A MIXED METHODS STUDY TO MEASURE THE IMPACT OF MASTERY-BASED, PERSONALIZED LEARNING ON AT-RISK STUDENT ACHIEVEMENT

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AUTHORIZATION TO SUBMIT

DISSERTATION

This dissertation of Dustin Barrett, submitted for the degree of Doctor of Philosophy in Education with a major in Educational Leadership and titled A MIXED METHODS STUDY TO MEASURE THE IMPACT OF MASTERY-BASED, PERSONALIZED LEARNING ON AT-RISK STUDENT ACHIEVEMENT has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies.

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DEDICATION

I would like to dedicate this dissertation foremost to the students in our educational system who struggle academically and do not reap the full benefits of education. These students are occasionally labeled “at-risk”, and are often segregated to the fringes of the traditional educational environment. This group of students search for success and struggle through failure until alternative options arise for them, an educator or educators embrace the challenges these students present, or they reach the point where dropping out of school becomes a tolerable option. Each one of these students holds immeasurable value and should not be forgotten in order to achieve greater efficiency or provide us, as educators, the ability to maintain comfortability and consistency. These students remind those of us in education that what we hold as institutional truths should be challenged.

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ABSTRACT

At-risk children have demonstrated that the traditional industrial model of education often does not work well for them, yet the majority continue to be educated in this fashion. With the evolving ability to incorporate technology into education, the potential exists to develop innovative, personalized methods to meet at-risk students' educational needs.

This study took place in three public high schools in the western United States for students designated as "at-risk." These schools, located in the same public school district, worked together to develop and implement mastery-based, personalized instructional models with blended or hybrid instructional delivery school-wide. The use of teachers as mentors provided the framework to develop student-teacher relationships, while blended delivery provided academic choice over pace, place, time, and path.

The impact of the introduction of a blended, mastery-based learning model during the first semester of full implementation included a reduction in behavior incidents among students in all three high schools. Four out of five cohort grade level groups across the three high schools experienced a statistically significant reduction in behavior occurrences. While behavioral occurrences reduced, school exclusion rates through suspension were not significantly impacted through initial implementation of the new educational model.

Student academic achievement data was also collected and demonstrated the difficulty researchers can have comparing a time-based traditional instructional model to a mastery-based model where time is variable. Initial implementation demonstrated a statistically significant reduction in credits earned over the first semester. Grade point averages were not shown to be impacted significantly through initial mastery-based model implementation.

Student perception was measured through a survey tool developed to gather student input on model transformation and demonstrated that the change to a personalized learning model included the majority of the elements identified as key to developing student engagement.

The results of this study support and expand the work of other researchers who have demonstrated that implementation of a mastery-based instructional model delivered through blended instruction benefits at-risk students.

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Chapter I

Introduction

Education and school reform are topics that are receiving a great deal of publicity, political consideration, and financial investiture (Corry & Carlson-Bancroft, 2014; Evans, 2012; Flumerfelt & Green, 2013; Sykes, Decker, Verbrugge, & Ryan, 2014). However, after decades of educational research, huge investitures of money, and increased scrutiny and accountability, the majority of schools continue to implement the traditional model of teaching (Newstead, Moran Wright, & Colby, 2010). Over the past few decades, a vast amount of research has been carried out on effective instructional techniques (Hattie, 2008; Knight, 2013; Marzano, Pickering, & Pollock, 2001; William, 2011). Current research has shown that the traditional model of instruction will not achieve the results for which we are looking as a nation; results that are focused on the ability to prepare students for career and college readiness or to compete globally (Corry & Carlson-Bancroft, 2014; Evans, 2012; Lear, 2007; McCain, 2009; Richardson, 2012). The traditional model of teaching has shown that it is especially ineffective with the segment of students who are labeled “at risk” (Archambault et al., 2010; Barbour & Siko, 2012; McWhorter, 2007; Watson & Gemin, 2008). The at-risk student population is in dire need of alternative educational practices that have the potential to show them how to function in the technologically rich world in which they now live (McWhorter, 2007). With the ability to learn whatever and whenever a student wants to learn, fundamental shifts in education must occur (Duncan & Barnett, 2009; Florian & Zimmerman, 2015; Mirriahi, Alonzo, McIntyre, Kligyte, & Fox, 2015; Richardson, 2012). Through the use of technology, the ability to drastically change the manner in which education is delivered has arrived (Lane, 2013; Mirriahi et al., 2015). However, education reform is not easy to implement and is even more difficult to sustain

(Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Headden, 2013). Personalized learning is one of the current buzzwords in the world of educational research and reform. Personalized learning shows the potential to drastically transform education from the traditional model to a model with a number of advantages, including increased engagement and increased student responsibility (Florian & Zimmerman, 2015; Headden, 2013; Pearlman, 2002; Prain et al., 2013). Through implementation of mastery- or competency-based learning, personalized learning utilizing technology can be realized (Evans, 2012). Mastery-based learning allows educators to focus strictly on content rather than seat time or other indicators to advance students when they are individually ready (Bramante & Colby, 2012; Evans, 2012).

Mastery-based, personalized instruction is difficult, if not impossible, to successfully implement without the incorporation of electronic learning. However, electronic learning has drawbacks (Archambault et al., 2010; Chang et al., 2014; Corry & Carlson-Bancroft, 2014; Yapici & Akbayin, 2012). The move away from traditional classroom instruction to mastery-based, personalized, electronic learning reduces the social advantages of face-to-face instruction (Corry & Carlson-Bancroft, 2014; Yapici & Akbayin, 2012). Blended learning, is a combination of electronic learning and face-to-face instruction, allowing for the ability to not only personalize, but also to provide rich social interaction, thus minimizing the disadvantages of both electronic learning and face-to-face instruction (Horn & Staker, 2015; Wang, Han, & Yang, 2015). Blended learning embraces the advantages of both methods of instruction (Horn & Staker, 2015; Newstead et al., 2010; Werth, Werth, & Kellerer, 2013). The blending of face-to-face instruction and electronic-based instruction results in a reduction in the amount of face-to-face instruction that takes place (Alammary, Sheard, & Carbone, 2014; Erdem & Kibar, 2014; Kazu & Demirkol, 2014; Korkmaz & Karakus, 2009; Krug, Roberts-Pittman, & Balch, 2011;

Napier, Dekhane, & Smith, 2011; Yapici & Akbayin, 2012). The reduction of face-to-face instruction requires that effective, research-based techniques are used in the classroom to ensure time and impact are maximized. In order to maximize the potential of delivering blended learning effectively, teachers must undergo tremendous shifts in methods and techniques as well as general understanding of their role in the classroom (Alammary et al., 2014; Horn & Staker, 2015; Kellerer, et al., 2014; Sykes et al., 2014; Wilder & Berry, 2016). Much of this shift involves the teacher moving into the role of a facilitator of instruction, as opposed to the traditional role as the deliverer of instruction (Horn & Staker, 2015; Sykes et al., 2014; Wilder & Berry, 2016). Teachers also need to consider they generally teach in the manner they have been taught (McCrea, 2012; McQuiggan, 2012). The manner in which teachers have been taught and trained to teach rarely includes exposure to or incorporation of online lesson design (McCrea, 2012; McQuiggan, 2012). Most teacher preparation programs are currently lacking formal training courses on best practice methods to utilize when teaching online; therefore, the role of the teacher and teacher professional development are key areas of focus when mastery-based, personalized instruction utilizing a blended model of instruction is implemented (Duncan & Barnett, 2009; Lane, 2013; McCrea, 2012; McQuiggan, 2012; Mirriahi et al., 2015). The use of instructional methods that will improve student success, combined with the use of positive culture building, effective planning, and the incorporation of formative assessment techniques, have the power to provide “leverage” or maximum output from students with minimal input from teachers (Knight, 2013). Many of the same strategies which work effectively with students in the classroom translate into the creation of a successful online learning environment as well (DiPietro, Ferdig, Black, & Preston, 2008). However, teachers and educational leaders need to be aware online teaching also requires an extended set of competencies in addition to the strategies that work well in the face-to-face setting (Duncan & Barnett, 2009).

Statement of the Problem

At-risk high school students are our most vulnerable population of students (Brownwell et al., 2010). Not only are they near the point of being lost from our high school enrollments, but without rapid change, they will also be lost statistically from the ability to earn respectable wages through acquisition of viable employment (Brownwell et al., 2010; Watson & Gemin, 2008). New techniques of delivery and structure, coupled with research-based instructional techniques, provide the potential to turn the education system from one that has proven ineffective for at-risk students to one that has the potential to make this population career or college ready (Watson & Gemin, 2008). The tools of technology and the research centered on instructional delivery and methodology provide the opportunity to shift our educational practice (Chang, Shu, Liang, Tseng, & Hsu, 2014; Corry & Carlson-Bancroft, 2014; Duncan & Barnett, 2009; McCrea, 2012; McQuiggan, 2012; Mirriahi et al., 2015; Kazu & Demirkol, 2014; Tsai, 2012). A more modern learning environment that has the potential to greatly impact the success of all students, including the extremely vulnerable at-risk population, can be achieved (Flumerfelt & Green, 2013; Watson & Gemin, 2008).

Purpose of the Study

The purpose of this study is to gather data on the effectiveness of the transition of three at-risk high schools which employ traditional industrial model methods of instruction into schools utilizing a blended learning instructional model to personalize student instruction. During the transition from traditional model to blended model, professional development with a focus on research-based instructional techniques to maximize the effectiveness of face-to-face and electronic learning was employed. Transforming a school into a mastery-based, personalized learning environment is a rapidly increasing phenomenon (Chubb, 2012; Corry & Carlson-Bancroft, 2014). Educational researchers have consistently found that data is limited on effectiveness and best methods to design and implement the process of redesign to a mastery-based, personalized model utilizing a blended learning method of instruction (Florian & Zimmerman, 2015; Headden, 2013; Prain et al., 2013; Wang et al., 2015). Research data is also limited on the overall effectiveness of blended learning in various settings, particularly public high schools (Barbour & Siko, 2012; Bissell, 2012; Corry & Carlson-Bancroft, 2014; Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Headden, 2013). This study includes the incorporation of research-based, face-to-face instructional methods to supplement and increase the effectiveness of mastery-based, personalized instruction, which is rarely addressed in current studies. As mastery-based, personalized learning models utilizing blended learning increase in educational environments, the trend is to implement these programs with online learning as the primary instructional method, utilizing face-to-face instruction as a supplement as necessary, to meet student needs. The model in this study shows a variance of implementation methods ranging from online first to a model which started with a blend of face-to-face and online instruction as the core instructional model. This variance of models provides opportunity to determine best practice for the at-risk population involved and the difficulties inherent in various models, some of which are known or suspected and others that were to be determined through the research process.

Background

Traditional teaching methods where the instructor delivers information to students in a group setting was not designed to meet the needs of students at an individual level (Horn &

Staker, 2015). This method of teaching adapted well to an industrial model of instruction which facilitates the delivery of information efficiently to a large number in a “one-size-fits-all classroom” (Horn & Staker, 2015, p. 12) or “whole group instruction” model (Headden, 2013, p. 16). The traditional model, however, does not provide the ability to focus instruction on what individual students need to be successful, are interested in personally, and does not allow adaptations to pace as needed for individual students to be successful (Headden, 2013; Horn & Staker, 2015). Traditional face-to-face instruction remains a popular method of instruction among students and teachers (Erdem & Kibar, 2014; Napier, et al., 2011; Yapici & Akbayin, 2012a). This popularity may stem from the familiarity with the model that teachers and students possess due to being taught and trained in this model or brought through past grade levels utilizing traditional instruction. Traditional teaching provides social interaction in a format impossible to replicate electronically and does not lead to the isolation often felt in the online environment, which is also positively viewed by teachers and students. Teachers also report that a great deal of lesson flexibility can be lost in the online or electronic environment which normally follows a highly prescriptive curriculum (Prain et al., 2013).

Online learning has grown rapidly in popularity due to exponential growth in technology, increased opportunity, and a wider range of digital options (Barbour & Siko, 2012; Corry & Carlson-Bancroft, 2014; Duncan & Barnett, 2009; Florian & Zimmerman, 2015; Kerr, 2011; Lane, 2013; McQuiggan, 2012; Prain et al., 2013; Tsai, 2012; Watson, Pape, Murin, Gemin, & Vashaw, 2014). A major transition is taking place that has put “the global delivery of education in a flux” (Florian & Zimmerman, 2015, p. 103). Knowledge is no longer gained in the same format as it has been in the past; it is now readily available on a global scale via the internet (Florian & Zimmerman, 2015). Online learning provides the ability for students to learn at their own pace, choose topics of study that are of interest to them, and provides teachers the ability to adapt instructional design so it is based on individual student need (Corry & Carlson-Bancroft, 2014). Teaching through the utilization of electronic media overcomes a number of issues present in the traditional model of education, including: Lack of course access; ability to access advanced placement or college credit bearing courses; lack of highly qualified or properly endorsed instructors; growing student populations; limited building space; schedule conflicts; flexibility; and the ability to recover credits and raise grade point averages (Duncan & Barnett, 2009). Electronic or online learning is rapidly evolving and becoming better as access, exposure, and available tools are developed and refined (Headden, 2013; Lane, 2013). Online instruction, however, does not provide the social interaction, or some of the cooperative learning advantages available through face-to-face instruction in a traditional model (Kazu & Demirkol, 2014). The lack of social interaction often leads to a feeling of isolation in the online environment increasing drop-out rates among students enrolled in online courses (Tsai, 2012). A large majority of teaching programs currently lack formal training in teaching online and often focus on the tools of teaching online rather than the pedagogy or best practices of teaching via an electronic format (Duncan & Barnett, 2009; Lane, 2013; McQuiggan, 2012; Mirriahi et al., 2015). This lack of proper training or professional development opportunities has led to a shortage of teachers who are properly prepared to teach effectively using electronic media (Duncan & Barnett, 2009; Mirriahi et al., 2015).

Blended learning, the thoughtful integration of instructional methods which contain both face-to-face and electronic learning, provides the advantages of face-to-face instruction while providing the ability to personalize instruction (Alammary et al., 2014). Blended learning in the United States has been traced back in the literature to “the Chautauqua

Movement for rural Sunday School education circa 1890's, with teachers giving instruction followed by lesson completion via the U.S. Postal Service" (Florian & Zimmerman, 2015, p. 104). Obviously, technology has evolved a great deal over the last 120 years and blended learning has progressed along with the advances in technology. The rapid advancement of blended learning that has provided the opportunity to combine "technology-mediated learning with campus–based learning has made learning more complex than ever before" (Wang et al., 2015, p. 381). Several models have been used to discuss blended learning, but they normally lack the ability to tie the complex elements of blended learning into a single framework (Wang et al., 2015). Wang et al. (2015) propose the use of the complex adaptive systems framework to describe blended learning in a quest to connect all of the pieces of blended learning in a comprehendible framework, while also embracing the static and transformative nature of blended learning. A model such as the Complex Adaptive Blended Learning System (CABLS), based on the complex adaptive systems framework, can be used to promote understanding of blended learning and the interaction of the key elements of blended learning (Wang et al., 2015).

