified. Despite the different answers, enjoyment of STEM courses and information was seen across all of the participants' answers.

Some students who answered the question were direct in their reasoning for self-identification. Tiffany simply stated, "Um, [because] I enjoy math and science classes." This shows her clear enjoyment of the subject matter contained within STEM courses. However, others were more specific about their enjoyment of STEM activities. Grace

self-identified with specific activities, stating, “Definitely, I mean I have done an internship at a dermatology center. Um, and I really enjoyed it. I did finish it like last month, but I really enjoyed that.” Her acknowledgement of enjoyment of specific STEM activities links to the idea that STEM-focused students do not simply have to like STEM coursework. They can enjoy activities and beyond the classroom experiences that relate to STEM.

Another commonality that existed within many of the semi-structured student interviews was the idea of interest. An example of students self-identifying and relating interest was Carla. Carla identified multiple aspects about STEM that were interesting, stating,

> Um, I think I am really interested in how the body functions and physics and how it works. And I think learning more into that is really interesting. Um, I think I am really interested in how the body functions and physics and how it works. And I think learning more into that is really interesting.

Carla’s interest in STEM defined her as a STEM-focused student. This was also reflected in Fiona’s answer: “Because I always enjoyed science classes the most. And I have always been the most interested in those kind of classes when I was younger.” Her interest from a young age helped her self-identify as a STEM-focused student.

Benefits of Beyond the Classroom Experiences

One of the most fundamental parts of the Careers in STEM Club is introducing students to beyond the classroom experiences. These experiences are important in the experiential learning model when used as concrete experiences (D. A. Kolb, 1984). Beyond the classroom experiences are also a great way for students to learn (Kisiel,

2006; Mallya et al., 2012; Wilson et al., 2019) and gain experience in areas of interest (Knobloch, 2003; Vong & Vrkljan, 2020). The Careers in STEM Club was designed to create positive impressions that will allow students to see the benefits of beyond the classroom experiences. All six participants in this study discussed the benefits of beyond the classroom experiences.

Many participants identified that beyond the classroom experiences were a great resource for them to learn about and explore career options. One student who identified this was Fiona. When asked about why she thought beyond the classroom experiences were important, she stated:

> I guess going into college, trying to see what it might be like to work in a STEM field, like. [Because] with, when you're a senior, trying to figure out what you want to major in. Trying to figure that out and seeing what a job might be like after college.

This shows Fiona identified key elements of beyond the classroom experiences that are supported by research. She understood she could gain clarity on her career focus, learn what a job might be like, and gain experience in a field. Emma echoed this sentiment when she stated:

> It's beneficial to a lot of students. Because now there are a lot of kids that are doing their own startup businesses from a young age. So, there are already kids that are really ahead of the field, so getting some experience in whatever STEM field is really beneficial.

She understood the information and experience that can be learned from beyond the classroom experiences can be greatly beneficial. She identified that beyond the classroom experiences can really put a student ahead in a field of interest.

Chapter Summary

Quantitative and qualitative analysis were performed on the data collected from the participants in the Careers in STEM Club. Quantitative data collected from the student survey showed participants' interest in participation increased across four of five statements and increased across a collective mean, whereas their motivation decreased across five of the 11 statements and decreased across a collective mean. Qualitative data collected from the reflection journals and semi-structured interviews revealed five major themes: impressions of a STEM-focused student, benefits of beyond the classroom experiences, benefits of blended learning, positive and negative changes in motivation, and positive and neutral changes in interest in participation.

CHAPTER 5

DISCUSSION, IMPLICATIONS, AND LIMITATIONS

This chapter highlights the intersection of the findings of this study with the current literature. The purpose of this action research study was to evaluate the implementation of a blended learning system on the motivation and interest in participation in beyond the classroom experiences for high school students. During the course of quantitative and qualitative evaluation, information was gleaned from the data. By analyzing the quantitative data, information about students' perceptions of the blended learning system arose. By analyzing the qualitative data, five major themes emerged: the benefits of blended learning, positive and neutral changes in interest in participation, positive and negative changes in motivation, impressions of a STEM-focused student, and benefits of beyond the classroom experiences. This chapter contains a (a) discussion, (b) implications, and (c) limitations of the study.

Discussion

To fully understand and answer the research questions involved in this action research, I used multiple methods: quantitative data collected within this study, qualitative data collected within this study, and existing research from the academic community. The following research questions guided the study: How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? and What is the effect of a

blended learning system on STEM-focused high school student's motivation to engage in beyond the classroom experiences?

Research Question 1

How does interest in participation in beyond the classroom experiences change after STEM-focused high school students participate in a blended learning system? During this research study, I explored interest in participation in beyond the classroom experiences through quantitative data from student surveys and qualitative data from semi-structured interviews and reflection journals.

Increases in Interest in Participation

In this study, the overall mean score for participants who completed the student survey increased. However, this increase was not seen for every participant in the student survey. Individually, three participants increased their scores for interest in participation, three participants decreased their scores for interest in participation, and one participant kept the same score, which was the maximum possible value in both surveys.

The overall results of this study align with the current research and even expand on some areas. Research shows blended learning can have a positive impact on student participation within an educational environment (de Barba et al., 2016; Demosthenous et al., 2020; Green et al., 2014; Tayebinik & Puteh, 2013). Additionally, blended learning that uses experiential learning models can increase academic outcomes for students (Beckem & Watkins, 2012; Maier & Thomas, 2013; Zhai et al., 2017). Those results were also seen within the current study. When all of the participants' scores were averaged together, their mean score increased in the post survey.

One way in which this research expands upon the existing research is in the ability to analyze individual student responses. Due to the small sample size within the study, individual descriptive statistics were calculated for this research question. Results showed not every participant responded with an increase in interest in participation despite the mean increasing. Therefore, the increases in interest in participation were larger than the decreases. This can help inform other research that may not account for interest in participation on an individual level.

Another way in which this research expands on the current research on blended learning relates to the specific aims of this research. Unfortunately, there is little research in interest in participation in beyond the classroom experiences. Most research focused on changes in participation and engagement levels. These topics are related to the focus of this study, though the change in engagement resulting from blended learning was not explicitly explored.

This study provided a valuable opportunity to understand how participation, engagement, and interest in participation overlap. The students who participated in the Careers in STEM Club indicated through quantitative and qualitative data that their interest in participation in beyond the classroom experiences increased due to the intervention. The student survey had five statements that related to student interest in participation: (a) I will work hard in beyond the classroom experiences that involve STEM (statement 1), (b) I am interested in beyond the classroom experiences that use science (statement 2), (c) I am interested in beyond the classroom experiences that use technology (statement 3), (d) I am interested in beyond the classroom experiences that use math (statement 4), and (e) I am interested in beyond the classroom experiences that use engineering (statement 5). In

the post-intervention survey, the statements for hard work, interest, math, and engineering showed increases in mean scores. This aligns with the existing research that showed blended learning increases student engagement with educational materials (G. Cheng & Chau, 2016; Hussein, 2015). The largest increase came from the statements that related to hard work and engineering. These increases could be explained by the qualitative data collected in the semi-structured interviews. Three students who were interviewed had an interest in engineering, and those topics were deeply explored within the content of the Careers in STEM Club. Students were asked to put in extra effort to explore their future career goals, which caused these students to explore engineering. These students were directly putting in additional work (i.e., statement 1) to explore engineering (i.e., statement 5).

The only statement that showed a decrease in the post survey related to technology. This change was also explained through the qualitative data. Of the six participants who were interviewed and in all of the reflection journals collected, no students mentioned they wished to pursue a career centered around technology. Participants listed engineering fields, laboratory research fields, and medical fields as areas of interest for future careers. Though all of these fields use technology, none are identified as strict technology fields. Because students were asked to explore their own interests in future careers, this caused them to distance themselves from technology career fields.

During the semi-structured interviews, students were directly asked whether the blended learning system affected their interest in participation. Of the six participants, five answered that their interest in participation increased during the intervention.

Students responded with, “I think, same with, like, finding how I wanted to participate,” “with this club, it showed me any opportunity including STEM, you should definitely take it . . . It could also increase your interest in STEM a lot,” and “I’d say it changed it in a really positive manner . . .But, I think like this club, it’s really good at researching local areas for STEM-related careers, or just maybe just, small experiences.” These statements expanded upon the student survey results and indicated that not only were students increasing their interest in participation, the increase was directly related to the blended learning system.