Blended learning has shown the promise of working effectively with at-risk high school students who have struggled in the traditional setting (Watson & Gremin, 2008). Blended learning provides some of the necessary elements, determined through research, to increase engagement and provide students a level of ownership over their educational process (Corry & Carlson-Bancroft, 2014). It has been asserted that blended learning's "effectiveness and validity as a new form of learning has been established in practice" (Wang et al., 2015, p. 380). Presently there is a shortage of research on the effectiveness of blended learning, especially in a school-wide implementation (Headden, 2013). Studies have shown moderate to high levels of success in multiple areas, including student behavior, student perception, and increased academic performance (Bissell, 2012; Erdem & Kibar, 2014; Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Kazu & Demirkol, 2014; Kenney & Newcombe, 2011; Korkmaz & Karakus, 2009; Means, Toyama, Murphy, Bakia, & Jones, 2010; Napier et al., 2011; Vickers, Field, & Melakoski, 2015; Yapici & Akbayin, 2012a; Yapici & Akbayin, 2012b). Studies have also shown little if any improvement through the implementation of a blended learning model on key educational indicators, such as perception and achievement (Calderon et al., 2012; Chang et al., 2014; Napier et al., 2011; Stewart, Stott, & Nuttall, 2011). Blended learning research continues to be fragmented and lack exploration of several important elements of blended learning, including the lack of ability to scale blended learning up to the institutional level in the majority of applications (Wang et al., 2015).

Research-based instructional methods have been determined to be an effective manner to increase student learning and engagement (Marzano et al., 2001). Through the use of research-based instructional methods, such as formative assessment techniques and cooperative learning, teachers can produce increased results with a minimum amount of effort and create leverage in the classroom (Knight, 2013). Through a combination of research-based instructional methods and a blended learning instructional model, increased success for public high school students who have been labeled as at risk of not graduating shows great potential (Knight, 2013; Tobin & Sprague, 1999; Watson & Gemin, 2008). The work of John Hattie (2008) indicates through meta-analyses that several of the elements included in the implementation of research-based, face-to-face instructional methods and blended learning, if applied correctly, can be highly impactful to student achievement.

Research Questions

Creswell (2015) discusses the importance of narrowing the research problem into questions that specify the purpose and address what the researcher would like to have answered through the study. The central research questions for this study include the following:

1. What impact does mastery-based, personalized learning have on the behavior of at-risk students?
2. What is the impact of a mastery-based, personalized learning instructional model on student academic achievement?
3. What is the student perception of a shift to a mastery-based, personalized instructional model with delivery through blended learning?

Description of Terms

The following terms may need some clarification and are based on the literature review conducted during this study:

Agents. Agents are the human elements present in a complex adaptive system that "partner and contribute to solution making" (Ellis & Herbert, 2011, p. 34). Agents "generate a variety of creative and flexible responses through their relationships, thus increasing resilience and robustness of a complex adaptive system" (Jordon, Lanham, Anderson, & McDaniel, 2010, p. 229).

At-risk students. In general terms, "at-risk" students are students at risk of not graduating from high school for any of various reasons or combination of reasons, including but not limited to: demographic characteristics, family and personal background, amount of parental educational involvement, academic history, behavioral factors, teacher perception, and characteristics of school student is attending (Kaufman & Bradbury, 1992).

Behavior incidents. For the purposes of this study, behavior incidents are defined as in-school suspensions, out-of-school suspensions, lunch detentions, and behavioral referrals to the office.

Blended learning. The thoughtful integration of instructional methods which contain both face-to-face and electronic learning (Alammary et al., 2014).

Competency-based learning. A method of learning based on demonstrating academic proficiency in subject matter to complete a course or earn credit rather than credit achievement being based on seat-time or the Carnegie Unit (Sullivan & Downey, 2015).

Complex Adaptive Systems Theory. Widely used theory to gain understanding into the complexity of dynamic and non-linear systems (Wang et al., 2015). "Complex adaptive systems are dynamic and open, and have the ability to self-organize, adapt to, and evolve with their environment" (Wang et al., 2015, p. 382).

Course achievement. For the purpose of this study, course achievement is the level of content mastery measured by final letter grade achieved by students.

Electronic learning. The delivery of educational content over the internet (Corry & Carlson-Bancroft, 2014).

Elements. The parts or components that make up a system such as a complex, adaptive system. Elements are the lowest level of organization in the subsystems which compose a complex, adaptive system (Bilsen, Bekebrede, & Mayer, 2009). Elements interact with each other in a complex, adaptive system in an unpredictable, nonlinear fashion (Burns & Knox, 2011).

Face-to-face instruction. The delivery of instruction in a manner that allows face-to-face interaction between students and/or face-to-face instruction between student and teacher (Yapici & Akbayin, 2012).

Facilitator of instruction. The shift in teacher role in the blended environment where the teacher becomes a facilitator of the personalized learning of students by co-teaching and using online curriculum and resources rather than assuming the traditional role as leader of the classroom (Sykes et al., 2014).

Learning Management System (LMS). A learning management system provides a location for teachers to post curricular materials, facilitates the submission of assignments by students, and provides a location for teachers to post grades. Learning management systems also often include methods to communicate with students and various other enhancements that essentially create a virtual classroom (Lane, 2013).

Mastery-based learning. The move away from a fixed amount of time to complete content learning toward allowing students the time necessary to access content based on the time students need as individuals. Students do not move on to the next content standard until current content is mastered to a specified level (Lin, et al., 2013).

Personalized learning. Student learning system based on allowing students to learn at the pace they are most capable based on individual learning style and interests using technology to provide the ability to develop the level of individualization this requires (Sykes et al., 2014).

Personalized learning platform (PLP). An adaptable, e-learning delivery space that accounts for learner characteristics to promote effective learning at an individual student level (Hsu, 2012).

Professional development. The training and support provided to school staff (Sykes et al., 2014).

Research-based instruction. The use of instructional methods developed by engaging in the science of teaching using research and data collection to determine the effectiveness of teaching strategies (Marzano et al., 2001).

School reform/School redesign. Reviewing all elements of a school such as school structure, teacher roles, and curriculum to put a model into place that will best address the needs of individual students (Evans, 2012).

Subsystems. Sections of a complex adaptive system that have their own characteristics and are dependent upon the other subsystems in a nonlinear fashion (Wang, Han, & Yang, 2015). Subsystems are composed of elements and agents and have their own characteristics.

Traditional model of teaching. Teacher-centered model of instruction where a fixed curriculum is delivered at a fixed pace by the teacher to a classroom of students (Sykes et al., 2014).

Significance of the Study

Blended learning is one of the fastest growing movements in education (Yapici & Akbayin, 2012a). Through blended learning, the ability to personalize instruction is made available while the positive social aspects of face-to-face learning are not completely lost (Corry & Carlson-Bancroft, 2014). However, most of the research on blended learning is based on models implemented at higher education institutions, and even this data is limited or mixed (Barbour & Siko, 2012; Bissell, 2012; Corry & Carlson-Bancroft, 2014; Flumerfelt & Green, 2013; Headden, 2013; Wang et al., 2015). The outcry from researchers is for more data on the effectiveness of blended learning, best practices in implementation of the blended model, the proper mix of online versus face-to-face instruction, the best tools to utilize when using a blended model, how to properly prepare teachers for the online instructional element of blended learning, and how to scale blended learning up to the institutional level, particularly in systems outside of higher education (Barbour & Siko, 2012; Bissell, 2012; Corry & Carlson-Bancroft, 2014, Florian & Zimmerman, 2015; Mirriahi et al., 2015; Picciano, 2011; Tsai, 2012; Wang et al., 2015). Shifting to a blended learning model is not an easy process and needs to be done well to ensure effectiveness and sustainability (Flumerfelt & Green, 2013). Currently, research data is very limited on the process of effectively redesigning a public high school from the traditional model of teaching into a blended learning model, particularly high schools that serve students designated as at-risk. Data related to shifting to a blended model, while focusing on research-based, face-to-face instructional methods, are essentially nonexistent. This study was designed to provide much needed data for the redesign process of three, small, public high schools in a suburban setting from traditional teaching methods to a blended model, with a focus on utilizing research-based instructional methods.

Another differentiator between this study and the research studies currently available is the model implemented did not begin with online instruction as the primary method of instruction and face-to-face instruction as a supplement. In this study, the focus was on implementing blended learning in a fashion which provides the ability to utilize those elements of face-to-face instruction that research has determined are of great value, such as cooperative learning, while utilizing online learning for those elements where direct contact with the course instructor is not required, such as lecture and some forms of assessment or task completion.

The objective of the study is to provide much needed data on model transformation to contribute to the knowledge base available for teachers, school administrators, or school districts who are considering the implementation of a mastery-based, personalized learning model utilizing blended instruction. Most specifically, the data and research contained in this study is of considerable value for those who work in the public high school setting and those who have influence on the instructional model used in public high schools. However, the data gathered during this study as well as the methods utilized during model transformation have applicability throughout the field of education as well as business, employment, leadership and management training where blended learning has been expanding and mastery of content is key (Hilliard, 2015).

Introduction to the Theoretical Framework

Blended Learning is an extremely complicated instructional method with a number of elements often requiring a team to adequately design (Clark-Ibanez & Scott, 2008; Freeman & Tremblay, 2013; Wang et al., 2015). The elements or components of the complex blended learning system and the human agents of the system must interact with one another continuously, and these interactions constantly influence one another (Wang et al., 2015). This interaction of elements does not occur in simple linear fashion, but rather functions similar to other complex systems in a nonlinear fashion (Wang et al., 2015). As a complex, nonlinear system, blended learning cannot be simply broken down into its structural units, but must instead be looked at holistically (Aydinoglu, 2010, Wang et al., 2015). A holistic view of blended learning requires a complex systems model to adequately depict the nuances of blended learning (Wang et al., 2015). An effective blended learning system must be able to adapt to feedback and adjust to properly meet the needs of the various elements of the system (Edson, 2012; Ellis & Herbert, 2011; Hall & Clark, 2010; Kim & Mackey, 2014; Wang et al., 2015). The complex adaptive systems theory provides a framework to enable blended learning to be viewed holistically and modeled more accurately (Wang et al., 2015). Complex adaptive systems theory also provides the ability to focus on interactions rather than on elemental components, which will not provide an accurate view of the complex nonlinear model (Aydinoglu, 2010; Ellis & Herbert, 2011). A focus on interactions is directly in line with the goal of this research study, which was aimed to gather insight on the effect of blended learning on student learning, behavior, and perception.

Overview of Research Methods

The research procedures used in this study were both qualitative and quantitative in nature. Qualitative data was collected during student interviews through the use of open-ended questions pertaining to student perception of the transition from a traditional instructional model to a mastery-based, personalized learning model utilizing blended learning. Quantitative data was collected through surveys taken by students on their perception of the transition from a traditional model of instruction to a mastery-based, personalized learning model utilizing blended learning. Quantitative data related to research questions one and two was also collected on the number of student behavior incidents, suspension rates, credits earned, and grade point averages from the student data management system used in the district of study. Behavioral and academic data was collected during first semester of 2015-2016, prior to model change, and during the first semester of 2016-2017, the first semester of full implementation of the mastery-based educational model. Behavior data included all incidents of behavior significant enough to merit being entered into the student data management system, PowerSchool, and ranged from incidents of minor disturbance to the learning environment to drug, alcohol, and tobacco policy violations. Consequences for behavior incidents ranged from verbal reprimand to suspension.

Students eligible to participate in interviews and complete the perception survey included all students enrolled in the schools of study who returned consent forms. Participants in the quantitative section of the study include all students in the PowerSchool data management system from each of the three schools who were enrolled during both semesters data collection occurred. All student participants qualified as at-risk in one or more categories defined by the state in which the research took place.

Chapter II

The Literature Review

Introduction

The rapid evolution of the internet has created opportunities historically unavailable to educators. This progression has increased the availability of both educational tools and opportunities (He, 2014; Kerr, 2011; Lane, 2013; Vasquez & Serianni, 2012; Watson et al., 2014). Educational tools range from video games that increase the development of academic skills in multiple subject areas to fully developed educational platforms, such as learning management systems (LMS's) and personalized learning platforms (PLP's), that provide access to a full set of course curricula. Many of these LMS's and PLP's also contain goal setting and progress tracking capabilities enabling students to track their development toward post high school objectives, such as attainment of specified college acceptance criteria. Virtually every aspect of education has been impacted by technology, from attendance, course completion, and behavior tracking, which are all maintained electronically, to completion of a high school diploma or an entire degree program from a distance without ever setting foot in a brick-and-mortar building. It is difficult to imagine at this point how anyone engaged in K-12 or post high school education will not be impacted by electronic learning and an assortment of technological tools. Even the highly discussed and heavily implemented high stakes tests required in most states for graduation are distributed in an electronic format. These high stakes tests are also the tests required by the federal government to meet the stipulations set forth by the revised and reauthorized Elementary and Secondary Education Act, currently labeled the Every Student Succeeds Act. Often, these computer-delivered assessments are mandated to be completed by students as early as 3rd grade. It is also difficult to imagine how the level of communication, speed, and ease of information collection and dissemination would be completed if not for the tools of technology (McQuiggan, 2012; Watson et al., 2014). Currently, hundreds of thousands of students are receiving their schooling fully online, and millions are enrolled in one or more online courses (Watson, Gemin, Pape, & Vashaw, 2015). The number of online enrollees has increased at such a high rate for several reasons, including larger numbers of distance learning providers and expanded internet access (Watson et al., 2015) As of 2013, 83% of high schools offered some form of online course option for students (Bolkan, 2013). This explosion has created vastly expanded online options through public, private, and charter schools in the competition for the billions of state, federal, and donor educational dollars available (Watson et al,. 2015). This research study is based on the transformation of three an at-risk high schools to maximize sustained student learning through the use of research-based instructional practices and the development of a personalized learning environment using the power of technology. Over the last several decades, school reform has shifted to a marked degree from a primary focus on improvement of instruction using research-based strategies to a focus on creating personalized learning environments (Flumerfelt & Green, 2013).