Students also indicated specific activities within the blended learning system were instrumental in increasing their interest in participation. When asked whether there were specific activities that increased their interest in participation, students had a variety of positive responses: “I liked how we did, um, the career quiz. I feel like that, kind of opened up other options,” “having also Mrs. Baratta here, because she is a guidance counselor. I thought that was interesting to have her opinion,” and “Yeah, I also liked the interview.” These activities, which were available due to the blended learning system, had a positive impact on students’ interest in participation.

Of the specific activities that students mentioned, the majority related to the career portfolio. The career portfolio was a generalized name we gave to material or skill that would be helpful in securing a beyond the classroom experience in the future. Some students referenced the skills acquired during the intervention: “I think like this club, it’s really good at researching local areas for STEM-related careers, or just maybe just, small experiences,” “where we looked up the stuff, that definitely piqued my interest,” and “doing the interview skills is something very important that we don’t usually get exposed

to." Other students referenced documents or materials that would be valuable to them in the future, "like I said I really liked the resume practice" and "the career survey." This shows the portfolio of skills and materials that was built using blended learning increased interest in participation. This was best summarized by a participant who stated, "being able to practice would make me more likely to try something beyond the classroom."

An additional advantage of the blended learning system on interest in participation was the flexibility to combine face-to-face instruction with online instruction. This advantage opened up many new paths of communication for the students in the Careers in STEM Club. Due to the blended nature of the club, students were able to share ideas and work with students who shared interests. Many participants indicated the ability to meet and discuss STEM careers with like-minded students was impactful on their interest in participation in beyond the classroom experiences. Participants explained, "just being around my friends and other people who had similar interests was kind of interesting to me" and "finding, I guess, people around me that were also interested. Like, kind of brought together with STEM. Which is a very cool thing." These students were able to reap the benefits of blended learning and increase their motivation with the help of their peers.

Neutral Effect on Interest in Participation

One student did not report a change in interest in participation. She stated, "My interest is the same." When she elaborated on why this club had a neutral effect on her interest in participation, she stated, "Like, just [cuz] I am going away soon and I don't want to dedicate . . . my interest in those things without being able to stay and give my enough to those programs." In this case, the blended learning system was not able to

overcome the student's time barriers. The pressure of being a senior and leaving for college within a few months limited her interest in participation.

Summary of Interest in Participation

Results of this study showed the implemented blended learning system had a generally positive impact on students' interest in participation in beyond the classroom experiences. Students who participated in the Careers in STEM Club showed an increase in quantitative data, while expounding on their results with qualitative data. The structure of blended learning and the activities it allowed students to perform caused students to want to participate in beyond the classroom experiences. However, this positive impact was not universal as students saw a decrease in interest in participation in technology fields and one student reported a neutral effect in terms of interest in participation.

Research Question 2

What is the effect of a blended learning system on STEM-focused high school students' motivation to engage in beyond the classroom experiences?

Research into motivational models shows multiple factors influence student motivation (Keller, 1987; Reeve, 1989; Ryan & Deci, 2020). How these factors are affected by the blended learning system implemented in the current research was explored in two major ways: through the ARCS model of motivation (Keller, 1987) and self-determination theory (Deci & Ryan, 2000). Both methods of analysis were important to this study due to the conflicting quantitative and qualitative data collected. Additionally, students provided data that fit both models of motivation, so both were analyzed to provide more comprehensive answers to the research question.

ARCS Model of Motivation

The ARCS model of motivation emphasizes that attention, relevance, confidence, and satisfaction all play a role in motivation for students (Keller, 1987). Information provided by the student survey, reflection journals, and semi-structured interviews showed student motivation for beyond the classroom experiences did not align between the quantitative and qualitative data. Students indicated their motivation was not uniformly positively affected or uniformly negatively affected by the Careers in STEM Club. One possible explanation is that the standards of the ARCS model were affected by multiple factors within the Careers in STEM Club. The following sections address the data collected on the topics of (a) attention, (b) relevance, (c) confidence, and (d) satisfaction.

Attention. The first focus within the ARCS model is attention (Keller, 1987). This focus is rooted in grabbing the student's attention due to it being a prerequisite for learning. Teachers use attention to increase motivation by accessing learners' interests and curiosity (Keller, 1987). In previous studies, blended learning was shown to be more effective than online learning for holding and fostering attention among university students (Ma & Lee, 2021). However, blended learning has not shown an increase in attention compared to face-to-face instruction (Ma & Lee, 2021). Other studies showed blended learning helped increase attention post COVID-19 in highly motivated university students (Durrani & Kamal, 2021). The findings within the current study expand on the previous research in two ways. First, they describe beyond the classroom experiences and blended learning. Second, they explain the dynamics of motivation and blended learning

in high school students, an area that currently has limited research. These differences help explain why there are differences between the previous research and the current study.

During the student survey, two statements were designed to assess student attention: “I am very interested in beyond the classroom experiences” (motivation statement 8) and “I like beyond the classroom experiences” (motivation statement 9). The mean value for motivation statement 8 decreased after the intervention. The mean value for motivation statement 9 remained the same in the pre-intervention and post-intervention student survey.

The student survey data were supported by student interviews. During the student interviews, four of the six students identified time barriers as a factor that decreased their attention and interest in beyond the classroom experiences. Students used phrases such as “I just feel like I don’t really have that much time” and “I don’t want to go there and then be like, flakey” as examples of why their attention was not changed by the intervention. The time barriers posed by the lifestyles of high school students were impactful on students being able to give their full attention to beyond the classroom experiences. This resulted in mixed results when assessing attention change.

Relevance. The second focus within the ARCS model is relevance (McMahon, 2014). Relevance draws learners into educational materials by allowing them to see the purpose of the learning activities in which they will be participating. Previous research showed blended learning systems do not provide an increase in relevance when compared to face-to-face learning or online learning (Ma & Lee, 2021). The results from this research did not directly align with previous research.

During the student survey, two statements were used to assess students' ideas about relevance: "I think I will be able to use what I learn in beyond the classroom experiences in other school related areas" (motivation statement 7) and "I think the materials from beyond the classroom experiences are useful for me to learn" (motivation statement 11). The mean value for motivation statement 7 increased after the intervention. However, the mean value for motivation statement 11 decreased after the intervention. These results show students did not have a uniform increase or decrease in relevance during the course of the Careers in STEM Club.

Interestingly, all of the data collected from the semi-structured interviews indicated students made connections between the beyond the classroom experiences and their real life during blended learning. This differed from the quantitative data collected because of the overwhelming positive alignment of their statements. This indicates there was nuance to the changes in relevance that was unable to be captured in the qualitative data.

Students connected their beyond the classroom experiences after the intervention by making statements such as "trying to figure that out and seeing what a job might be like after college" and "just like getting experience. Like, [cuz] I wanna, like, work in a STEM-related field. So, just like, getting out there and getting experiences that aren't sitting in a classroom." With these statements, students were demonstrating they understood the connections between the beyond the classroom experiences and their life and future career. This shows the students increased their ability to connect the material they learned within the Careers in STEM Club with their life.

Additionally, every student made direct references to the blended learning aspects of the Careers in STEM Club affecting relevance. This happened when they stated, “I haven’t had much experience and I think seeing where other people fall, and they are not sure about their resumes. And we are all just fine” and “it made me realize that, like, these companies want my help. Or want me to be working with them. I feel like before, I did not feel that way.” These students were expressing that the activities in the blended learning system helped them make connections to the real world. Specifically, students frequently referenced that the resume building, interviews, and career survey were impactful in connecting the blended learning to their life.

Confidence. The third focus within the ARCS model is confidence (McMahon, 2014). The feeling of confidence with the material gives students the feeling that they are learning and are capable of succeeding within their lessons. Research shows blended learning can increase confidence in post-COVID-19 students (Durrani & Kamal, 2021). Blended learning can also increase confidence within students when compared to online learning, though it does not show an increase compared to face-to-face learning (Ma & Lee, 2021). The quantitative data and the qualitative data collected within this study did not align, making it difficult to relate to previous research. Quantitative data collected showed student confidence decreased after the intervention, whereas the qualitative data strongly indicated student confidence increased. The difference between the types of data can be accounted for due to the high starting confidence of students within this study.

The student survey had one statement aligned to confidence, “In a beyond the classroom experience, I prefer material that really challenges me so I can learn new things” (motivation statement 1). The mean value for this statement decreased after the

intervention. Interestingly, the qualitative data did not reflect the same finding. Interview participants indicated they were more confident because of the blended learning activities: “I feel like I am more prepared now. I feel like I am more willing to reach out to . . . other firms or places of employment.” Other students responded, “Because I know the process now more so. Before I was like going in blind. And now, at least I know how to start that process” and “it made me realize that, like, these companies want my help. Or want me to be working with them. I feel like before, I did not feel that way.” These are all statements showing students were confident in their abilities to find beyond the classroom experiences.

One possible explanation for the decrease in quantitative confidence may be the students’ high pre-intervention responses. The Likert scale statements were evaluated on a scale from 1 to 7, and the pre-intervention mean of 6.86 for this statement was very high. Five of the seven participants responded with a score of 6 or 7. Though it may have been possible for students to increase their confidence, there was not a large opportunity for growth. An indication that there was some growth in confidence can be seen in the standard deviations of the participant responses. The pre-intervention standard deviation of 1.07 was over double the post-intervention standard deviation of 0.49. This shows that though the mean may have decreased, students’ responses were more grouped around the mean and showed decreased variance.

Students’ responses to motivation statement 1 may have been so high due to the fact that all six students who were interviewed, five of whom overlapped in the student survey, identified as STEM-focused students. When directly asked why they self-identified as a STEM-focused student, participants responded that it was due to their

passion for STEM, their previous beyond the classroom experiences with STEM, and their high achievement levels with STEM. These responses indicate these students would have high pre-intervention responses to motivation statement 1.

Satisfaction. The fourth focus within the ARCS model is satisfaction (McMahon, 2014). Student satisfaction will be achieved if a teacher has successfully achieved the first three focuses of the ARCS model. Previous research indicated students who learn from a blended model have increased satisfaction when compared to face-to-face learning and online instruction (Ma & Lee, 2021). Blended learning was also found to increase satisfaction in post-COVID-19 students (Durrani & Kamal, 2021). These studies showed students had an overall increase in satisfaction when qualitative data were analyzed and a neutral affect when quantitative data were analyzed.

The student survey had one statement related to satisfaction: “The most satisfying thing for me in a beyond the classroom experience is trying to understand the experience as thoroughly as possible.” The mean value for this statement remained the same after the intervention. Only two participants changed the values of their responses to this statement after the intervention and the change was only one integer in each case.

Once again as with motivation, the qualitative data did not align with the quantitative data collected. Multiple participants within the interviews specifically referenced their overall satisfaction with the overall blended learning system. Examples of this were “I think you did a really good job,” “the atmosphere of the club too. It was really insightful, but also really, like, light,” and “it is definitely interesting the concept. I hope more people will join.” Students also stressed their satisfaction with individual activities in the blended learning system: “I really liked the resume practice,” “I liked

how we did, um, the career quiz. I feel like that, kind of opened up other options," and "I also liked the interview."

Self-Determination Theory

Another method of evaluating motivation is SDT, a theory that is based on the idea that an individual's performance and their well-being are linked by the type of motivation they have for the activities they perform (Deci et al., 2017). This method of evaluation can be applied in many settings, though it is very popular within education. This is because SDT helps describe student behavior based on the motivations of students (Evans, 2015). Therefore, SDT was an important theory to help assess the complex data collected within this study.

SDT has important ties to blended learning. In multiple studies, SDT has been shown to have a positive effect on a blended learning environment (Joo et al., 2013; Sergis et al., 2018; Tan & Hew, 2016). Research shows that when the principles of SDT are applied to blended learning, there are positive outcomes for student achievement and motivation (Joo et al., 2013; Sergis et al., 2018) as well as increased student engagement with the blended learning environment (Tan & Hew, 2016).

SDT separates motivation into two major categories, intrinsic motivation and extrinsic motivation (Ryan & Deci, 2020). The following sections explore both (a) intrinsic motivation and (b) extrinsic motivation and how they relate to the findings from this action research.

Intrinsic Motivation. The first aspect of SDT used within this study was intrinsic motivation. Intrinsic motivation has multiple definitions, but the one used in this study was proposed by Legualt. Legault (2016) defined intrinsic motivation as "engagement in

behavior that is inherently satisfying or enjoyable" (p. 1). This open-ended definition allows for application to a large variety of behaviors and actions. The existing research shows it is possible to increase students' intrinsic motivation though intervention (Rosenzweig & Wigfield, 2016). This research was reflected in the current study due to the fact that both quantitative and qualitative data sources showed an increase in intrinsic motivation.

During the student survey, two statements were used to asses students' ideas about intrinsic motivation: "In a beyond the classroom experience, I prefer material that arouses my curiosity, even if it is difficult to learn" (motivation statement 2) and "When I have the opportunity in a beyond the classroom experience, I choose experiences that I can learn from even if they don't guarantee an external reward (money, credits, resume building elements, etc.)" (motivation statement 4). The responses to both of these statements increased in the post-intervention student survey. These data indicate students had an increase in motivational areas that were defined by Legault (2016).

Furthermore, the responses provided by participants in the semi-structured interview were important in explaining the rise in intrinsic motivation. When asked whether the blended learning system affected their motivation for beyond the classroom experiences, every participant indicated a positive change in motivation. As examples, participants responded with "increased by a lot," "little to medium change," and "I would say it has increased."

Participants then were asked to provide activities that caused a change in motivation. During this section of the interview, all of the students provided examples that were related to intrinsic motivation. Responses ranged from "I think it was

motivating to try, and realize that I could participate in those kind of things," "I feel like doing the interview, kind of like, increased my motivation. [Cuz], I feel like it made it, I don't know, easier to see what it would be like," to "I really liked getting to go see the other teachers. It was nice." The students' ability to relate their responses to factors that were inherently satisfying or enjoyable (Legault, 2016) show how there was an increase in intrinsic motivation. These responses also show how the blended learning system facilitated activities that increased students' enjoyment and satisfaction with beyond the classroom experiences.

Extrinsic Motivation. Extrinsic motivation is the second important part of SDT used in this study. Legault (2016) stated extrinsic motivation is "fundamentally contingent upon the attainment of an outcome that is separable from the action itself" (p. 1). Extrinsic motivation is a useful tool in improving educational outcomes. Though research on extrinsic motivation is not uniform, it has been shown that extrinsic rewards can increase student investment (Covington & Ueller, 2001) and academic performance for some students (Diseth et al., 2020; Liu et al., 2020).

The student survey had one statement aligned to extrinsic motivation: "Getting an external reward (money, credits, resume building elements, etc.) in a beyond the classroom experience is the most satisfying thing for me right now" (motivation statement 5). The mean value for this statement decreased after the intervention. This indicates the need for external rewards decreased during the intervention.

An explanation for the decrease in participants' extrinsic motivation was observed during the semi-structured interviews. Participants indicated one of the impactful things about the blended learning system was the fact that it increased their familiarity with

beyond the classroom experiences. Responses similar to “I think that finding a new experience was really exciting for me” were recorded. This was supported by other students expressing that the blended learning system opened new doors into career paths, “but like, now, like, learning about more science-related careers, I see that there are more options.” Many participants had their view of STEM careers expanded by the blended learning system. With that opportunity, they were less focused on external rewards, such as family approval, money, prestige, and other external factors, and more motivated to find something that would be a fulfilling career. One student expressed, “I mean I still want to learn, but like can I sustain this for a longer amount of time?” This shows how extrinsic motivation shifted as a result of the blended learning system.

Summary of Motivation

The data collected for motivation were not linear and required a thorough analysis to understand. Through the use of the ARCS model for motivation, it became clear the blended learning system influenced mixed increases and decreases in motivation when it came to attention, relevance, and confidence. However, the blended learning system influenced an increase in motivation when it came to satisfaction. Through the use of SDT, the data showed the blended learning system increased intrinsic motivation and decreased extrinsic motivation among the participants.

All of these data points show that the blended learning system was not uniform in its change in motivation. Some aspects of participants’ motivation were increased, whereas other aspects of motivation decreased. The complexity of these results indicates the need for more research on student motivation for beyond the classroom experiences.

Additional study will enable researchers to understand more about ways to positively affect student motivation for beyond the classroom experiences.

Implications

This section contains a discussion of the implications based on the data analyzed during this action research. The following sections cover (a) personal implications, (b) implications for a blended learning system focused on beyond the classroom experiences, and (c) implications for future research.

Personal Implications

Through this action research study, I gained additional insight about the role of experiential learning. Through analysis and reflection on the data collected within this study, I have realized I have changed my feelings about experiential learning and its use within the educational system.

Beyond the classroom experiences that are rooted in the four major tenets of D. A. Kolb's (1984) experiential learning model have been shown to increase student learning outcomes (Beckem & Watkins, 2012; Maier & Thomas, 2013; Wyrick & Hilsen, 2002). This powerful learning method has the potential to create powerful and lasting learning environments for students. I know this first-hand because as a college student I had the opportunity to participate in beyond the classroom experiences rooted in experiential learning. These experiences included lab research, student teaching, and educational observation/reflection. These experiences made a profound impact on the direction of my education and future career and were why I used experiential learning within the Careers in STEM Club.