The quest to find research-based strategies that maximize the impact of instruction to improve student learning continues to be a theme of research (Hattie, 2008; Knight, 2013). However, recently the primary focus of school reform has shifted to school structure and educational design (Sykes et al., 2014). Personalized learning and competency-based or mastery learning have joined the league of buzz words of educational reformation and school redesign. The Race to the Top Grant offered by the United States Department of Education offered hundreds of millions of dollars to school districts or district consortiums to develop ways to reform schools from traditional methods and toward personalized instruction models (Sykes et al., 2014). The infusion of funding, which the Race to the Top grants provided, led to several research studies and reports designed to develop and track the success of school reform based on changes in school structure and educational design (Evans, 2012; Johnson, Kendziora, & Osher, 2012; Sykes et al., 2014). However, most of these studies and white page reports are hypothetical in nature due to a lack of working models utilizing personalized instruction. Currently, research data is starting to become available from mastery-based and blended educational models, but this research is in its infancy and primarily in post-high school institutions (DiPietro et al., 2008; Evans, 2012; Headden, 2013; Lane, 2013; McQuiggan, 2012; Prain et al., 2013; Richardson, 2012).

Upon review of the literature targeted toward personalized learning and blended learning, no studies mention the importance of improved instruction through the use of research-based methods in the face-to-face teaching environment used in combination with solid research-based techniques in online instruction. This neglect to discuss research-based methods in the face-to-face environment in combination with best practices in the online environment may be due to the lacking amount of teacher professional development available (DiPietro et al., 2008; He, 2014; Kerr, 2011; Lane, 2013; McQuiggan, 2012). Research studies on blended learning and personalized learning as a method of school redesign tend to focus on higher education courses, but remain limited in high school applications (Corry & Carlson-Bancroft, 2014; Yapici & Akbayin, 2012). As an action research study designed to measure the impact on student learning of a population of students designated as at-risk in a blended instruction delivery model, both face-to-face instructional improvement and online instructional improvement need to be considered.

Theoretical Framework

Teaching and learning have never been as complex as they are presently (Wang et al., 2015). With the integration of technology and the differing skills required to embrace and utilize technology, several changes must occur in the field of education (Clark-Ibanez & Scott, 2008; DiPietro et al., 2008; Duncan & Barnett, 2009; Francis, 2012; Freeman & Tremblay, 2013; Headden, 2013; Kerr, 2011; Lane, 2013; McCrea, 2012; McQuiggan, 2012; Mirriahi et al., 2015; Napier et al.,2011; Prain et al., 2013; Tsai, 2012; Vasquez & Serianni, 2012; Wang et al., 2015). One of the major shifts that needs to occur is how we view the complexity of education as researchers and practitioners (Wang et al., 2015). Education must be looked at from a holistic standpoint rather than broken down into compositional elements (Burns & Knox, 2011; van Bilsen et al., 2010; Wang et al., 2015). A holistic view is required because of the intricate nature of the interactions that occur in any educational system and how these interactions affect all other aspects of an educational system (Burns & Knox, 2011; van Bilsen et al., 2010; Wang et al., 2015). Reducing education to its elements, while convenient for research and application purposes, provides an inaccurate description of the system due to a required disregard for the interactions that take place in a constant fashion (van Bilsen et al., 2010; Wang et al., 2015).

A blended learning system adds a level of complexity to an educational system due to the addition of elements that differ from those used in traditional educational design (Wang et al., 2015). The incorporation of technology to provide students some level of control over time, place, path, and pace requires methods and structure not commonly seen in traditional instruction (Horn & Staker, 2015). A blended learning system must be adaptive to allow it to consistently progress through the use of continuous improvement feedback from various elements in the system (Wang et al., 2015). Flexibility and adaptation are vital in a blended instructional model as technology evolves at ever increasing rates, making the tools available and skills needed to utilize these tools a constant progression (Wang et al., 2015). Complex adaptive systems theory provides a lens to view a blended learning system in a holistic manner where all components, including interactions, can be properly analyzed (Wang et al., 2015).

Complex adaptive systems theory was initially proposed to enable natural systems to be viewed holistically rather than broken down into elements. When systems are analyzed from a position where individual elements are of primary focus, they become difficult to explain because they do not account for interactions (Edson, 2012; van Bilsen et al., 2010; Wang et al., 2015). Ecosystems are a popularly utilized example of a complex adaptive system (Edson, 2012; Kim & Mackey, 2014). Ecosystems are nested in a much larger system, the Earth system, yet contain subsystems and elements of their own which constantly adapt to keep the ecosystem functioning properly (Kim & Mackey, 2014). Complex adaptive systems theory began to be utilized on a larger scale during the 1960's (Aydinoglu, 2010). By the 1960's, computational power increased, and researchers shifted from breaking systems down into linear subsystems to make analysis more convenient. This shift has allowed the consideration of systems holistically to account for external and internal interactions (Aydinoglu, 2010). Complex adaptive systems (CAS's) are nonlinear in nature and share key characteristic descriptors, such as self-management, resource exchange that drives complexity, inflection points where the system can follow separate paths, continuous adaptation, and learning as options become available. For a system to be a CAS, it must also operate at a creative level on the edge of control and chaos (Aydinoglu, 2010; Burns & Knox, 2011; Desouza & Lin, 2011; Edson, 2012; Ellis, 2011; Ellis & Herbert, 2011; Hall & Clark, 2010, Kim & Mackey, 2013; LePoire, 2015; Marchi et al., 2014; van Bilsen et al., 2010; Wang et al., 2015). Complex adaptive systems also contain components which have been described using various terms by researchers. For the purpose of this study, terminology drawn from various researchers have been adapted to fit with components present in a blended learning system: subsystems, elements or agents (based on the characteristic of living or nonliving), interactions, and purpose (Edson, 2012; Jordan et al., 2010; Kim & Mackey, 2014; Wang et al., 2015).

Nonlinear interactions occur in a complex system in various forms between subsystems and elements in those subsystems, and between the system and external systems, placing interactions into two categories: internal and external (Aydinoglu, 2010; Burns & Knox, 2011; Edson, 2012; van Bilsen et al., 2010). In a blended learning system, interactions occur internally between subsystems, between elements, between agents, or in various formations between systems, elements, and agents. Wang et al. (2015) uses the term subsystems to describe both subsystems and agents or elements due to the understanding that each agent or element also interacts in a system of their own; however, for this discussion, we have utilized the terminology presented to allow clear focus on the blended learning system. Interactions between the blended learning system, various subsystems, elements, or agents and the external environment or external systems also occur frequently (Wang et al., 2015). These external interactions affect the blended learning system, requiring adaptations to take place to maintain the system itself (Wang et al., 2015). The external interactions that present themselves are primarily due to the nesting of a school utilizing a blended learning system into other larger systems at the district, state, and national levels (Burns & Knox, 2011). The internal and external interactions that take place in a blended learning model, as in any CAS, are nonlinear and unpredictable, which produces a great deal of the inherent complexity (Burns & Knox, 2011; Wang et al., 2015).

Self-management in a blended learning system occurs as in other CAS's as elements, agents, and systems interact in a manner to produce some level of governance in the system. This governance allows the system to be preserved, rather than breaking down, and increases the perceived effectiveness of the system (Aydinoglu, 2010; Burns & Knox, 2011; Desouza & Lin, 2011; Edson, 2012; Ellis, 2011; Ellis & Herbert, 2011; Hall & Clark, 2010; Jordon et al., 2010; Kim & Mackey, 2014; Marchi et al., 2014; van Bilsen et al., 2010; Wang et al., 2015). Self-management requires evolution, learning, and adaptation by the system, the subsystems, and the agents or elements (Aydinoglu, 2010; Burns & Knox, 2011; Desouza & Lin, 2011; Edson, 2012; Ellis, 2011; Ellis & Herbert, 2011; Hall & Clark, 2010; Jordon et al., 2010; Kim & Mackey, 2014; Marchi et al., 2014; van Bilsen et al., 2010; Wang et al., 2015). Self-management is essential not only to evolve the system and make it more effective, but also to allow the system to account for the dynamism of elements and agents which are not static (Jordan et al., 2010).

Resources exchanged in a CAS can be categorized as energy, materials, knowledge, or people (Desouza & Lin, 2011). In a blended system, this exchange can include materials such as financial resources or tools, knowledge, and/or various agents, (e.g., teachers, students, instructional coaches) which have the ability to influence subsystems or the system itself. The influence of these resource additions or exchanges in the blended system requires responsive interactions that guide self-management and drives adaptation.

Inflection points, also termed leverage points, tipping points, or transition points, occur in all CAS's and are points where the system has the ability to proceed in one of many directions (Edson, 2012; LePoire, 2015; van Bilsen et al., 2010). In a blended learning system, some examples of inflection points include when external forces work to influence decisions made, when agents in the blended learning system make decisions among available options, and when significant improvements in technology occur (Wang et al., 2015). Inflection points add complexity to a blended learning system and are the principal reason it is virtually impossible for one CAS to mirror another (Jordon et al., 2010). If a system contains agents who have the ability to reason, make decisions, and in some cases, mask intentions, complexity increases exponentially (Burns & Knox, 2011; Desouza & Lin, 2011; Marchi et al., 2014; van Bilsen et al., 2010).

CAS's must continually adapt if they are to be resilient enough to survive or flourish (Aydinoglu, 2010; Burns & Knox, 2011; Desouza & Lin, 2011; Edson, 2012; Ellis, 2011; Ellis & Herbert, 2011; Hall & Clark, 2010; Jordon et al., 2010; Kim & Mackey, 2014; Marchi et al., 2014; van Bilsen et al., 2010; Wang et al., 2015). Learning is an essential component of a successful CAS and depends on feedback from internal and external elements or agents (Desouza & Lin, 2011; Edson, 2012; Hall & Clark, 2010; Jordon et al., 2010; LePoire, 2015; Marchi et al., 2014). In a CAS such as a blended learning system, adaptation leads to the emergence of innovation, the ability to deal with uncertainty, and the ability to constantly reorganize the system or evolve (Aydinoglu, 2010; Burns & Knox, 2011; Desouza & Lin, 2011; Edson, 2012; Ellis, 2011; Ellis & Herbert, 2011; Hall & Clark, 2010; Jordon et al., 2010; Kim & Mackey, 2014; LePoire, 2015; Marchi et al., 2014; van Bilsen et al., 2010; Wang et al., 2015). The constant reorganization of the system does not specify that all changes will be positive, but a key to the adaptive resiliency and success of a system is the ability to evolve and deal with changes successfully (Marchi et al., 2014). In many cases, adaptations in a system are analyzed after they occur due to the difficulty in predicting results in advance (van Bilsen et al., 2010). All adaptations in a system must be viewed holistically to determine why they took place and how the system, the subsystems, the elements, and the agents were affected by the adaption

(Aydinoglu, 2010; Edson, 2012; van Bilsen et al., 2010; Wang et al., 2015). If only one subsystem or set of agents/elements is viewed in singularity, the feedback will not provide the information on interactions necessary to assist in future guidance of the system (Aydinoglu, 2010). In a blended learning system, as in any CAS with human agents, decisions made can have critical effects on the behavior of the system (Burns & Knox, 2011; Desouza & Lin, 2011; Marchi et al., 2014; van Bilsen et al., 2010).

For a CAS to operate most effectively, it must operate in a space where creativity is not stifled by an over-exercised level of control, yet the system is not allowed to destructure and descend into chaos (Aydinoglu, 2010; Kim & Mackey, 2014; Marchi et al., 2014; Wang et al., 2015). The space a CAS best operates is often termed the edge of chaos, and it requires a system that is highly adaptive to maintain this position (Aydinoglu, 2010; Kim & Mackey, 2014; Marchi et al., 2014; Wang et al., 2015). Diversity and heterogeneity of ideas, elements, and agents are essential items to consider in a CAS given their ability to provide stability or initiate change (Jordon et al., 2010). In a CAS, equilibrium is never truly experienced due to the influences constantly placed on the system (Aydinoglu, 2010). The struggle becomes moderating these influences or adapting to the influences in order to maintain operation in a zone where creative processes are not diminished to maximize learning and innovation (Marchi et al., 2014). Providing creative space on the edge of chaos requires agents involved in blended learning to respect the other agents involved and avoid major impositions of change or predetermined solutions so adaptations can evolve (Ellis, 2011). Major impositions in a blended learning environment can lead to a focus on maintenance of equilibrium rather than innovation as well as lead to a system becoming nested in a comfortable state rather than moving toward continuous improvement (Burns & Knox, 2011).

Wang et al. (2015) proposes a model to view blended learning in a holistic fashion as a complex adaptive system composed of six subsystems, which contain various subsystems themselves. While the description of the complex blended learning system used in this study varies in some respects, the model in Figure 1 provides a solid visual representation of the complexity of blended learning.

Figure 1

The Framework of Complex Adaptive Blended Learning Systems

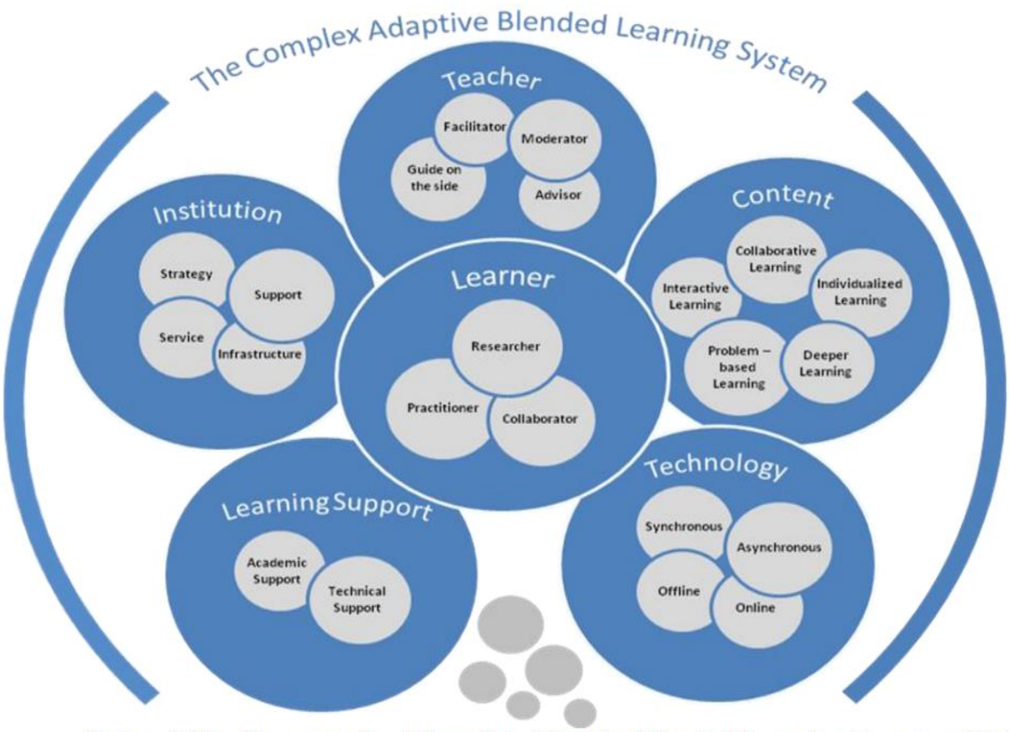

Figure 1. The Framework of Complex Adaptive Blended Learning Systems (CABLS)

Figure 1. A visual representation of the potential elements in a blended learning system and their interactions. *Source:* Wang et al. (2015). Reprinted with permission (Appendix A).