However, now that I have had the ability to see others engaging with this style of learning, my opinion has slightly changed. Before this research study, I viewed experiential learning as a high-level teaching philosophy that had nothing but positives to offer students. In my personal view, it was a superior form of teaching that should be used by as many educators as possible. However, through this research I have realized that experiential learning is not correct for every scenario. Based on the analysis of my data, I now understand that experiential learning requires a large time commitment by both teacher and student and is only appropriate when both parties have the time to commit to this style of learning.

Teachers who are using experiential learning have to make a large time commitment to their classrooms. I now understand this due to the setup and rollout of the Careers in STEM Club. Trying to juggle the concrete experiences, reflective observation, abstract conceptualization, and active experimentation took a lot more time than I had originally expected. This was exaggerated with the limited time that was available with an after-school club. The brief 45-minute period that was allotted for the Careers in STEM Club often felt rushed due to juggling the multiple aspects of experiential learning. For teachers to be able to use experiential learning correctly, they need to understand the time requirements for this style of learning. Educators need to be able to plan appropriately and use lessons effectively based on their personal time constraints.

Experiential learning time commitments are also shared by students in slightly different fashions. Through the Careers in STEM Club, this became apparent when students were absent from the club. The nature of the Careers in STEM Club running into the timing of other after-school clubs created several situations where students were

absent due to other commitments. During the course of the club, students who missed one session had difficulty catching up due to the cyclical nature of experiential learning. When students missed a concrete experience, they often were unsure and hesitant to complete the other steps of the experiential learning cycle. This negatively affected their overall takeaway from the club.

Though my opinion on experiential learning may have changed, I still believe it to be a powerful learning method. When both students and educators can make the commitment to experiential learning, it has been proven to improve educational outcomes (D. A. Kolb, 1984). However, I now believe it is not correct for all educational situations, just situations that are able to fully use its powerful learning advantages.

Implications for a Blended Learning System Focused on Beyond the Classroom Experiences

Through this action research, several insights into connecting students to beyond the classroom experiences with a blended learning system surfaced. Two of the insights that are important to the Careers in STEM Club are (a) considering time restrictions to STEM-focused students and (b) understanding the timing of a blended learning system.

Considering Time Restrictions to STEM-Focused Students

The time commitments that are put on the modern high school student are significant. High school students average 7 hours a weekday at school, 2.5 hours of work/housework/homework on weekdays, and 3.5 hours of work/housework/homework on the weekends (Marshall, 2007). Additionally, students feel significant stress from the high school environment, with female students feeling higher rates of stress than male students (Anniko et al., 2019; Marshall, 2007). These significant time commitments need

to be considered when designing a blended learning system for beyond the classroom experiences.

The students who participated in the Careers in STEM Club were not immune to the stress from high school. In fact, several of the students had more commitments than was indicated in current research. Commitments including jobs, sports, AP classes, and college preparation were all mentioned as activities that occupied the time of these students. Additionally, beyond the classroom experiences were perceived as a large time commitment by the students who participated in this study. Due to that commitment, they could be seen as an additional stressor to an already busy lifestyle.

Through this research, I learned students need time to be able to integrate beyond the classroom experiences into their schedule. Though students increased their interest in participation during the course of the Careers in STEM Club, their motivation did not uniformly increase. Through the semi-structured interviews, I found that students wished they could find more low time commitment experiences, including field trips, competitions, and single-day opportunities. Though this was a focus of the club, it often took a back seat to other longer experiences, including internships, jobs, research positions, and shadowing opportunities. Further consideration needs to be given to evaluate the available time of students within the Careers in STEM Club. This will help funnel students toward beyond the classroom experiences that are appropriate for their time restrictions.

Understanding the Timing of a Blended Learning System

One of the benefits of blended learning is that it can be adapted to the needs of students (Motteram & Sharma, 2009). Educators have the ability to adjust the timing,

layout, and student participation of the activities within. By using blended learning, teachers can adapt to the needs of students on a more personal basis (Garrison & Kanuka, 2004). This flexibility is a major boon to students who are engaged in blended learning.

As it relates to the purposes of the Careers in STEM Club, this flexibility needs to be considered when recruiting members to the club. Originally, the idea was to recruit students who were high school juniors and seniors. This would allow the Careers in STEM Club to recruit students who had a greater science background, were more able to transport themselves to beyond the classroom experiences, and had a clearer perspective of their future college major/career. However, the seniors within the club reported having additional commitments within their high school career that restricted their ability to dedicate time to beyond the classroom experiences. The need to apply for college and having only one summer before they left their hometown were factors the students mentioned. These activities affected motivation for beyond the classroom experiences from the senior population.

In future iterations of this club, it will be important to consider the timing of the Careers in STEM Club and use the flexibility of blended learning to students' advantage. For this club to maximize the impact on students, it should include students who are in their sophomore year in high school or younger. The flexibility and personalization of blended learning would allow instructors to have students who were initially not considered to thrive within the club. Students could tailor their activities to their personal situation and abilities for blended learning. Activities and discussions could be altered to include solutions to the less advanced science backgrounds, limited transportation options, and future major and job search possessed by younger students.

Alongside this alteration, recruitment for younger students would be increased to help bring more of these students into the club. This would provide younger students additional time to interact with the blended learning system before they are limited by the time commitments that come with being a senior in high school. The additional unimpeded time may have a positive impact on students' motivation for beyond the classroom experiences.

Implications for Future Research

The findings of this study lead to multiple avenues for future research. These avenues would provide a way to continue the action research cycle. Following these future directions would allow the cyclical nature of action research to continue (Mertler, 2020). All of the future avenues would be ways to further the knowledge of blended learning, beyond the classroom experiences, motivation, and interest in participation. Additionally, future action research could be used to decrease the limitations that were present in this study. This would include the sample size, the STEM focus of all participants, and the dual role of teacher and researcher.

Topics for future research include (a) motivation affected by blended learning, (b) implications of senior year of high school on motivation, and (c) combinations of research.

Motivation Affected by Blended Learning

Studies have shown blended learning has an impact on student motivation (Islam et al., 2018; Owston et al., 2013). This is important for educators to understand because some aspects of motivation can be positively affected by blended learning. However,

questions about how blended learning affects different aspects of motivation could be explored with further research.

Implications of Senior Year of High School on Motivation

Using the ARCS model of motivation, teachers can motivate students within the classroom (Keller, 1987). This idea is backed by the tenets of SDT that reinforce that intrinsic and extrinsic motivation are key for student success (Deci & Ryan, 2000). However, students who are seniors in high school have unique circumstances that are not seen at any other level of primary education. The increased freedom, the stress of graduation, and the time commitment that college brings provide seniors with unique challenges. Future research into how motivation is affected during this educational period would expand the knowledge on how to motivate students.

Combinations of Research

There is voluminous educational research into many of the major aspects of this research study. This surfeit of research includes research on blended learning, experiential learning, motivation, and interest in participation. However, research into the intersection of these topics is limited. It would be of interest to conduct future studies that combine blended learning and aspects of beyond the classroom experiences, such as motivation and interest in participation.

Limitations

This action research study, like all studies, had limitations. The research performed in this study was action research, meaning the research was specific to the circumstances and environment of the researcher (Mertler, 2020). Though results may be locally informative, they are likely unfit for a broader generalization. Additionally, during

this action research I acted as both the teacher and researcher. This means the data generated may have positionality, meaning participants may have been looking to appease their teacher while responding to me as a researcher.

Limitations were also present in the collection of data. The quantitative student survey was limited by a small selection of statements. This may have produced skewed results due to the small number of questions. It also prevented a reliability assessment of the student survey. A larger sample size would allow for a more comprehensive evaluation of quantitative data.

Additionally, the qualitative data generated were only from the perspectives of individual students, though the club was designed as a collaborative process. Without a method of collecting qualitative data in a group format, the research may not reflect the true ideas and positions of the participants.

Additionally, the sample sizes generated for the student surveys, refection journals, and semi-structured interviews were small. The decreased sample sizes limited the quantitative findings by limiting assumptions of normality and the reliability of the data. The small population size for the qualitative data limited to perspectives that could be compared.

Finally, this study was limited to students who would be interested in a club with a focus on STEM careers. Students who volunteered to participate in this club were already inclined toward STEM careers, and all students interviewed self-identified as STEM-focused students. This alignment by students does not reflect the larger population of the broader research setting.

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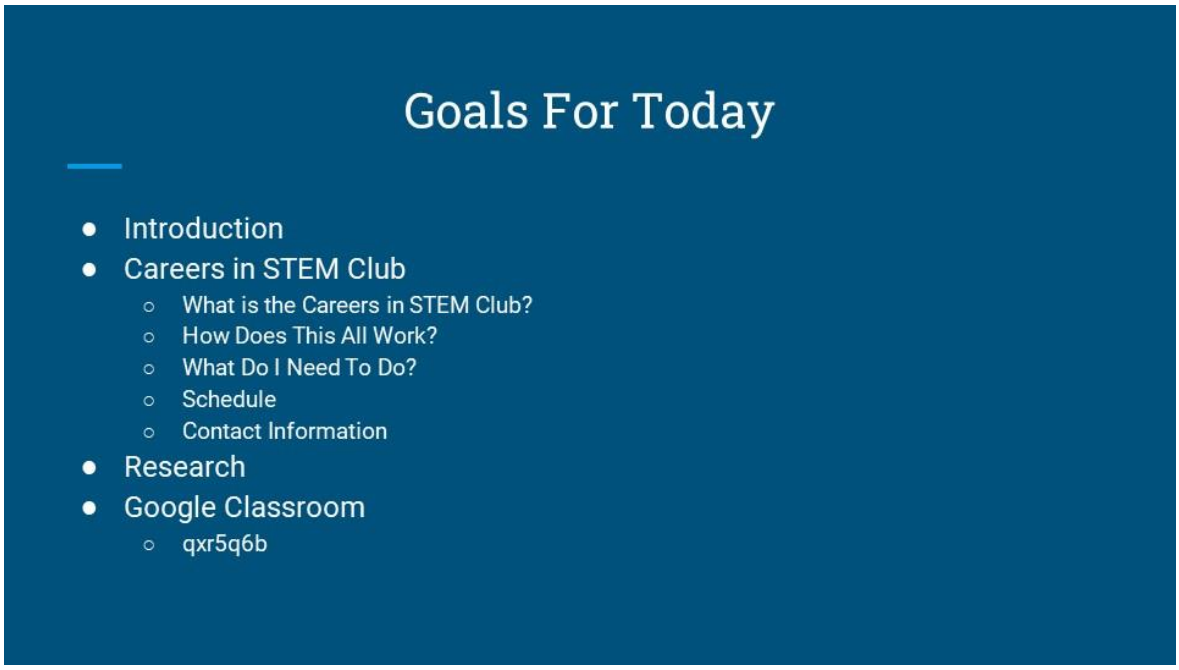
APPENDIX A

PRESENTATION SLIDES FROM THE CAREERS IN STEM CLUB



Introductions

- Let's take a minutes and introduce ourselves!
- Please give us some or all of the following information…
  - What is your name?
  - Why are you here?
  - What interests you about STEM?

What Is The Careers In STEM Club?

- This club is for STEM focused students that are thinking about a career in a STEM field
- The goal of this club is to give you real world experiences
- These "Beyond the Classroom" experiences will give you insight about your future careers in STEM
- We will use a "hybrid learning" model to help teach you everything that you might need to know about these experiences

How Does This All Work?

- We will meet every other week to talk about the different elements that are needed to have beyond the classroom experiences
- This includes…
  - Where do I find beyond the classroom experiences?
  - What do I want to do?
  - Applications
  - Interviews
  - Resumes
  - Guest speakers
  - And more

What Do I Need To Do?

- This club is very simple!
- Show up to meetings
  - Please try to make as many meetings as possible!
  - We will try to avoid conflicts such as sports, band, and plays!
  - The meetings will be the best chance to learn about that week's major topic
- Work one some things at home
  - We will encourage you to work on things when you have spare time at home
  - Example: If we are learning about how to write STEM resumes, you might be asked to work on your resume at home

Schedule

- We are going to try to meet every other week
- This entirely depends on weather conditions
  - It is winter in New Jersey… anything can happen!
- Current meeting dates are…
  - January 6th, 20th
  - February 10th, 24th
  - March 10th, 24th
  - April 6th, 28th
  - May 12th, 26th
- The current meeting dates are listed on Google Classroom

Contact Information

- This information is posted here and on the Google Classroom!
- Contact us anytime you need to talk to us!
- Mrs. Baratta
  - kbaratta@nhvweb.net
  - Guidance Office
- Mr. Owdij
  - mowdij@nhvweb.net
  - Room 251

Research

- Mr. Owdij is currently in graduate school at the University of South Carolina
- I am going to be using a large number of the skills and techniques that I have learned at USC during this club
- I would like to be able to collect data from members of this club
  - This data would be entirely confidential
  - It would involve a pre/post survey, reflection journals, and a possible interview
- You do not need to be part of the research to be part of the club!
  - There will be no difference between those that participate in research and those that do not!
- I will pass out forms for both you and your parents to sign if you would like to participate!

Thank You For Coming!

What Is Out There?

Finding Beyond The Classroom Expereinces

Raise Your Hand if you knew...

- New Jersey is known as the Medicine Chest of the country
- Many countries use NJ as an example when setting up pharmaceutical industries
- There are over 100 different Biotech companies in New Jersey
- New Jersey employs the largest percentage Biotech workforce in the nation
- You currently sit within 30 minutes of six major hospitals

Quick and Informal poll

- Let's just see who has connections to STEM in the classroom
- Raise your hand if you have a parent that works in…
- A Science field
- A technology field
- An engineering field
- A Math Field
- Just for perspective, everyone raise your hand if you have a parent that works in a STEM field

New Jersey

The simple fact is that New Jersey contains a large number of STEM jobs. These jobs are generally high paying and have high rates of satisfaction.

Many of these institutions are willing and able to offer opportunities to students that are exploring STEM. You have the unique opportunity to get a jump start on your career during high school!

What Is Out There?

There are many institutions that are looking for motivated people to help their company or organization. Both private companies and public institutions are looking to work with high school students!

There are a wide variety of experiences that are available to high school students. These experiences come from every field of study, and can help any student!

Where Do I Look?

Places that you can find STEM beyond the classroom experiences:

1. Colleges
2. Businesses
3. Hospitals
4. Research labs
5. Medical offices
6. Family members/family friends

What Can I Find?

Many beyond the classroom experiences are waiting for you!

Examples of beyond the classroom experiences that you can find:

1. Research opportunities
2. Collegiate learning experiences
3. Shadowing opportunities
4. Internships
5. Jobs
6. Informal learning experiences

What Should I avoid?

There are many different types of beyond the classroom experiences. However, not every experience is right for everyone!

Before applying, please be sure to find out if the beyond the classroom experience is:

1. Safe
2. Affordable
3. Fits within your schedule
4. Something that you can commit to

What Are People Looking For?

- There are different types of beyond the classroom experiences.
- Almost all of these experiences require different types of qualifications/credentials.
- These qualifications/credentials will bar the entry to most of these experiences.
- Knowing what is required of you will look prepared for these experiences!

Don't Worry!

- We are here to help!
- This club is designed to help students put together good credentials
  - We will focus on the things that a high school student needs to present
  - We want you to be able to present yourself in a professional manner!
- Over the next few weeks we will work on developing and enhancing things that will be required!

Let's Take a Second

- Everyone grab a blank piece of paper!
- Do me a favor…
  - Write down anything that might need when applying to a beyond the classroom experience
  - Put a check mark next to it if you have one already
  - Add a "+" if you feel that your item is currently ready for applications

Major Things You Will Need (Part 1)

- Good Grades/Proof of Good Grades
  - Many different experiences will ask that you have good grades
  - Typically these grades will have to meet certain standards
    - Ex: 3.0 GPA, "A"s in Honors science classes
  - You will be able to get a transcript from the guidance office
  - You often do not need to be the top of the class, just have good grades
- A resume
  - A resume is a document that shows others your background
  - This is common in experiences that are internships/jobs
  - Resumes have a particular style to highlight key features
    - We will review what a good STEM resume looks like

Major Things You Will Need (Part 1)

- A cover letter
  - A cover letter will help others know who you are and what you would like to do
  - Most cover letters are specific to the experience that you are applying for
    - However, we will create a template that can be altered for each experience
- Interview skills
  - Many different types of experiences will require you to interview
  - Interviews can be in person, over the phone, or through video conferencing
  - There are many different ways to succeed in an interview
    - Body language
    - Answering questions
    - Being engaged
    - Having questions

Anything Else?

- There are plenty of other minor things that can be specific to experiences
  - Proof of immunizations
  - Confidentiality agreements
  - Application questions
  - Surveys
  - Essay style questions
- However, these often are tailored to the experience that you are undertaking
- We will prepare you for these as well!