While the six major subsystems in Figure 1 describe the components of a blended system well, different terminology is utilized for this study. For the purposes of this study, the teachers and learners are classified as agents rather than subsystems. The subsystems placed inside the teacher subsystem by Wang et al. (2015) are roles of agents acting as teachers. The role in the teacher subsystem of facilitator is shifted to activator in order to account for the active role teachers can have on engagement while still allowing learning to take place in a student-centered fashion. The teaching subsystem in the blended learning model of this study includes students, instructional coaches, administrators, and support staff, which would also all fall into the learners subsystem as agents. Interactions are also simplified by Wang et al. (2015) by the overlapping of circles, which is easily understood as a CAS model and can quickly become overly busy and hard to follow. However, the tradeoff is a loss of modeled interaction. For example, technology and learning support do not overlap the teacher subsystem, but certainly have a direct effect on teachers.

At-risk Students: Who They are and How They are Classified

The definition of "at-risk" varies among researchers and educational agencies (Lange & Sletten, 1995). According to the U.S. Department of Education (2012), the definition of an at-risk (or high-needs) student is a student who is at-risk of academic failure due to any of a number of reasons, such as poverty, being significantly behind academically, previously dropped out, attending a high minority school, homelessness, placement in foster care, past or present incarceration, disabilities, or being an English language learner. These "high-needs students" may require extra support to increase their chances of graduating on time (U.S. Department of Education, 2012). The cause of an "at-risk" student designation is an important factor to consider when developing an educational plan to effectively maximize their learning (Tobin & Sprague, 1999).

Several factors have been determined through research as the most common reasons or most influential factors leading to students being designated as at risk of not graduating

(Archambault et al., 2010; Barbour & Siko, 2012; Brownell et al., 2010; Simonsen & Sugai, 2013; U.S. Department of Education, 2012; Watson & Gemin, 2008; Wilson, Stemp, & McGinty, 2011). Low socio-economic status of the student's family is a strong indicator of not graduating from high school (Archambault et al., 2010; Barbour & Siko, 2012; Brownell et al., 2010; U.S. Department of Education, 2012; Watson & Gemin, 2008). Substance abuse is another indicator which strongly influences the likelihood of high school graduation (Archambault et al., 2010; U.S. Department of Education, 2012; Watson & Gemin, 2008). Other important indicators of reduced graduation rates include lack of academic success, designation as an English language learner, emotional disorders, attendance issues, being a teen parent, and legal issues, to name a few of the more prevalent indicators (Archambault et al, 2010; Barbour & Siko, 2012; Brownell et al., 2010; Lange & Sletten, 1995; Simonsen & Sugai, 2013; Tobin & Sprague, 1999; U.S. Department of Education, 2012; Watson & Gemin, 2008, Wilson et al., 2011)

Best Practices in the Education of At-Risk Students

At-risk students require specialized, alternative learning programs to increase the opportunity for this population to be successful (Flower, McDaniel, & Jolivette, 2011; Tobin & Sprague, 1999; Wilson et al. 2011). Alternative school programs exist for the very purpose of providing options for at-risk students who have shown that the traditional model of instruction does not work well for them (Lange & Sletten, 1995). The traditional model most frequently seen in American secondary schools is a one-size-fits-all, factory model with a standardized instructional method designed to enable the teaching of large student numbers efficiently (Horn & Staker, 2015). However, a large number of alternative models utilize methods of instruction similar to those used in the high schools where at-risk students have lacked success; traditional models of instruction simply altered to create smaller class sizes. The work of John Hattie (2008) on smaller class sizes demonstrates smaller class size is not as powerful as popularly perceived in comparison to other instructionally impactful strategies. A review of literature reveals that several educational strategies typically work well with at-risk students. These strategies include low student-to-teacher ratios, highly structured learning environments, positive behavior management methods, utilizing school-based adult mentors, functional behavioral assessments, social skills instruction, effective academic instruction, parent involvement, and implementation of positive behavioral interventions and supports (Barbour & Siko, 2012; Flower et al., 2011; Lange & Sletten, 1995; Tobin & Sprague, 1999).

One of the most powerful strategies that has shown success with at-risk students is having a low ratio of students to teacher (Davidson, 2002; Flower et al., 2011; Lange & Sletten, 1995; Tobin & Sprague, 1999). As mentioned above, Hattie (2008) demonstrated in his meta-analysis research that smaller class sizes considered as an individual structural change does not greatly impact student learning. However, a smaller ratio of students to teacher results in a greater ability to engage at a personal level with students and provides the teacher with the ability to determine a student's individual strengths and weaknesses by "not leaving relationships to chance" (Davidson, 2002, p. 2). The ability to create positive teacher-student relationships has been demonstrated to be one of the most impactful strategies in the field of education, making pronounced changes in student learning and behavior (Hattie, 2008). Smaller student-to-teacher ratios also enable teachers to influence the behavioral issues at-risk students often possess and teach more appropriate replacement behaviors (Tobin & Sprague, 1999). Lower student-to-teacher ratios enable teachers to more effectively differentiate or personalize instruction due to increased comprehension of student ability levels, which can provide improved student learning (Carolan & Guinn, 2007; Lear, 2007).

Highly-structured learning environments with the ability to move to a less restrictive activity or area have been shown to be beneficial for at-risk student learning (Tobin & Sprague, 1999). At-risk students often lack well-developed, self-management skills and need the opportunity to learn the ability to self-manage. Students classified as at-risk often come from households that are lacking a high level of structure; therefore, self-management needs to be taught and opportunities to self-manage need to be provided in a safe, structured environment (Barbour & Siko, 2012; Lange & Sletten, 1995; Tobin & Sprague, 1999).

Behavior management is normally a major concern when working within the alternative high school setting with at-risk students (Tobin & Sprague, 1999). Maintaining a positive approach to behavior management has proven to be the best method when dealing with at-risk students (Tobin & Sprague, 1999). With adults in relationships, research has found that a five-to-one ratio of positive responses to negative responses predicts with a high level of accuracy how successful a relationship will be (Gottman, 1999). Gottman (1999) termed this five-to-one ratio as “the magic ratio.” This research theme continued beyond couples in relationships in order to provide the ability to determine the importance of various forms of interactions and how these interactions can create positive or negative results (Gottman, 2001). This work demonstrates that people are constantly making “bids” to strengthen relationships, and how we react to others’ “bids” determines how strong a relationship will become (Gottman, 2001). Without proper planning and staff development on techniques to increase positive interactions, the ability to offer and accept “bids” will not occur at the rate which maximizes relationship building (Knight, 2013). Behavior management systems should be based on positive feedback for acceptable behavior or compliance rather than a consistent input of negative feedback (Knight, 2013; Tobin & Sprague, 1999). A behavior management system must be well planned before implementation.

One option for implementing a successful behavior management system is using a method such as School-wide Positive Behavior Interventions and Supports (Simonsen & Sugai, 2013). This method ensures that students have clearly understood behavior expectations and staff has a plan in place to provide consistent implementation (Simonsen & Sugai, 2013). Having a well-developed positive behavior management system can help prevent staff from resorting to what, in many cases, becomes a natural negative response to behaviors outside of expectations or to schools tending toward policies that are reactive and have significant adverse outcomes for students (Simonsen & Sugai, 2013).

Negative feedback is a common form of feedback received by at-risk youth; however, it has been shown that positive feedback can significantly reduce delinquent activity (Tobin & Sprague, 1999). When working with at-risk youth, it is always important to analyze problem behaviors and attempt to identify the cause of the behavior (Tobin & Sprague, 1999). This analysis is often done most successfully on an individual student basis, but it can also be used in some school-wide situations where the behavior is prolific among a school population. Therefore, most successful behavior intervention systems have school-wide, class-wide, and individual behavior management elements (Simonsen & Sugai, 2013).

Individual behavior interventions can be created in several ways, including use of a school’s Behavioral Response to Intervention team or creation of a Functional Behavioral Assessment (Sprick & Garrison, 2008; Tobin & Sprague, 1999). These interventions focus on what causes the behavior and what replacement positive behaviors can be put in place to reduce or remove behaviors occurring outside of expectations (Flower et al., 2011; Tobin & Sprague, 1999). When working with high school age students and designing both school-wide and individual behavior plans, it is normally good practice to involve students to enable an intervention team to gather the best data to modify behavior and develop student responsibility (Tobin & Sprague, 1999).

At-risk students, for reasons as varied as why they have been classified as at-risk, often lack well-developed social skills (Simonsen & Sugai, 2013; Tobin & Sprague, 1999). Problem solving, the ability to resolve conflicts in an amenable manner, anger management, and the ability to understand the conditions of others are areas that need to be addressed when educating at-risk students (Tobin & Sprague, 1999). Lessons, or specific classes developed to address these topics, are important to consider if the goal of the program goes beyond simply providing a diploma, but includes the desire to create a career- or college-ready young adult. The transition, post-high school, from the artificial environment traditionally in place in most schools creates a difficult situation for students to overcome (McWhorter, 2007). Suddenly, upon graduation day, students are removed from a highly-structured environment into an environment that does not have the same levels of control and predictability. Without overtly addressing the social skill deficits often present in at-risk students, these students leave high school improperly prepared for life after high school, if indeed schools are able to keep them enrolled long enough to reach graduation (McWhorter, 2007).

Effective academic instruction is essential for at-risk students who have struggled in the traditional school setting and have often fallen behind peers in a setting not designed to meet their needs (Flower et al., 2011; Tobin & Sprague, 1999). At-risk students frequently require additional academic intervention in multiple subject areas, including reading, writing, and math, in order to successfully reach the academic levels of similar age peers (Flower et al., 2011; Tobin & Sprague, 1999). Hattie (2008) determined that good teachers, using effective teaching techniques to provide students a well-designed curriculum, have the greatest potential to increase student learning growth above the normal learning rate. Some of the elements Hattie (2008) identified through his research as highly impactful include formative assessment, teacher clarity, feedback, teacher-student relationships, and cooperative learning, to name a few of those that are primarily within control of the class instructor. Knight (2013) has also shown that using research-based instructional techniques developed through practice and study can influence student learning in a positive manner. This topic is relatively expansive and will be addressed in more detail later in this study's literature review.

Parent involvement in the school experience of at-risk students is often limited (Flower et al., 2011). This lack of involvement is often due to the negative feedback that parents receive from school staff with regard to at-risk students' academic and behavioral performance (Flower et al., 2011). Tobin and Sprague (1999) recommend the use of school-based parent training to assist in the development of strong parenting skills, which are often needed in the parents of at-risk students. Parents are important partners with the school, and the inclusion of parents in a positive way is likely to have a significant effect on the success of at risk students (Flower et al., 2011).

Behavior and Academic Achievement

Discipline issues due to negative behavior are a major concern of school staff (Pisacreta, Tincani, Connell, & Axelrod, 2011). A large percentage of teachers have raised issue with the amount of lost teaching time due to challenging student behavior (Pisacreta et al., 2011). Negative student behavior frequently results in reduced academic achievement (Borg, 2015;

Breslau, Breslau, Miller, & Raykov, 2011; Georges, Brooks-Gunn, & Malone, 2012; Hoffmann, Erickson, & Spence, 2013; Pisacreta et al., 2011). Academic achievement is affected at not only the individual student level, but at the classroom level as well, resulting in academic opportunity loss for the groups of students in classrooms where behavior issues take place (Georges, Brooks-Gunn, & Malone, 2012; Kelm, McIntosh, & Cooley, 2014). One of the methods utilized in many school districts to deal with students who exhibit behavior issues is to recommend or force placement of students who exhibit delinquency into an alternative high school designated to serve students at risk of not graduating (Herndon, Bembenutty, & Gill, 2015; Wilkerson et al., 2016).

Placement in an alternative setting is often not a positive solution for students who struggle academically or behaviorally (Wilkerson et al., 2016). Alternative settings have mixed results with students and have been shown to reduce academic achievement, reduce attendance rates, and increase dropout rates (Wilkerson et al., 2016). While students report positive views of smaller class sizes and teacher relationships, high dropout rates continue to occur in alternative settings, and school model differences are limited between the programs in place at most alternative settings for at-risk students and the programs in place at traditional high schools (Wilkerson et al., 2016). Alternative schools need to develop new support models to provide both academic and social-emotional support for students at risk of academic failure (Wilkerson et al., 2016). These models need to include both positive behavior intervention methods and a focus on academics that are engaging and relevant (Kelm, McIntosh, & Cooley, 2014; Rienties & Toetenel, 2016; Segedin, 2012).

Behavior management draws a great deal of academic time from school staff. Students who may be the source of behavior issues or are affected by delinquent behavior also lose academic time (Kelm, McIntosh, & Cooley, 2014). Proactive planning, data analysis and the implementation of behavior interventions with fidelity can save school staff and students valuable academic time (Kelm, McIntosh, & Cooley, 2014). Mastery-based, personalized learning delivered through blended instruction provides the possibility of reducing the behavior management needs of school staff by providing students the ability to move at their own pace, focus on academics that are relevant to them, and choose the location in which they desire to work (Flumerfelt & Green, 2013; Francis, 2012; Horn & Staker, 2015).