Feeling Overwhelmed Yet?

- Don't worry!
  - We will work on each of the major things that you will need!
- We will build up a portfolio that will help you quickly apply for these experiences
- With your professional portfolio you will be able to apply more experiences
- You will also look better when applying to these experiences!

Focusing Your Search

What Do You Like To Do?

STEM

- The term “STEM” was designed in the 1990s to help try to link and include a large number of fields
- The goal was to create learning opportunities across multiple disciplines
- Students would be able to see how math, science, technology and engineering were related
- That means that there are a lot of careers that are involved in STEM

What Does STEM Mean To You?

- When describing STEM careers, there is a wide variety of outcomes
  - STEM careers can span from banking to exploring outer space
- With so many different ideas, it can often be confusing what experiences you want to explore
- It can be very helpful to sit down and think about what STEM fields you are interested in!
- Then you can align your beyond the classroom experiences with your areas of interest!

Exploring Careers

- It is important to know what STEM careers mean to you!
- Today we will explore that topic!
- The first thing that I would like you to do is rank the following topics in order of interest (1-4)
  - Science
  - Technology
  - Engineering
  - Math

Expanding Your Top 3

- Take your time in the next section!
- Take your top three STEM fields and provide three different careers that you might find appealing in each field
  - You are more than welcome to use your chromebook to look up topics!
- You can be as specific or as general as you would like
  - “Health care” would be an acceptable answer
  - “Pediatric ICU Nurse” would also be acceptable

Login To Your Chromebooks

- Now login to your chromebooks and see if these positions exist near us!
- Try to see if some of your options exist as careers in the local area
  - These not not have to be positions that are available to you… yet!
  - You may not have the proper training or qualifications for all of these positions until you complete further training

There Are Other Ways!

- There are several other ways that you can find out more about STEM careers
  - Talking to parents or family members
  - Reading interviews/journals about careers
  - Observing STEM professionals at work
  - Researching online
- We are going to try one alternative solution right now!
- Please go to the following website
  - https://www.science.unsw.edu.au/stem-careers/stem-careers-quiz

What Does It All Mean?

- There are many different STEM careers that can be explored
- Knowledge of what makes you interested in STEM can be invaluable to making the correct choices
- This can increase your chances of finding and enjoying beyond the classroom experiences!

Why Should I Apply?

- Applying to STEM beyond the classroom experiences can be intimidating!
- There are many reasons why high school students could view these positions as outside of their comfort zone
- However, these positions are going to be allocated to people who can fulfill the requirements
- These jobs WANT you to apply!
- They WANT you to be a part of their organization!

Where Do I Go?

- Finding a STEM beyond the classroom experience is often the first and most difficult task
- It can be difficult to find an experience that is right for you
- Good ways to search are…
  - Checking the Careers in STEM Database
  - Google searching "Jobs in XXXX" or "Internships in XXXX"
  - Visiting Career focused websites
  - Talking to people who have already have beyond the classroom experiences

What Is Next?

- When applying to a beyond the classroom experience, you should ensure that you are able to participate
- There are several factors that might exclude a high school student
  - Age restrictions
  - Location restrictions
  - Driving restrictions
  - Skills/knowledge restrictions
- All of these things should be considered, but they are not impassable barriers!
- Many times you can work around issues if you put your mind to it!

During The Application

- When applying try to keep the following tips in mind!
  - You are great!
    - It might seem weird to talk glowingly about yourself, but it is important to know that you are well qualified for the experience
  - Be honest
    - There is nothing more off putting to a business than someone who "embellishes" the truth on their resume
    - If companies believe that you are not being truthful, topics will be brought up in the interview
  - Be on time
    - Most companies will not accept someone who applies late
    - This may reflect upon your later work ethic

After The Application

- It is always good to try to reach out to the organization after you apply
- A short and well worded email can show interest and help employers understand your motivation
  - It is important to be brief and polite
  - Try not to repeat information that you may have included in your application
  - Always hit spell check!


Let's Put Our Skills To The Test
Based off of your previous weeks
Find a STEM beyond the classroom experience that is interesting to you
On the Google Classroom,
Submit the experience
Application requirements
Application dates/deadlines
If you are able to participate

Practicing Skills

At This Point

- So far you have learned how to...
  - Prepare for applications
  - Craft a good portfolio
  - Find and apply for positions
- One more major hurdle will need to be overcome for most STEM beyond the classroom experiences!
- The interview can be a make or break experience for many people

What Is An Interview?

- Interviews are often the way that an organization will select between qualified candidates
- Interviewing well can greatly improve your chances of landing a beyond the classroom experience
- Many people are intimidated by interviews
  - Remember… they invited you!
  - These organizations wish to speak with you!
- Keep calm, cool, and collected
  - These people will soon be your peers!

Interview Basics

- There are some basic skills that can help you understand how to succeed in your interview
- A first impression can make or break an interview
  - Be polite, well dressed for the position desired and on time
  - Remain positive throughout the interview
- They will likely discuss information that you put in your application or about the experience
  - It would be to your advantage to review both of these before the interview
- Always take the time to research the experience, organization, and location
  - Having knowledge of the situation and asking questions shows interest!

The Setting - Phone or Online

- Most interviews will be conducted in person, through a phone call, or through a video conference
- When not in person for an interview there are several tips and tricks that can help you
- Have a quiet and mess free environment
    - Both can show your ability to organize your life
- Dress for the experience you want
    - Even if you are on the phone, it can help you get in a proper mindset
- Always do a test run
    - Make sure your cell phone, computer, or tablet is able to handle the interview

The Setting - In Person

- Many interviews will be conducted in person
- These interviews can be one on one or small groups interviewing you
- There are several tips and tricks that can help you out
- A good handshake can be important
    - Firm, confident, and eye contact!
- Look the interviewer in the eyes while answering questions
    - This indicates that you really want to be there!
- Your phone can wait!
    - Give your undivided attention to the interview!
- Ask questions
    - Many interviewers will allow you to ask questions
    - Questions show you have researched the position and are interested in the experience

Let's Talk About Skills - In Person

- Imagine you are in an in person interview:
  - Practice a handshake with a partner
    - Firm, confident, and eye contact
  - Practice your eye contact skills
    - Have your partner ask you a question
    - Answer the question while making eye contact and remaining interested
  - Answer a difficult question
    - Have your partner ask a difficult question
    - It is OK to think about an answer before you respond
      - Just let the interviewer know that you have to consider your response

APPENDIX B

SKILLS DEVELOPMENT FOR THE CAREERS IN STEM CLUB

Week 2 - Skills Development

1. Use the space below to provide two examples of locations that you might be able to find beyond the classroom experiences from the local area. Feel free to use your Chromebooks to find locations!

2. For each of the locations, provide the type of learning experiences that you would find in that location. Feel free to use your Chromebooks to find locations!

3. For each location, please provide one possible “thing to avoid” that might be at that location. Feel free to use your Chromebooks to find locations!

Week 3 - Skills Development

1. Find an online resource that shows what sections you will need for a resume. Please list the different sections that you will need for a resume below. Feel free to use your Chromebook to complete this question!

Now find an online resume template that is compatible with Google Docs. This will make your resume design process much more efficient! Please list the website for the resume template below.

Week 4 - Skills Development

1. Using the list that you created during the club, find two beyond the classroom experiences that match specific positions that you identified. It does not have to be a perfect match! As long as the skills from the beyond the classroom experience will translate to the position you identified.

Week 5 - Skill Development

1. Find any STEM beyond the classroom experience and identify if there are any restrictions for the application. Please list any of those restrictions below.

2. Sounding confident, but not obnoxious on an application is a skill! Please write one positive statement about yourself (that might apply to an application) below.

3. Find the spell check feature of Google Docs. Please spell-check this document.

Week 6 - Skills Development

1. Please find a partner. Record their name below

Come up with three questions that are related to one topic. This topic can be about anything (be creative). Write your questions below.
(Example: What are your favorite kind of pets? Do you have any pets? What type of pet would not work in your home?)

3. Please act as an interviewer with your partner. Please simulate the start of an interview and ask them your three questions. Use the space below to evaluate their interview skills.

4. Please act as an interviewee with your partner. Please simulate the start of an interview and answer the three questions that they have written. Use the space below to describe how you think you interview went.

5. Compare and contrast notes with your partner.

APPENDIX C

REFLECTION JOURNALS FOR THE CAREERS IN STEM CLUB

Reflection Journal - Week 1

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words

Week 1 Question: What are your thoughts about beyond the classroom experiences? How can they help you? Why would you want to do them?

Reflection Journal - Week 2

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words!

Week 2 Question: Can you think of one type of beyond the classroom experience that would be impactful to you? Why?

Reflection Journal - Week 3

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words

Week 3 Question: How would you describe your current “portfolio”? What items might need improvement? Why? What items do you feel comfortable with? Why?

Reflection Journal - Week 4

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words

Week 4 Question: How do you expect to find beyond the classroom experiences? What methods might you use to seek out and find these experiences? Why do you think you would use these methods?

Reflection Journal - Week 5

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words

Week 5 Question: What positions or jobs have you applied to before? How do you think that applying to a STEM beyond the classroom experience may be different? Why do you think that?

Reflection Journal - Week 6

This reflection journal is a place for you to express ideas and insights about your experiences with the Careers in STEM Club. These journals will help you understand your thoughts and ideas about beyond the classroom experiences. Please elaborate in your own words

Week 6 Question: Have you ever participated in an interview before? If you have, please describe it. What do you think that a STEM beyond the classroom interview may be like? How would this differ from a regular job interview?

APPENDIX D

AT HOME ASSESSMENTS FOR THE CAREERS IN STEM CLUB

Week 2 - At Home Assignment

Using all of the knowledge and skills that you have picked up from the last club meeting, you are ready to try to identify a good beyond the classroom experience!

Please find one beyond the classroom experience that you would consider participating in. Please list the organization that runs the experience, the type of experience that is being offered, and if it has any red flags.

Week 3 - At Home Assignment

This week we learned the skills needed to create one item for our application portfolio, a resume. This resume will be a big addition to our application portfolio because it will allow us to apply to a wide variety of beyond-the-classroom experiences quickly and efficiently!

Using the template that you found and the topics that you identified as important, please create a rough draft of your resume. This resume does not need to be perfect! It is just a starting point!

Week 4 - At Home Assignment

This assignment will build off the skills that we have learned since the club started! We are going to try to find one beyond the classroom experience that is suited for us and fits our needs.

Please find one beyond the classroom experience that matches a STEM position that you identified as one of interest. Please list the organization that runs the experience, the type of experience that is being offered, and if it has any red flags.

Week 5 - At Home Assignment

It is FINALLY time to start applying for STEM beyond the classroom experiences. This assignment may take a little bit longer than others however, it will be fun! You can use all the skills you have learned so far to find, apply your portfolio, and apply for the position.

Please find one STEM beyond the classroom experience and apply to it! Give a brief description of your experience below.

Week 6 - At Home Assignment

You are getting better at interview skills! With all the practice that you had during our last meeting, you are well on your way to becoming a successful interviewee. However, you will need a little more specific knowledge to help you on your journey.

Please find a few common interview questions for your desired position. You can find this information for your position if you use Google. Please list the questions below. For each question, add some bullet points that you would use to answer the question if you were asked in a real interview.

APPENDIX E

CONSENT/ASSENT FORM

UNIVERSITY OF SOUTH CAROLINA

CONSENT TO BE A RESEARCH SUBJECT

Careers In STEM Research

KEY INFORMATION ABOUT THIS RESEARCH STUDY:
You are invited to volunteer for a research study conducted by Michael Owdij I am a student in the Department of educational technology, at the University of South Carolina. The University of South Carolina, Department of educational technology is sponsoring this research study. The purpose of this study is to understand what motivates and influences interest in participation in STEM beyond the classroom experiences. You are being asked to participate in this study because you are a member of the Careers in STEM Club This study is being done at Branchburg and will involve approximately 10 volunteers.

The following is a short summary of this study to help you decide whether to be a part of this study. More detailed information is listed later in this form.

This study will involve participation in the Careers in STEM Club. This twelve-week study will measure student's motivation and interest in participation in the Careers in STEM Club. Students that volunteer for this study will be give a pre/post assessment, will be asked to keep a reflection journal and may be asked to answer questions in the form of an interview at the conclusion of the study.

Students that participate in this study will be providing valuable information for the Careers in STEM Club. This information will help provide insight as to how to get students involved in beyond the classroom experiences. This information can help influence the future years of the Careers in STEM Club.

All students that participate within the study will have their personal information, answers, and data kept confidential. This will help assure that there are no risks involved to any students that are participating.

Students are not required to participate in research to be a part of the Careers in STEM Club. Other than the pre/post survey and the interview, there will be no other notable differences in the club for those that do not participate.

PROCEDURES:
If you agree to participate in this study, you will do the following:

1. Be asked to complete an initial survey that will contain two sections. The first section of the survey is focused on student motivation to complete beyond the classroom experiences. The second section of the survey is focused on student interest to participate in beyond the classroom experiences. The survey will take approximately 10 minutes to complete.
2. Participate in the six sessions of the Careers in STEM Club. Club meetings will happen after school and will be held in room 251. Meetings will be approximately thirty minutes.
3. Be asked to complete a post intervention survey that will contain two sections. The first section of the survey is focused on student motivation to complete beyond the classroom experiences. The second section of the survey is focused on student interest to participate in beyond the classroom experiences. The survey will take approximately 10 minutes to complete.
4. Possibly be asked to participate in a semi-structured interview. The interview will be an open-ended discussion that is designed to get detailed and personal answers from students that participated in the Careers in STEM Club. Interviews will be recorded and transcribed for data analysis.

DURATION:
Participation in the study involves 6 club meetings over a period of twelve weeks. Each study visit will last about thirty minutes/hours.

RISKS/DISCOMFORTS:
During the course of this study, subjects may be subject to risks or discomforts. Possible risks or discomforts that could be involved in this study are listed below.

Loss of Confidentiality:
There is the risk of a breach of confidentiality, despite the steps that will be taken to protect your identity. Specific safeguards to protect confidentiality are described in a separate section of this document.

BENEFITS:
Taking part in this study is not likely to benefit you personally. However, this research may help researchers understand the motivation and interest in participation of students that are engaging with STEM beyond the classroom experiences.

You may benefit from participating in this study by the increase in effectiveness of the Careers in STEM Club. Once more is known about students, the structure of the club may be shifted to help improve the effectiveness of the club.

COSTS:
There will be no costs to you for participating in this study other than possible costs related to beyond the classroom experiences.

PAYMENT TO PARTICIPANTS:
You will not be paid for participating in this study.

COLLECTION OF IDENTIFIABLE PRIVATE INFORMATION OR IDENTIFIABLE BIOSPECIMENS:
Information about you may be used for future research studies or may be shared with other researchers; however, this only will be done after identifiers linking the information/biospecimens to you are removed. This will be done without additional consent from you.

NEW INFORMATION:
If there are significant new findings during the research study that could impact your willingness to continue participating, you will be notified.

STUDENT PARTICIPATION:
Participation in this study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without negative consequences. Your participation, non-participation, and/or withdrawal will not affect your grades or your relationship with your teachers, peers, or Branchburg High School.

CONFIDENTIALITY OF RECORDS:
Information obtained about you during this research may be published, but you will not be identified. Any information that is obtained concerning this research that can be identified with you will remain confidential to the extent possible within State and Federal law. The investigators associated with this study, the sponsor, and the Institutional Review Board will have access to identifying information. All records in South Carolina are subject to subpoena by a court of law. Study information will be securely stored in locked files and on password-protected computers.

VOLUNTARY PARTICIPATION:
Participation in this research study is voluntary. You are free not to participate, or to stop participating at any time, for any reason without negative consequences. In the event that you do withdraw from this study, the information you have already provided will be kept in a confidential manner. If you wish to withdraw from the study, please call or email the principal investigator listed on this form.

I have been given a chance to ask questions about this research study. These questions have been answered to my satisfaction. **If I have any more questions about my participation in this study, or a study related injury, I am to contact Michael Owdij at (908) 713 4199 x4367 or email mowdij@nhvweb.net.**

Concerns about your rights as a research subject are to be directed to, Lisa Johnson, Assistant Director, Office of Research Compliance, University of South Carolina, 1600 Hampton Street, Suite 414D, Columbia, SC 29208, phone: (803) 777-6670 or email: LisaJ@mailbox.sc.edu.

*For Minors 13-17 years of age:
My participation has been explained to me, and all my questions have been answered. I am willing to participate.

Print Name of Minor	Age of Minor
Signature of Minor	Date

I agree to participate in this study. I have been given a copy of this form for my own records.

If you wish to participate, you should sign below.

Signature of Subject / Participant	Date
Signature of Qualified Person Obtaining Consent	Date

APPENDIX F

STUDENT SURVEY

Section 1 of 4

Introduction Survey - Careers In STEM Club

Please complete the following form on motivation and participation in STEM-focused activities.