Personalized Instruction: Implementation and Achievement

Personalized instruction, as mentioned in the introduction, is currently one of the most prominent buzz words in education. Personalized instruction is, in essence, providing students the ability to decide what their course of study will look like based upon their interests, needs, and personal learning objectives (Corry & Carlson-Bancroft, 2014). The factory-based model of school design does not meet the needs of individual students who each learn different material, in a different manner, and at a different pace than their peers (Horn & Staker, 2015). This knowledge of an individual's learning style and varying ability levels leads to separate themes geared toward greater success with individual students, such as learning styles, multiple intelligences, and differentiated learning. When applied in the traditional classroom setting, the ability to personalize instruction based on the need of individual students becomes difficult, if not impossible. The traditional model of instruction has reduced the impact of such concepts as learning styles, multiple intelligences and differentiated learning in practice. Personalized learning requires a removal from the traditional framework of teaching and the traditional role of the teacher (Evans, 2012; Horn & Staker, 20015; Sykes et al., 2014). In personalized learning, the defined space of class periods in a specified subject matter is derailed. Students are provided the ability to determine where and when they will educationally engage and in what subject matter they choose to engage (Horn & Staker, 2015). Personalized learning has not truly been a reality in public education until the advancement of technology resulted in the ability for students to learn what they want, when they want, and with whom they want (Horn & Staker, 2015; Richardson, 2012). Through the use of technology, teachers now become facilitators of knowledge rather than dispensers of knowledge (Horn & Staker, 2015; Sykes et al., 2014). This distinction is a huge shift for teachers, but a necessary one due to the rapidly increasing role of technology in education and the work environment (Florian & Zimmerman, 2015; Horn & Staker, 2015). Teachers become the facilitators of student-led classrooms and assist with the development of the skills required to locate and differentiate valid sources, problem solve, and reflect to develop personal understanding (Horn & Staker, 2015).

Personalized learning has a number of advantages, including the ability for teachers to develop lessons based on the needs or interests of individuals, providing students the ability to work at their own pace, and the flexibility to allow learning to occur any time at any place (Archambault et al., 2010; Richardson, 2012). Personalized learning has also been shown through research models to be an effective strategy for at-risk students (Flumerfelt & Green, 2013; Watson & Gemin, 2008). When mastery-based education is used as a key element of a personalized learning program, students are also provided greater control over their educational journey, making students “more engaged and motivated investors of their own education” (Prain et al., 2013, p. 657). Personalized instruction also has disadvantages, however, such as the lack of face-to-face communication and relationship building with a classroom teacher and other students (Kazu & Demirkol, 2014). The conceptual lack of clarity has been indicated as a major critique of personalized learning as well (Prain et al., 2013).

Traditional face-to-face instruction remains a popular method of instruction among students (Erdem & Kibar, 2014; Yapici & Akbayin, 2012b). Blended learning has emerged over the last two decades as a method of instruction that allows the best of both face-to-face and personalized learning to exist simultaneously (Freeman & Tremblay, 2013; Kazu & Demirkol, 2014; Ma'arop & Embi, 2016; Yapici & Akbayin, 2012b). The teacher utilizes the computer or electronic device to provide instruction that would traditionally be disseminated through lecture, reading, or individual work completion (Horn & Staker, 2015). This approach retains the ability to teach face-to-face when discussions, cooperative learning, personalized assessment, and other methods are best suited to facilitate learning (Alammary, et al., 2014; Corry & Carlson-Bancroft, 2014). Blended learning can be used in various forms depending on the material being covered and what the course instructor deems is the proper mix of online verses face-to-face instruction (Alammary et al., 2014; Freeman & Tremblay, 2013; Yapici & Akbayin, 2012b). Some subjects simply lend themselves to more face-to-face instruction while others lend themselves to more online-based education (Yapici & Akbayin, 2012b). Determining the proper mix of online to face-to-face involves the consideration of many factors including state level funding for technology and teachers, state and local school district policies, and the strengths or weaknesses of teachers delivering instruction. Studies have shown that blended learning, when employed properly, can contribute more to student achievement than traditional teaching methods can alone (Alijani, Kwun, & Yu, 2014; Headden, 2013; Ma'arop & Embi, 2016; Yapici & Akbayin, 2012).

The Transition from a Traditional Model to a Blended Instructional Model

The transition from a traditional model of instruction to a blended model requires the consideration of several key elements, including professional development of staff, enhancing technology, shifting the role of the teacher, renovating the physical spaces of the school, utilizing data to inform instruction, and a focus on college and career readiness skills (Freeman & Tremblay, 2013; Ma'arop & Embi; 2016; Sykes et al., 2014). The exploration of these elements is in the early stages, but has received a large boost through the infusion of funds to several districts or district consortiums from the Race to the Top District Grant Program provided by the U.S. Department of Education (Evans, 2012; Sykes et al., 2014) . The Department of Education awarded 510 million dollars to twenty-one applicants in December, 2012 and December, 2013. These Race to the Top District grantors selected the twenty-one awardees from 550 applicants primarily to support programs that specified personalized learning designs. By reviewing the challenges and important considerations specified by the districts awarded Race to the Top funds, guidance can be provided to schools or districts just starting the journey toward personalized instruction (Sykes et al., 2014).

Professional development for staff is a key element in a number of studies discussing the development of a blended model of instruction (Alammary et al., 2014; Calderon, Ginsberg, & Ciabocchi, 2012; DiPietro et al., 2008; Kenney & Newcombe, 2011; Sykes et al., 2014; Yapici & Akbayin, 2012). The majority of the professional development required to successfully implement a blended learning model is targeted towards teachers (Alammary et al., 2014; Calderon et al., DiPietro et al., 2008; Kenney & Newcombe, 2011; Sykes et al., 2014; Yapici & Akbayin, 2012). The professional development of teachers can be separated into two major areas of focus. The first area is the transition of the teacher's role from dispenser of knowledge to facilitator of learning (Calderon et al., 2010; Sykes et al., 2014). The teacher becomes a guide in a blended model of learning who develops both online and face-to-face lessons centered on individual needs, interests, and abilities of students (Freeman & Tremblay; 2013; Horn & Staker, 2015; Sykes et al., 2014). The other area of focus for teacher professional development is the development of technology skills and online lesson design (Alammary et al., 2014; Calderon et al., 2010; DiPietro et al., 2008; Kenney & Newcombe, 2011; Sykes et al., 2014; Yapici & Akbayin, 2012b). Teachers normally teach as they have been instructed during their personal educational journey (McCrea, 2012; McQuiggan, 2012). However, the majority in the teaching practice, including those teaching online, have not received instruction through an online or blended model (Alammary et al., 2014; Duncan & Barnett, 2009). Traditional classroom teachers have the skills to develop face-to-face lessons in most cases, but the creation of successful online lessons requires a separate set of considerations and skills, which is often not a natural shift for teachers (DiPietro et al., 2008; Duncan & Barnett, 2009; Kenney & Newcombe, 2011; Kerr, 2011; McQuiggan, 2012; Mirriahi et al., 2015). Teacher development of technology skills provides teachers the ability to choose and implement the best tools for use in the online environment to maximize lesson effectiveness and personalization (Alammary et al., 2014; Calderon et al., 2010; Yapici & Akbayin, 2012). However, a focus on tools, which is included in several teacher training programs, falls short, and an inclusion of pedagogy needs to be included in teacher preparation programs (Duncan & Barnett, 2009; Kerr, 2011; Lane, 2013). Sykes et al. (2014) also suggest professional development for staff through the inclusion of personalized learning coaches to provide the ongoing development of teacher skills as well as identify needs.

Enhancing technology is an essential component to implementing an effective blended learning model (Mirriahi et al., 2015; Sykes et al., 2014). When considering a move to blended learning it is the technology that provides the ability to personalize instruction (Alijani et al., 2014; Korkmaz & Karakus, 2009). Items that need to be examined when selecting educational technology include required infrastructure upgrades, IT support, and selection and implementation of devices (Sykes et al., 2014). However, instructional technology should not be the primary focus of teacher professional development at the expense of best practices and pedagogy (Duncan & Barnett, 2009; Kerr, 2011; Lane, 2013).

The infrastructure of a school and school district are essential components of personalization due to the importance of infrastructure in allowing connectivity and access to online material (Evans, 2012; Sykes et al, 2014). Schools need to evaluate the current status of their infrastructure, where improvements need to be made, and what additional infrastructure needs to be put into place (Evans, 2012; Sykes et al., 2014).

The utilization of a large number of devices, such as laptops or tablets, requires technological support for teachers and students (Ma'arop & Embi; 2016; Napier et al., 2011; Sykes et al., 2014). Without sound consideration of technological support needs, it is conceivable that a school will run into issues, such as classrooms that will not connect to the internet or devices that will not work, yet are essential to access online lessons (Ma'arop & Embi, 2016; Sykes, et al., 2014). Some of the logistical issues of technology support that need to be considered include: Who will be responsible to set up devices? What amount of time will be required to set up devices? Does the district have adequate IT support to efficiently roll out the necessary devices? Can the devices that students need be properly maintained? Where will devices be stored? What will occur if devices are lost or stolen? Is a loaner pool of devices available? What is the backup plan if device connectivity is not available? (Ma'arop & Embi; 2016; Sykes, et al., 2014).

Device selection is a difficult element of consideration when developing a blended model. This difficulty is due to the large selection of devices available in the market and the vast array of capabilities these devices offer (Sykes et al., 2014). Important considerations for the district include device cost, maintenance, purchase or lease, insurance cost, life span, whether roll out design will be one-to-one or via classroom sets, if teachers will receive the same device, what level of digital content access will be allowed or prohibited, if special education needs have been considered, and what stakeholder input will be considered in device selection (Sykes et al., 2014). Considerations for the school and/or teacher include available features of the device to ensure appropriate lesson development, what digital content is available on the device, and how to effectively monitor the devices (Sykes et al., 2014). Ma'arop & Embi (2016) suggest a needs assessment to develop a plan that addresses the various struggles associated with implementing blended learning.

The logistics behind rolling out the devices to be used in blended learning is also an important topic for consideration (Sykes et al., 2014). Devices for blended learning can be rolled out based on the design of the program in place at the school level. Does the model of instruction at the school level call for devices to be stored at school, or is the model designed around student access to the devices for use at home? What methods will be used to inform parents and students of device use expectations? The ability of students to download software of various forms and to store software or files is vital for consideration. The level of access that is available to students at home is another important topic, as this will establish the ability to set expectations away from the school environment (Evans, 2012; Sykes et al., 2014).

With a shift away from traditional, factory-model school design and toward a blended model of learning, the physical design of a school becomes an important topic of consideration (Horn & Staker, 2015; Sykes et al., 2014). The renovation of physical space often comes down to available funds and how an existing structure can be redesigned to best adapt to blended learning. Building design and space need to be considered, since in many cases funds are often not available to make major building shifts or build with blended learning in mind (Horn & Staker, 2015; Sykes et al., 2014). Some important considerations when evaluating physical spaces include: What changes do we have the ability to make to classrooms and common areas of the school? How can schools be redesigned to provide for small group collaboration? What redesign of school spaces are required to allow students to appropriately access technological content? (Sykes et al., 2014). Horn and Staker (2015) provide several examples of how schools that have implemented blended learning have worked to change or develop spaces that are effective for blended learning. Physical space design needs to be developed or modified based on the circumstances facing a school (Horn & Staker, 2015). They recommend a consideration of modularity to provide adaptations to space as needed for different learning arrangements to be designed (Horn & Staker, 2015).

The utilization of data to inform instruction is essential to personalize instruction (Evans, 2012; Sykes et al., 2014). Without frequent assessment of data, teachers will not have an understanding of student ability levels, interests, or current gaps in students' knowledge base (Evans, 2012; Sykes et al., 2014). Students and parents also need frequent access to data to enable students to drive their own learning and allow parents to properly support the education of their student (Evans, 2012; Sykes et al., 2014). Schools that implement a blended model to personalize instruction need to take advantage of the ability of assessments to provide data which enables continuous improvement to occur (Sykes et al., 2014). Current assessments need to be evaluated to ensure they provide teachers with actionable data that measures a student's mastery level, thus ensuring a personalized learning path can be developed (Sykes et al., 2014). If assessments that provide data to properly guide student instruction are not available in a school or district, a discussion needs to occur concerning assessments that are available to meet this objective or whether the district or school has the ability to design assessments that will provide the data needed to ensure consistent student growth (Sykes et al., 2014).

Data needs to be easily accessible, as it will only be usable if it is available in a timely manner and accessed with minimal effort (Evans, 2012; Sykes et al., 2014). One of the key elements learned from schools that have embarked on a journey into personalized instruction through a blended model is that systems of data collection need to be consolidated to allow teachers, students, and parents easy access to data (Sykes et al., 2014). Other key considerations include the ability to design online assessment tools that provide immediate feedback and to what extent the data will be made available to students to enable them to drive their own learning (Sykes et al., 2014).

Teachers moving toward a blended model must meet regularly to discuss data and interpret how to best design courses and paths of personalized instruction for students based on their needs (Napier et al., 2011; Sykes et al., 2014). In order for these meetings to assist teachers with personalized instructional design, teachers need to be provided professional development (Alammary et al., 2014; Evans, 2012; Ma'arop & Embi, 2016; Napier et al., 2011; Sykes et al., 2014).

When a school is looking to implement a blended learning model, the development of college and career readiness skills may be an area they want to consider in the development phase (Sykes et al., 2014). Schools focused on successfully transitioning students to post-high school options need to ensure opportunities exist for students to collaborate with community and, four-year colleges as well as businesses (Sykes et al., 2014). Schools developing a personalized, blended model also need to consider how 21st century skills, such as critical thinking and collaboration, are integrated into educational design (Erdem & Kibar, 2014; Florian &

Zimmerman, 2015; Sykes et al., 2014). The development of a competency-based model that ensures a mastery of skills needed post-high school should also be a consideration of an implemented personalized learning model (Evans, 2012; Sykes et al., 2014).

Research-Based Instruction

Research-based instructional methods have been a major focus of educational improvement for several decades (Hattie, 2008; Knight, 2013; Marzano et al., 2001; William, 2011). However, the ability to gather data and review the work of a greater number of researchers seems to be developing as quickly as the technology which allows it to occur. The research-based model to improve instruction utilized in this study centers around the work of Jim Knight from the University of Kansas. Knight has released several books that are firmly rooted in the work of Marzano, Danielson, Bennett, Saphier, Hattie, and many other prominent researchers in the field of education (Knight, 2013). Knight (2013) proposes that instruction should employ methods that contain great leverage, or the ability to increase results in the most dramatic fashion with the least amount of investiture. In the district of study, the work of Jim Knight was chosen for several reasons, including a need to comply with the school improvement efforts specified by the No Child Left Behind legislation, as well as Knight's research-based work and holistic approach to improving student learning. Through consideration and lesson planning that includes four elements (content planning, formative assessment, instruction, and community building), teachers are better able to create what Knight terms "high-impact instruction" (Knight, 2013, p. 10). Knight (2013) further asserts, with a research-based foundation, that the use of an instructional coach can impact learning in dynamic fashion in his books *Unmistakable Impact* (2011) and *High Impact Instruction* (2013). Administrators are urged to consider teachers as equal partners in the development of any instructional improvement plan and respect them as professionals who are essential to the process (Knight, 2013).