Please read each section heading in order to understand how to answer each question.

Email:

Section 2 of 4

Demographics

What is your name?

What is your student ID?

What is your grade level?
(Options 11, 12)

How likely are you to participate in a beyond the classroom experience?
1 – Not Likely
10 – Very Likely
(Options 1, 2 ,3 ,4 ,5 ,6 ,7 ,8 ,9 ,10)

Have you ever participated in one or beyond the classroom experiences?
(Options Yes, No)

Describe the beyond the classroom experiences you have participated in.

Section 3 of 4

Please answer the following questions about beyond the classroom experience motivation. The questions are all rated on a scale of 1 - 7. The values of your responses are as follows:

1 - Not At All True of Me

2 -

3 -

4 -

5 -

6 -

7 - Very True of Me

Pintrich, P. R. (1991). A manual for the use of the motivated strategies for learning questionnaire (MSLQ). In National Center for Research to Improve Postsecondary Teaching and Learning.

In a beyond the classroom experiences, I prefer material that really challenges me so I can learn new things
1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
In a beyond the classroom experience, I prefer material that arouses my curiosity, even if it is difficult to learn.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
The most satisfying thing for me in a beyond the classroom experience is trying to

understand the experience as thoroughly as possible.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
When I have the opportunity in a beyond the classroom experience, I choose experiences

that I can learn from even if they don't guarantee an external reward (money, credits,

resume building elements, etc.).

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
Getting an external reward (money, credits, resume building elements, etc.) in a beyond

the classroom experience is the most satisfying thing for me right now.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
I want to do well in beyond the classroom experiences because it is important to show

my ability to my family, friends, employer, or others.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
I think I will be able to use what I learn in beyond the classroom experiences in other

school related areas.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
I am very interested in beyond the classroom experiences.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
I like beyond the classroom experiences.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
It is important for me to learn the material from a beyond the classroom experience.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
I think the materials from beyond the classroom experiences are useful for me to learn.

1 – Not At All True Of Me
7 – Very True Of Me
(Options 1, 2, 3, 4, 5, 6, 7)
Section 4 of 4

Interest in Participation

Please answer the following questions about STEM participation. The questions are all rated on a scale of 1 - 5. The values of your responses are all different, so please read them carefully!

Kier, M. W., Blanchard, M. R., Osborne, J. W., Albert, J. L., Kier, M. W., Blanchard, M. R., … Albert, J. L. (2014). The Development of the STEM Career Interest Survey (STEM-CIS). Res Sci Educ, 44, 461–481.

I will work hard in beyond the classroom experiences that involve STEM
1 – Strongly Disagree
5 – Strongly Agree
(Options 1, 2, 3, 4, 5)

I am interested in beyond the classroom experiences that use science.
1 – Strongly Disagree
5 – Strongly Agree
(Options 1, 2, 3, 4, 5)
I am interested in beyond the class room experiences that use technology.
1 – Strongly Disagree
5 – Strongly Agree
(Options 1, 2, 3, 4, 5)
I am interested in beyond the classroom experiences that use math.
1 – Strongly Disagree
5 – Strongly Agree

(Options 1, 2, 3, 4, 5)
I am interested in beyond the classroom experiences that use engineering.
1 – Strongly Disagree
5 – Strongly Agree
(Options 1, 2, 3, 4, 5)

APPENDIX G

INTERVIEW PROTOCOL

Informational Protocol

Interviewer: *Hello, and welcome to our semi-structured interview that relates to the Careers in STEM Club. To facilitate our note-taking, I am going to record our conversations today. This will allow for easier transcription of the interview. Thank you for your agreeing to participate!*

We have planned this interview to last no longer than one half hour. During this time, we have several questions that we would like to cover. If time begins to run short, it may be necessary change the overall interview in order to finish the line of questioning. I will make sure to keep your informed of the time so you have a chance to completely answer the questions.

Do you have any questions about the interview that you are about to participate in?

(Pause for response)

Introduction Protocol

Interviewer: *You have been selected to speak with us today because you are a member of the Careers in STEM club. As a researcher, I would love to gain insight about your ideas and perspectives on the Careers in STEM Club, and how it relates to your motivation and interest in participation with STEM beyond the classroom experiences. This interview does not aim to evaluate your experiences or thoughts. Rather, we are trying to learn more about your motivation and interest in participation, and hopefully learn useful information that can be used to help the Careers in STEM Club in the future.*

Today we will ask you several open-ended questions. I may also follow up several of the questions with probes or further questions. Please fully and completely answer the question with your own words and ideas. With more detailed answers, I can gain more insight into your thoughts and ideas.

Background Questions

Interviewer: *What is your age?*

Interviewer: *What is your academic class?*

Interviewer: *How many Careers in STEM Meetings have you attended this year?*

Interviewer: *How many academic years of STEM courses have you completed?*

- *Probe: How many academic years of STEM courses are you currently enrolled in?*
- *Probe: How many academic years of STEM courses do you plan on taking in the future of your high school experience?*

Interviewer: *Can you describe what you think a STEM-focused student might be?*

Interviewer: *Would you describe yourself as a STEM-focused student? Why or why not?*

- *Probe: Do you think that you fit your definition?*

Interviewer: *What about STEM beyond the classroom experiences most interests you? Why?*

- *Probe: Did those things interest you before your participation in the Careers in STEM Club?*
- *Probe: Have your interests in beyond the classroom experiences changed over time? How?*

Interviewer: *Can you tell us about any STEM beyond the classroom experiences that you have had before you joined the Careers in STEM Club?*

Interviewer: *How do you feel about STEM beyond the classroom experiences?*

Motivation Questions

Interviewer: *I am now going to ask you questions that relate to your motivation about beyond the classroom experiences. These questions may or may not relate to how your motivation has changed during the course of the Careers in STEM Club. Please provide detailed answers.*

Interviewer: *Before joining the Careers in STEM Club, how would you describe your motivation for STEM beyond the classroom experiences?*

- *Probe: Why do you think that this was your motivation?*
- *Probe: What were major factors that influenced your motivation?*
- *Probe: Did your motivation to participate in the beyond the classroom experiences ever change? If so, why?*

Interviewer: *How has this club changed your motivation for STEM beyond the classroom experiences?*

- *Probe: Has this change in motivation made you more likely to seek out beyond the classroom experiences? Why or why not*
- *Probe: How much has your motivation changed since the start of the club?*

Interviewer*:* *How has this club increased or decreased your motivation for experiencing beyond the classroom experiences?*

- *Probe: Are there methods or activities that caused a large increase or decrease in motivation?*
- *Probe: Are there other ways to affect motivation that were not represented in the club?*

<u>Interest in Participation</u>

Interviewer: *I am now going to ask you questions that relate to your interest to participate in beyond the classroom experiences. These questions may or may not relate to how your interest in participation has changed during the course of the Careers in STEM Club. Please provide detailed answers.*

Interviewer*:* *Can you describe your current interest in participation in beyond the classroom experiences?*

- *Probe: Why do you feel this way?*
- *Probe: What do you think are the major factors that make you feel this way?*

Interviewer: *How has this club changed your interest in participation in STEM beyond the classroom experiences?*

- *Probe: Has this change in interest in participation made you more likely to seek out beyond the classroom experiences? Why or why not*
- *Probe: How much has your interest in participation changed since the start of the club?*

Interviewer*:* *How has this club increased or decreased your interest in participation in beyond the classroom experiences?*

- *Probe: Are there methods or activities that caused a large increase or decrease in interest in participation?*
- *Probe: Are there other ways to affect interest in participation that were not represented in the club?*

APPENDIX H

BRANCHBURG HIGH SCHOOL DISTRICT RESEARCH APPROVAL

Michael:

Your proposal was approved at last night's Board of Education meeting. Please let me know if you need any additional information.

Thank you.

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Kim Triglia
Executive Secretary/Business Office
Branchburg Regional High School District
908-735-2846 Ext. 5116

APPENDIX I

UNIVERSITY INTERNAL REVIEW BOARD APPROVAL LETTER

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH

DECLARATION of NOT RESEARCH

Michael Owdij

1 Cedar Grove Road

Branchburg, NJ 08876

Re: **Pro00118380**

Dear Michael Owdij:

This is to certify that research study entitled ***MOTIVATION AND INTEREST IN PARTICIPATION IN STEM BEYOND THE CLASSROOM EXPERIENCES: EFFECTS OF HYBRID LEARNING SYSTEMS ON HIGH SCHOOL STUDENTS*** was reviewed on **1/18/2022** by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

Sincerely,

Lisa M. Johnson

ORC Assistant Director and IRB Manager