Importance of Mentors who Utilize Sound Practice

A great deal of research has been conducted on the effectiveness of mentors to increase behavioral and academic gains among at-risk students (Davidson, 2002; Ference & Rhodes, 2002; Gordon, Downey, & Bangert, 2013; Grossman, Chan, Schwartz, & Rhodes, 2011; Larose, Chaloux, Monaghan, &Tarabulsy, 2010; McQuillin, Smith, & Strait, 2011; McWhorter, 2007; Simoes & Alarcao, 2013(a); Tobin & Sprague, 1999, Vannest et al., 2008). The results of this research have been mixed showing that, in certain cases, mentoring (which can take the form of advising or counseling) can positively affect student academic performance and behavior, but it can also have no effect or deleterious effects (Larose et al., 2010; Vannest et al., 2008). In essence, the research shows that putting two people together and calling it a mentoring situation can not only yield no results, it actually has the potential to yield negative results (Vannest et al., 2008). At-risk students, especially those with emotional or behavior disorders, often have a difficult time becoming familiar with new people, adjusting to new routines, and dealing with the expectations and the presence of another individual (Vannest et al., 2008). Conversely, in various other studies, the placement of students with mentors, advisors, or counselors, when implemented effectively, has shown invaluable increases in behavior and academic performance as well as reduced the likelihood of a student dropping out of school (Davidson, 2002; Ference & Rhodes, 2002; Larose et al., 2010; McWhorter, 2007; Tobin & Sprague, 1999, Vannest et al., 2008). Some of these studies have also shown that effective mentor relationships can increase the likelihood that a student at risk of completing high school not only completes high school, but also will go on to some form of post-high school education (McWhorter, 2007; Vannest et al., 2008).

The most common theme of effective mentoring relationships appears to be the ability for the mentor and the student being mentored to develop common goals (Larose et al., 2010; Vannest et al., 2008). If common goals exist between mentors and their mentees, both academic and behavioral improvements occur to a greater degree than those created through the influence of other relationship traits studied (Larose et al, 2010; Vannest et al, 2008). Mentoring is not necessarily a naturally developed skill for either mentors or students, so professional development is key to the success of a mentoring program (Tobin & Sprague, 1999; Vannest et al., 2008).

It is also important to point out that the longevity of mentoring is somewhat short-term in the majority of studies related to the effectiveness of mentoring and is mentioned as a validity issue requiring more study (Larose et al., 2010; Vannest et al., 2008). Relative longevity is possible within the high school setting where mentoring relationships can last for four years or more. Other elements of successful counseling relationships include use of positive behavior management, student choice in mentoring and amount of mentoring, mutual benefit for the parties involved in the mentoring relationship, and agreement by both parties that the mentoring arrangement is a positive working alliance (Larose et al, 2010; Tobin & Sprague, 1999; Vannest et al., 2008).

Conclusion

Available research shows that the application of a mastery-based, personalized learning model delivered through blended instruction does not guarantee greater success among students academically. However, research does indicate that increased academic achievement, increased student engagement, and a more positive student perception of education can be achieved through application of a mastery-based, personalized learning model delivered through blended instruction in a school that serves at-risk learners.

A key element of any school that moves toward a mastery-based, personalized instructional model delivered through blended instruction should be a focus on staff professional development that will ensure the skills to mentor students, develop online course materials, and use high impact instructional methods.

A review of the literature further proposes that the use of an instructional coach and the implementation of research-based instructional techniques and best practices following Jim Knight’s work through the University of Kansas Center for Research on Learning will enhance student learning. This improvement process involves utilizing an instructional coach, school leadership team, and professional development to build a one-page school improvement plan focusing on high-impact techniques in the areas of planning, instruction, and community building to efficiently increase student learning (Knight, 2013). This element of the study moves beyond what is seen in most literature reviewed on mastery-based, personalized learning, or blended learning, which focus primarily on school model redesign and the shifting role of the teacher, not on increasing the instructional effectiveness of school staff.

Chapter III

Design and Methodology

Introduction

As described in the literature review, at-risk students are classified based on one or more of several qualifying characteristics (see Appendix B). The qualifying criteria include both behavior-related and emotional-control issues. One of the difficulties, for both students and staff in high schools that serve at-risk students, is the consolidation of at-risk students into a single instructional setting. This consolidation creates a situation where behavior makes a significant impact on instruction and learning. Behavior is often tracked in research journal articles that discuss school reform as an indicator of potential improvement (Gordon, Downey, & Bangert, 2013; Flumerfelt & Green, 2013; Vannest et al., 2008). Frequency of behavior infraction occurrence was selected as a variable in this study due to the prevalence of behavior-related data in research on school improvement (Gordon, Downey, & Bangert, 2013; Flumerfelt & Green, 2013; Vannest et al., 2008).

Course achievement, based on the Carnegie unit, in the credit-based high school environment that is predominant in the United States is traditionally used to determine when a student has reached graduation (Silva & White, 2015). The importance of credit achievement is highlighted by its inclusion in the factors for qualification as an at-risk student by the state where this study was conducted (Appendix B). Credit achievement is also the standard process by which a student meets the requirements set by states and districts to ensure certain curricular expectations are met, thereby establishing a student as prepared to progress from high school to the post-secondary environment of work, trade school, or college (Silva & White, 2015). The predominance of systems that utilize course achievement as a progression toward graduation and the importance of graduation rates as a standard measure of high school quality specifies why course achievement was selected in this study as an item tracked for data collection.

Student engagement is a predictor of student success rates (Baldwin & Koh, 2012; Francis, 2012; Jonson-Reid, 2010; Leach & Zepke, 2009; Leach & Zepke, 2011; Russell & Slater, 2011; Wilson et al., 2011; Zepke & Leach, 2010). Students who are enrolled in a system that does not adequately meet their needs are more likely to seek alternatives to attendance and completion (Ingul, Klockner, Silverman, & Nordahl, 2012). The educational system has a rapidly increasing number of educational providers vying for students, and computers have lifted the restriction of distance when online options are considered and internet access is available (Watson et al., 2014). Student perception can also be used as an indicator that an instructional model is in need of improvement and indicate specific areas where improvement is needed (Flumerfelt & Green, 2013; Leach & Zepke, 2011; Russell & Slater, 2011; Taylor, Atas, & Ghani, 2017). Leach and Zepke (2011) assert that student engagement is a complex concept and that use of a conceptual organizer provides a better framework from which to work to better understand the many facets of engagement. Therefore, the conceptual framework developed by Leach and Zepke (2011) was utilized to design a tool that gathered student perception data which assisted in determining the success of the introduced educational model as well as to identify areas of improvement. For the purpose of this study, the primary researcher and personnel in the district of study developed the Mastery-based Learning Student Perception Survey (MLSPS) from Leach and Zepke's (2011) conceptual organizer to gather student perception and ensure the elements of an educational model that promote student engagement are in place.

Research Design

This study utilized both quantitative and qualitative data collection methods in an action research design. Until the late 1980s and early 1990s, a great deal of disagreement persisted among researchers concerning the validity of combining quantitative and qualitative research to examine research questions (Tashakkori & Teddlie, 1998). Presently, this debate has been largely resolved, and the use of mixed methods research, or a combination of quantitative and qualitative research methods, has been commonly employed in the social sciences (Creswell, 2015; Tashakkori & Teddlie, 1998). Quantitative and qualitative methods have shown themselves to be particularly compatible in education-related research with a number of research approaches utilizing mixed methods in the education and evaluation fields (Tashakkori & Teddlie, 1998). What has occurred over the last several decades can essentially be described as an evolution of research methods from monomethods to mixed methods (Creswell, 2015; Tashakkori & Teddlie, 1998). Complex adaptive systems theory guides a researcher to view complex systems, such as mastery-based or blended learning, as holistically as possible (Edson, 2012; van Bilsen et al., 2010; Wang et al., 2015). This need for a holistic view guided this study toward the use of mixed methods research, which can provide a better understanding than utilizing only quantitative or qualitative research methods individually (Creswell, 2015). In any mixed methods research, a primary method, quantitative or qualitative, is chosen to be in the foreground (Marshall & Rossman, 2016). Quantitative data was vital to this study, which focused on determining the impact of mastery-based, personalized learning utilizing a blended learning instructional model on student academic achievement, behavior, and perception. The quantitative data provided numbers that can be analyzed for comparison purposes or stand alone for review of system interactions. The use of mixed methods provides a researcher the ability to build on the strength of the quantitative data by utilizing qualitative data (Creswell, 2015). Integrating a conceptual or theoretical framework into a researcher's study provides the researcher the ability to refine the data collection methods to ensure the research questions have been answered (Ravitch & Riggan, 2012). According to complex adaptive systems theory, all subsystems of an instructional model constantly interact (Edson, 2012; van Bilsen et al., 2010; Wang et al., 2015); therefore, the researcher determined that data must be collected using various methods in order to provide feedback and enable adaptation and evolution of the system.

As the oversight of education continues from a national level to a local level, the use of quantitative data has become more and more valuable as a way to explain information through the efficient use of numbers, which afford economy in record keeping and data reporting (Tanner, 2012). Once the tool of experts, statistics to analyze qualitative data have evolved to become an element that needs to be included in all educators' domain (Tanner, 2012). Politicians, school boards and district administrators who set budget priorities can influence access to resources that are required to utilize certain instructional techniques (Bramante & Colby, 2012). With a lack of infrastructure and devices to access the internet, shifting a portion of the instruction online is not an option. Educational budgets are limited, and data is key in the current educational age of accountability to influence decision making (Tanner, 2012). Quantitative research, by definition, is designed to explain the relationships between variables (Creswell, 2015). The goal of this study was to analyze the effect of the independent variable, integration of a mastery-based instructional model utilizing blended learning, on the dependent variables of student behavior, student learning, and student perception. The comparison of variables lent itself readily to the use of quantitative research methods (Creswell, 2015). With the data detailing the impact of model transformation that this study provided, the district has the necessary information to justify or discontinue the use of funds to continue or expand mastery-based, blended learning. This data is of particular value in the hands of educational decision makers in a quantitative form, which can be displayed in a manner convenient for wide audiences and is based on solid numerical data (Tanner, 2012).

Qualitative research methods have become well established as a valuable tool in the social sciences, including the field of education (Marshall & Rossman, 2016). Qualitative researchers tend to view social worlds in a holistic and complex manner. This holistic and complex manner of envisioning the effect of a new instructional model on student perception lies in a direct parallel with the theoretical framework in place for this study. Qualitative research provides the ability to take a broader look at social phenomena, which can enable the researcher to fill the gaps. Through the use of quantitative methods, this study was designed to gather general perception data to help inform decision making. The use of a survey alone, however, does not allow the researcher to capture the actual voices of the student. Through the use of qualitative data collection methods, an interview of random student participants provided a look at the naturalistic view of the students' experience captured in their own words. Qualitative research allows the researcher to understand the individual perception of the at-risk students participating in this study. This additional insight justifies the use of qualitative methods due to the shortcomings of quantitative methods to holistically answer the third research question of this study. To fully embrace the student perception of a shift to a blended learning model, qualitative methods lends voice to the students that the model directly affects (Marshall & Rossman, 2016).

Researchers engage in action research to improve their practice and move forward the concerns of the marginalized (Marshall & Rossman, 2016). In the traditional industrialized model of education, a case could be made that all students are a marginalized population

(Bramante & Colby, 2012; Horn & Staker, 2015). Students are normally not afforded the ability to voice concerns or individual needs that lead to actionable change in most U.S. schools (Horn & Staker, 2015). Action research, when executed well, can blur the separation between researcher and participant, creating a democratic process focused on guiding practice, changing practice, and assessing the changes that have been made (Marshall & Rossman, 2016). The process of interactions guiding practice, changing or adapting practice, and assessing or reflecting on changes creates the evolution of the complex, adaptive blended learning system required to make the system resilient (Wang et al., 2015).

Participants

The data for this study was drawn from a population of students enrolled in grades 9-12 at three secondary high schools located in the western United States. These schools apply to their state department of education annually to operate as alternative high schools based on the specifications established in administrative code for alternative schools. They are only permitted to enroll students designated at-risk by state guidelines (see Appendix B). The schools involved in this study had a total school enrollment that varied between 484 students at the onset of data collection and 452 students at the conclusion of data collection. Of this total population, 88 were classified as 9^{th}-grade students, or freshman, defined as a student's first year enrolled in high school at the beginning of data collection. The total enrolled population of 9^{th} grade students decreased to 83 at the end of the data collection period. A total of 97 students were classified as 10^{th}-grade students, or sophomores, at the onset of data collection, defined as enrolled in high school for two years. This number increased to 99 at the end of the data collection period. Grade 11, or the junior class, consisted of 116 students who had entered a third year in high school by the beginning of the study time frame. This number increased to 119 by the end of data collection. The culminating year of high school, the senior class, composed of those in grade 12, had an enrollment of 183 when data collection ensued, but dropped to a total of 151 at the conclusion of data collection. A synopsis of enrollment data can be viewed in Table1.

Table 1

Enrollment Data

Enrollments as of September 1, 2016	9th Grade	10th Grade	11th Grade	12th Grade
Building 1	22	34	43	62
Building 2	21	36	32	70
Building 3	45	27	41	51
n	88	97	116	183
Enrollments as of January 20, 2017				
Building 1	19	31	41	47
Building 2	22	36	36	58
Building 3	42	32	42	46
n	83	99	119	151

The general demographics data for the three alternative high schools indicated a relatively high level of low socioeconomic status students, indicated by the percentage of free and reduced lunch enrollees. Overall, the three schools combined had a mean free and reduced lunch population of 53.94% at the onset of data collection, which decreased to 50.33% at the end of the data collection period. The percentage of free and reduced varied from 52.12% to 56.88% between the three schools at the onset of data collection, and from 46.91% to 52.98% at the conclusion of the data collection period.

Mean student population data on the ethnic composition of the three high schools indicate the population was comprised of 82.08% Caucasian, 3.69% Black, 10.2% Hispanic or Latino, less than 1% Asian, under 1% American Indian or Alaskan Native, less than 1% Native

Hawaiian or other Pacific Islander, and 2.23% two or more races at the end of the data collection period. Actual ethnic composition data for each school can be seen in Table 2.

Table 2

Ethnic Composition of Students

Ethnicity	American Indian or Alaskan Native	Asian	Black/African American	Caucasian/White
Building 1	.73%	.73%	7.25%	77.54%
Building 2	1.97%	.66%	1.97%	82.9%
Building 3	0	.62%	1.85%	85.8%
Totals	.9%	.67%	3.69%	82.08%
Ethnicity (cont.)	Hispanic or Latino	Native Hawaiian or Other Pacific Islander	Two or More Races	
Building 1	10.15%	.73%	2.9%	
Building 2	11.18%	0	1.31%	
Building 3	9.26%	0	2.47%	
Totals	10.20%	.24%	2.23%	

Note. Reported in percentage of total student population; based on student data management system self-selected categories.

The mean gender composition of the three schools was 60.62% male and 39.38% female at the conclusion of data collection. The special education population of the three alternative high schools varied from 16.45% to 20.37% of the student body, with a mean special education percentage of 18.07%. Special education students were all provided special education services in accordance with the documentation recorded on Individual Education Plans written for each student. The mean percentage of students who received Section 504 accommodations in the three alternative high schools was 17.04%. The percentage of students on Section 504 plans varied from 13.77% to 22.22% between schools. When viewed in combination, schools varied in population percentages of 31.16% to 42.59% of students receiving academic accommodations, indicating a large percentage of the total student population of each alternative high school.

The staff of the three high schools was based on a full-time equivalency (FTE) of 12.166 regular education teachers, which equated to 13 certified teachers in a combination of full- and part-time work status employed at each building. The regular education staff was supplemented in each school with either a .5 or 1.0 FTE special education teacher, based on special education population and decisions between the school administration and district special education administration. Each school contained either one or two special education paraprofessionals to support special education students with their academic or behavioral needs based on the service time specified on IEPs. Each of the three schools were staffed with 1.2 counseling FTE, which provided each building with a full-time counselor, who also managed the Section 504 accommodation plans. A Career and College Counselor was also assigned to each school and spent one day a week at each high school. The district where the study took place provided each building with one half-time academic coach to provide both classroom instructional assistance and professional development for staff. The three high school buildings shared one librarian on a rotating basis and one full-time administrator was located in each building to provide support to staff, students, and parents.

Data Collection

The setting of this study in three small high schools provided a location where a pilot implementing mastery-based, personalized instruction could be implemented and, if successful, provide possible insight to increase the use of this instructional model into larger high schools in the district. The desire and ability to pilot blended learning prompted school district administration to purchase one-to-one devices for each alternative high school. Electronic access to curricular material, assignments, and assessments was provided through a learning management system or personalized learning platform. Platforms or management systems are often composed of assessments, assignments, and curricular materials, as well as tracking monitors to measure time spent accessing the platform and other tools to enhance the experience for learners. The selection of a learning management system (LMS) was viewed as an essential element of instructional model design due to the importance of student engagement in academic success (Baldwin & Koh, 2012; Jonson-Reid, 2010; Leach & Zepke, 2010; Russell & Slater, 2011; Wilson et al., 2011; Zepke & Leach, 2010). Learning management systems all vary in structure and function, both of which heavily influence student engagement (Arpaci, 2017; Mtebe, 2015; Wu, Lin, Wen, Perng, & Hsu, 2016). Initial platform access at each of the three high schools was provided in two forms. The State Department of Education where the study took place purchased platform access for all state high schools in the subjects of social studies, math and English through Edmentum. The second initially piloted LMS had access purchased through grant funds by district administration involved in the transformation project of the three alternative high schools during the 2015-2016 school year and was utilized in a very limited fashion. During the 2016-2017 school year, when mastery-based learning was fully implemented, platform access was purchased through the state-supported digital learning academy's blended learning management system.

With support and assistance from district administration, the three principals in the schools of study applied for flexibility from the Carnegie unit credit requirement imposed through state code and additional funding from the state department through a state-supported mastery incubator program. The schools were awarded a seat-time waiver, a "no-harm" clause ensuring stable state funding, and $130,000 for all three schools to engage in a mastery-based model change for the 2016-2017 school year. This infusion of funding and pilot status at the district and state levels precipitated the need for data that could clearly communicate the impact of model change on students. Student academic achievement data was gathered from the PowerSchool student data management system (SDMS) and included the number of credits achieved after full implementation of a mastery-based, blended instructional model as compared to course achievement rates prior to model change. Quality of content mastery was also evaluated in this study by evaluating the level of mastery achieved on the four-point grade scale (i.e., D = 1 GPA point, C = 2 GPA points, B = 3 GPA points, A = 4 GPA points) for each course completed. The schools in this study made a determination to retain the traditional grade scale to ease transition to the mastery-based system for all stakeholders. The decision to continue with traditional grading was also agreed upon to provide time for the school staff to develop or adopt course competencies in-line with an anticipated five-year transformation process determined by school and district administration. No failing grades were issued due to content mastery being the standard of completion used without time constraint. A general agreement between schools set the initial mastery rate to determine credit completion at a 70% minimum. The only exception to this grading policy was in special circumstances when a very limited number of credits were granted for the grade of “D” by school administration. Students who had not achieved a “C” or better in any course continued to work toward course completion until the minimum mastery rate was achieved or a higher mark agreed upon by student, teacher, and parent was reached. To determine the impact of model transformation, student academic performance data was collected on both the number of credits completed and course grades achieved during the first semester of school year 2016-2017 and first semester of the 2015-2016 school year. All students were placed into grade level cohorts for comparison purposes utilizing paired samples *t*-testing. For students to be included in a grade level cohort, they had to be in attendance during both Fall of 2015 and Fall of 2016. Cohorts for academic data were composed of students who were enrolled in the three high school in 9th, 10th, 11th, and 12th grades during Fall of 2015 paired with students enrolled in 10th, 11th, 12th, and as reclassified seniors during the Fall of 2016, respectively. Academic data was collected during Fall of 2015, when the majority of instruction was delivered through traditional means, and compared using paired samples *t*-testing to data from Fall of 2016, when all instruction was delivered through a mastery-based, personalized system utilizing blended learning. Paired samples *t*-testing was utilized to determine if a statistically significant change occurred due to model transformation.

Due to mixed academic success in the published research on mastery and blended learning, a clear direction for hypothesis design was not selected (Chang et al., 2014; Florian & Zimmerman, 2015; Kazu & Demirkol, 2014; Yapici & Akbayin, 2012a). Therefore, for purposes of this study, the null hypothesis was that no statistically significant change would be determined during paired samples *t*-testing when academic achievement rates from first semester of 2015-2016 was compared to data from first semester of 2016-2017. The alternative hypothesis of this study was that there would be a statistically significant impact on academic achievement and failure to accept the null hypothesis. Due to a lack of prediction of direction in the hypothesis and the comparison of the same group of students, all data was statistically analyzed using two-tailed dependent samples *t*-testing to determine if the rate of course completion was impacted to a statistically significant level (Tanner, 2012).

Data on course grades was composed of the marks students achieved for all credits completed during both the first semester of the 2015-2016 school year and the first semester of the 2016-2017 school year when continuously enrolled. Student cohorts for statistical analysis of student academic achievement were created in an identical method to cohorts designed for course completion rates. The mixed success of mastery-based learning delivered through blended instructional methods on academic achievement resulted in a similar hypothesis design as in credit completion rate analysis. This design resulted in a null hypothesis stating that no statistically significant impact on course grades would result due to model transformation. In contrast, this made the alternate hypothesis the presence of a statistically significant change in course grades when comparing marks achieved by the same students during the first semester of the 2015-2016 school year and the first semester of the 2016-2017 school year. In order to conduct numerical statistical analysis, course letter grades were converted to their grade point average numerical equivalent with a grade of “A” being equal to 4 points, a grade of “B” being equal to 3 points, a grade of “C” being equal to 2 points, a grade of “D” being equal to 1 point, and a grade of “F” resulting in no grade points awarded. Due to an unspecified direction in the hypothesis, a two-tailed dependent samples *t*-test was used to statistically analyze correlated course grade data and determine if a statistically significant difference between the data from the first semester of 2015-2016 and the first semester of 2016-2017 existed.

Safety and how it is maintained within the school environment is a priority for all stakeholders involved in education (Elliott, 2015; Zhang, Musu-Gillette, & Oudekerk, 2016). Parents desire safe educational environments for their students, which can clearly be seen from the response to school shootings and violence in recent years (Elliott, 2015). The state education department in the state where this study was conducted has changed behavior reporting systems and data gathering methods over the last few years to take advantage of technology and accumulate behavioral data to chart policy decisions. Students as elements of the complex adaptive system of blended learning exhibit behavior that impacts the entire system (Hall & Clark, 2010; Wang et al., 2015). Consideration of behavior in a CAS must be done holistically to understand the dynamic impact it has on a system (Hall & Clark, 2010). Due to the impact of behavior in a complex system and the role of behavior in the classification of at-risk students, the inclusion of behavior data was seen as vital when researching the effect of educational models on students (Benner et al., 2013; Flower et al., 2011; Hall & Clark, 2010; Hirschfield & Gasper, 2011; Hodge, 2014). Behavior data was collected from the student information management system PowerSchool during the first semester of 2015-2016 and the first semester of the 2016-2017 school years. All incidents of behavior during the period of study were included, ranging from small incidents that resulted in relatively small consequences (e.g., lunch detention) to large incidents resulting in large consequences (e.g., school exclusion). Incidents recorded into PowerSchool were separated into two categories in the state of study: state reportable and local use only. For this study, both categories were included due to the focus of research question one on the impact of model change on student behavior. Disruption to the classroom has a pronounced impact on student learning, limiting teaching time dramatically (Kelm, McIntosh, & Cooley, 2014; Zhang et al., 2016), making the system interaction of student behavior a key element for inclusion when looking at blended learning holistically through the complex adaptive systems lens (Hall & Clark, 2010). Benner et al., (2013) provide a review of research data suggesting that 58% of classroom instructional time is lost to problem behavior management in typical educational settings. Data on behavior to answer research question one was not only collected on total behavior infraction rates, but on school exclusions for five student cohort groups. School exclusions were defined as the rate of suspension, both in-school and out-of-school, per student in each student cohort group. Cohort groups utilized for data collection on behavior infraction rates and school exclusion rates included students enrolled in 8^{th}, 9^{th}, 10^{th}, 11^{th}, and 12^{th} grades during the 2015-2016 school year and the same groups of students enrolled in 9^{th}, 10^{th}, 11^{th}, 12^{th}, and reclassified 12^{th} grade students during the 2016-2017 school year, respectively. Cohort groups strictly included students enrolled in the district of study during both the Fall of 2015 and the Fall of 2016 to provide usable data for statistical comparison using paired *t*-testing analysis. Eighth grade students where included in the formation of behavioral cohort groups if they were enrolled in a school within the district of study during the Fall of 2015 where all schools utilized a traditional model of instruction. These 8th grade students subsequently enrolled at one of the three high schools where data collection occurred for the Fall of 2016. Reclassified senior students were included in the cohort groups due to the relatively large percentage of seniors enrolled during Fall of 2015 who continued to be enrolled in the schools of study during the Fall of 2016. Exclusion rates were included to answer research question one on the impact of student behavior due to the role of exclusion in reducing academic contact time and the effect that alienation from school has on increasing student delinquency (Hirschfield & Gasper, 2011).

Student perception is a key factor that must be included in any comprehensive look at a student-based educational model (Alkharusi, 2016; Calderon et al., 2012; Erdem & Kibar, 2014; Lin, Chung, Yeh, & Chen, 2016; Napier et al., 2011). Students possessing an unfavorable perception of school are a key factor leading to school disengagement and increased dropout rates (Bramante & Colby, 2012; Horn & Staker, 2015; Wilson et al., 2011; Yapici & Akbayin, 2012a). Competition has greatly increased with the many face-to-face or digital options now available, which promise new opportunities through changes in one or more of the subsystems utilized in the complex system of education (Watson et al., 2014). Charter schools that focus on the use of technology, community building, collaboration, or another of the elements or subsystems of education spring up yearly across the United States (Whitmire, 2015). Digital schools and schools utilizing a blended learning delivery model are growing in enrollment at a remarkable pace, offering flexibility in delivery and, in some cases, personalized curriculum or intervention (Watson et al., 2014; Yapici & Akbayin, 2012a). Public charter or magnet options with specialized content and private schools that provide specialized programs often out of reach from public schools, primarily due to funding and regulation, all provide increased options for the education consumer (Christensen, Horn, Johnson, 2011; Horn & Staker, 2015). Student perception is an interaction in complex adaptive educational systems that impacts multiple facets of the system (Burns & Knox, 2011). The perception of students is strongly influenced by the level of satisfaction students have with regard to the various interacting elements of any educational system (Wilson et al., 2011). Student engagement is largely influenced by student satisfaction levels, which can be measured by collecting data on student perceptions of the elements of the teaching model under study (Leach & Zepke, 2009; Leach & Zepke, 2011; Russell & Slater, 2011; Wilson et al., 2011; Zepke & Leach, 2010). How students perceive their educational environment is difficult to accurately measure with solely quantitative methods, which show trends and numerical interpretations, but do not provide the same insight that qualitative methods expose (Marshall & Rossman, 2016; Tashakkori & Teddlie, 1998). Qualitative methods were utilized in this study to gain better understanding of mastery-based, personalized instruction through blended learning delivery by asking students to share how they have been impacted. The influence on students of the interacting elements in the complex blended learning system is of great importance and can only be discerned by providing students an opportunity to share their perceptions. This feedback drives the adaptation required in the complex system to ensure it steadily evolves in a student-centered direction (Desouza & Lin, 2011; Edson, 2012; Hall & Clark, 2010; Jordon et al., 2010; LePoire, 2015; Marchi et al., 2014).

Quantitative student perception data was gathered with the Mastery-based Learning Student Perception Survey (MLSPS) (Appendix C), designed to collect student input to guide the transformation of the three alternative high schools from a traditional industrial model to a personalized, mastery-based instructional model. The MLSPS was developed after reviewing research and multiple student-perception survey instruments and determining that no tool existed to adequately measure the elements required to answer the third research question of this study and properly guide the student-centered progression of the three high schools involved in this study. The MLSPS was designed around the principles of student engagement to accurately measure student perception of the various elements of, and interactions in, the mastery-based, personalized learning model with instruction delivered through blended learning. The factors that contribute to increased student engagement enhance academic achievement, reduce problem behaviors, and increase positive student opinions of an educational model (Jonson-Reid, 2010; Leach & Zepke, 2011; Russell & Slater, 2011; Zepke & Leach, 2010). However, engagement is a complicated concept to understand and measure like many of the components in a complex adaptive system (Burns & Knox, 2011; Leach & Zepke, 2011; Russell & Slater, 2011; Wang et al., 2015; Zepke & Leach, 2010). Therefore, the conceptual organizer on the elements that influence student engagement developed by Leach and Zepke (2011) was used as the tool to develop the MLSPS and the student perception categories measured for this study. The goal of the MLSPS was to establish a survey tool that ensured a more holistic view of the complex concept of student engagement and perception to determine how model change impacted these elements. A Likert scale was used to indicate levels of perception on 35 survey items, while an additional ten items on the MLSPS were included simply to gather general information and demographic data. The Likert scale ranged from 1 – “strongly disagree” to 5 – “strongly agree.”

The MLSPS was piloted by the administration of the high schools in its raw form during the spring of 2015. This pilot process occurred prior to this study in order to develop a tool designed to gather student perception data and determine a course for school redesign. This information was collected to share with staff while professional development to implement blended learning was in its early stages. The initial pilot of the MLSPS provided valuable insight to share with school staff, but the tool was composed of 86 items, which proved time-consuming and cumbersome. The number of items on the initial MLSPS carried the concern of nonresponse due to fatigue, which can lead to biased results (Adams & Umbach, 2012). When piloted a second time in the spring of 2016, the MLSPS was reduced to focus more accurately on the research questions of this study as well as the goals of the school redesign team. The MLSPS was reduced to 45 items, ten items related to general information and demographics and 35 items designed to gather student perception data using a Likert scale. It is important to note that data from the initial two pilots of the MLSPS were not used for this dissertation, but rather were utilized as informational guidance to plan program redesign in the three high schools involved in this study. Although the researcher had received authorization from the university's Human Research and Review Committee to conduct research prior to the second survey pilot, full clearance from the university was not in place. The author was involved in the initial pilots as a principal in one of the three high schools where research occurred and in development of the MLSPS; however, delivery of the instrument to students was focused on collecting student perception data and guide school transformation to a more student-centered model. When research for this dissertation began, after university (Appendix D) and district approval, the author attended registration and open house sessions at each high school to gather permission to carry out survey completion and interviews using the Informed Consent Forms for the Student

Mastery Survey (Appendix E) and student interview (Appendix F). For students under 18, consent forms were required to be completed by the child's legal guardian, while students over 18 were permitted to provide personal consent. In the high school where the author serves as principal, a research assistant was used to gather informed consent to reduce undue influence. Confidentially forms were signed by the research assistant in this study (Appendix G). Data collection using the MLSPS occurred in the fall of 2016 during the months of September, October, and November with students who had completed informed consent forms. Prior to initiating the survey, all students who participated in the completion of the MLSPS provided verbal assent indicating that they were aware that they had the option to discontinue survey completion at any point and that, if they felt uncomfortable answering any survey questions, they had the ability to skip questions. No changes were made to the items from the fall 2016 pilot. The 35 Likert scale survey items on the MLSPS were divided into four categories: motivation and agency, transactional engagement, institutional support, and active citizenship, based on the categories established by Leach & Zepke (2011). Cronbach's alpha values were calculated on each of the four individual survey categories ordinal scale data to test reliability. Due to the ongoing debate surrounding the proper statistical analysis of Likert scale data using parametric or nonparametric methods, the survey data was reported using both methods (Clason & Dormody, 1994; Creswell, 2015; Norman, 2010). The final method of data collection to determine student perception to answer research question three of this study was conducted via 24 semi-structured interviews during December of 2016 when students in the three high schools of study had been exposed to mastery-based, personalized learning delivered through blended instruction for nearly a full semester.

Qualitative perception data was gathered through semi-structured interviews with a randomly selected sample composed of eight students from each of the three schools. Two students from each grade level (9-12) at each school were selected through a random name sorter application from the group of students who had parent consent to participate in student interviews. Parental consent to participate in the semi-structured interviews was gathered in the same method as consent was gathered for completion of the MLSPS. At registration and open house, the researcher or research assistant (depending on location) made the Parent Informed Consent – Student Interview form (Appendix F) available for guardian or individual student consent. Each interview consisted of six questions (Appendix H) to gauge the students' "story" on a personal level. Interviews were conducted in the school of enrollment in a private conference room or office based on availability. A research assistant was utilized to conduct the interviews in the school where the researcher served as principal due to the concern of undue influence on interviewees by the researcher. Prior to interviews conducted by the research assistant, the primary researcher conducted preliminary interview rehearsals with the research assistant to establish reliability in the interview process. Both the primary researcher and research assistant conducted three pilot interviews to test the use of student assent forms (Appendix I) and ensure the verbatim interview instructions (Appendix J) were in the appropriate format. Prior screening was conducted in each school to ensure adequate locations were available for interviews. Interview equipment was checked during pilot interviews to ensure it worked according to expectations and that interview questions were in the correct format desired. Pilot interviews also allowed researchers to ensure the interview questions were valid for the goal of eliciting student perception of the model transformation that took place in the high schools. All pilot interviews were carried out with students who were not used in data collection interviews in the winter data collection period. Interviews were audio recorded and transcribed verbatim to allow for analysis and coding based on common themes. Each interview participant was emailed a synopsis of the common themes to member check interview data and ensure complete and credible data was collected (Appendix K). Coded data was triangulated with corresponding data contained on the MLSPS and available research to validate data gathered both qualitatively and quantitatively

Analytical Methods

Behavioral data was gathered from the PowerSchool student data management system (SDMS) utilized by the district where the study took place. School administration at each high school provided the researcher with all behavior infractions that occurred during first semesters of the 2015-2016 and 2016-2017 school year. The data did not include any identifying information on students. This behavior data included all infractions logged by the building principals of each of the three high schools. Behavior data on students enrolled in 8th grade during first semester of 2015-2016 was accessed through the historical behavioral record in the SDMS for comparison to data collected during first semester of the 2016-2017 school year. Students in 8th grade during 2015-2016 were included only if they were enrolled in a school in the district of study where it could be confirmed traditional instructional methods were in practice. Behavioral data collection included the number of incidents logged into the SDMS and any resulting in-school or out-of-school suspension days. This data was used to establish the rate at which instructional time was reduced or lost by students enrolled in the three high schools of study. One of the major issues faced in the traditional model of instruction is the loss of instructional time for students due to poor behavior (Georges et al., 2012; Sprague, Vincent, Tobin, & Pavel, 2013). At-risk student populations often have a number of deficits educationally due to an educational system that utilizes a behavior management system that can frequently exclude them from instructional access (Sprague et al., 2013). This exclusion makes both office referral and suspension time of primary importance in answering the first research question of this study. If students continue to be excluded from instruction at a high rate, blended learning may not be an effective model that positively impacts student rates of exclusion. When working with at-risk students, exclusion rates need to be considered when determining if an instructional model is effective for the student population (Wilkerson et al., 2016). Short-term instructional exclusion information data was reported in the study through the number of behavioral incidents recorded and determination of a mean exclusion rate for each student cohort. When behavior incidents are recorded, students have spent time out of the instructional setting in the office with school administration discussing the behavioral incident as well as potential reprimand or consequence. Long-term instructional exclusion was measured by reporting out-of-school and in-school suspension data and determining a rate of exclusion for each grade level student cohort. The PowerSchool student information system used in the district where the study took place requires administrators to enter a time duration for any form of suspension. Mean exclusionary time was reported for both out-of-school and in-school suspension during first semester of the 2015-2016 school year and first semester of the 2016-2017 school year in order to put a time value to educational exclusion data rates based on suspension. To properly analyze behavioral data, the number of out-of-school and in-school suspensions needed to be associated with the number of students enrolled in each student cohort to establish mean exclusion rates. The analysis of behavioral data answers research question number one of the study by reporting the number of behavioral exclusions that took place during the first semester of school year 2015-2016 prior to the full implementation of a mastery-based, personalized model of instruction delivered through blended learning in comparison to the number of exclusions during the first semester 2016-2017 after full implementation. Short-term and long-term exclusions during first semester of the 2015-2016 school year and first semester of the 2016-2017 school years were statistically analyzed for significant differences through paired sample *t*-testing for students of grades 8-12 who were continually enrolled over the term of both semesters. This behavior data enables researchers and policy makers to establish whether transforming a school model from a traditional instructional model to a blended, mastery-based model impacts the exclusion rates of at-risk students in a statistically significant manner. Two-tailed *t*-tests ran through the Statistical Package for the Social Sciences (SPSS) software were utilized for all behavioral and academic paired *t*-testing.

Academic data to answer question number two of the study, *how blended, mastery learning impacts student academic achievement*, was collected in two primary forms. The first area of academic data collection included the number of credits completed over the two semesters of study in comparison to the number of students enrolled in each grade level cohort. Transcribed credits are the primary means of achieving graduation and college placement or access to scholarship opportunities (Silva & White, 2015). A number of studies on blended, personalized, or mastery-based instruction include information concerning student learning in some form (Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Kazu & Demirkol, 2014; Kenney & Newcombe, 2011; Mitee & Obaitan, 2015; Schmidt, Shumow, & Kackar-Cam, 2015; Wilder & Berry, 2016; Yapici & Akbayin, 2012a). This data is important due to the role of academic achievement as the primary measure of an educational program's impact on student learning and the primary measure of success utilized in U.S. educational systems (Silva & White, 2015). The PowerSchool student information system was the source of all credit completion data. Data collected on the number of credits completed over both the first semester of 2015-2016 and the first semester of 2016-2017 was utilized to establish mean course completion rates. The second type of academic data collected was on the level of course content mastery indicated by achievement grades on a four-point scale. To determine if the transition to a mastery-based, personalized learning model delivered through blended instruction resulted in a statistically significant impact to course completion rates, paired sample *t*-tests were used for statistical analysis of each student cohort. Paired sample *t*-tests were also used to determine if course grades were impacted at a statistically significant level due to the transition in models that took place for students who were enrolled during both the first semester of 2015-2016 and the first semester of 2016-2017. The district of study classifies students based on the year of entry into high school to establish cohorts that parallel the graduation rates that must be reported to the state and federal government. Due to the method of classification in the district of study, the 9^{th} graders enrolled during the 2016-2017 school year were excluded from data analysis. Exclusion of 9^{th} grade students during the last semester of data collection occurred due to the lack of comparison data from the year prior when enrolled in middle school where a true credit system does not exist. However, the senior class is made up of students who are enrolled in their fourth year of high school as well as all subsequent years enrolled until graduation is achieved. For the sake of this study, students enrolled in their senior year in one of the high schools of study during Fall of 2015 and reclassified as seniors during the Fall of 2016 were included in data analysis. Reclassified seniors were designated as “12R” in first semester of 2015-2016 data.

Student perception data was collected both quantitatively and qualitatively. Quantitative student perception data gathered utilizing the MLSPS was reported as mean scores for each of the 35 items on the survey. Mean scores for each item were calculated for all three schools in combination and reflect student perception on each of the survey items based on the five-point Likert scale utilized in the MLSPS: 1 = “Strongly Disagree”, 2 = “Disagree”, 3 = “Neither Agree or Disagree”, 4 = “Agree”, 5 = “Strongly Disagree.” Standard deviation scores were also calculated for each survey item for all three schools combined. All calculations were carried out using SPSS software. Survey items measured perception in the four general categories established in the engagement graphic organizer from which the MLSPS survey was created (Leach & Zepke, 2011). Mean and standard deviation scores for each item and category were calculated to answer research question three and determine student perception of a mastery-based, personalized learning model delivered through blended learning. Data from the MLSPS was also reported using nonparametric methods to provide the ability to compare with parametric data and provide analysis of items not provided solely through parametric means. Likert scales provide ordinal data with a large amount of variance between categories, which can often be more clearly analyzed through nonparametric means (Clason & Dormody, 1994; Creswell, 2015; Tanner, 2012). Corrected correlations for each item as well as Cronbach’s Alpha values for each item if deleted from the survey were also reported to provide data on whether if future modifications were needed to improve the MLSPS.

General data collected on the ten informational items included at the end of the MLSPS were reported based on the nature of the demographics/general information questions. The demographic/general information questions provided general population data on the students in the study, such as gender, age, school, parent education, student’s educational goal, and perceived success in school, in order to better understand the at-risk population of students in the schools of study. All general student information was reported using non-parametric methods due to the nature of the data.

Cronbach's alpha values were calculated for each of the four engagement categories on the MLSPS to establish reliability through a measure of internal consistency (Creswell, 2015; Tanner, 2012). According to Creswell (2015), a Cronbach's alpha score of .60 is a generally acceptable level of reliability. Due to a desire to establish a reliable and valid tool to measure the elements of student perception, all reliability information and survey data were reported in order to provide the data needed to determine if changes were required for future use. However, all data in categories that did not prove reliable through Cronbach's alpha testing were omitted from further discussion, other than as areas of future improvement. In order to determine validity of the MLSPS, the survey instrument was sent to several educational professionals with knowledge of mastery, personalized, or blended learning to solicit feedback and suggestions on the survey instrument.

Creswell (2015) recommends using an interview protocol to ensure the interviewer is reminded of the questions and to ensure notes are properly recorded. Due to the use of a research assistant, a strict protocol was designed to increase reliability and ensure data was managed correctly (Creswell, 2015). The protocol for interviews included audio recording on both a cell phone and computer as well as following a strict interview script (Appendix J). The only exception from strict adherence to the six interview questions (Appendix H) and the interview script was to seek clarification if the interviewer was unclear of the meaning expressed by the interviewee. Qualitative student perception data was analyzed by transcribing the 24 audio-recorded student interviews verbatim and coding these transcripts to determine general themes. Once general themes were determined, they were triangulated with student perception data on the items of the MLSPS and research from literature review. The general themes were used to develop clusters that could be diagramed to show potential areas of student-perceived concerns and strengths in the model transformation. Qualitative research data was used to provide student voice concerning model change and insight into quantitative data collected.

Role of the Researcher

As demonstrated in Figure 1, the researcher is an element in the complex adaptive blended learning system that interacts and thus has an effect on multiple parts of the system (Wang et al, 2015). The influence a researcher has when working in action research is something of which they must be cognizant in order to avoid ethical issues (Creswell, 2015). The most obvious source of potential influence on this study by the researcher is the role of the author as a principal in one of the three schools involved in the study where data collection took place. The primary researcher has also visited both of the other two schools infrequently for meetings. The role of the researcher in this study thus contains potential for influence and must be addressed.

The author of this study has worked in public school districts that employ traditional, industrial models of instruction for twenty years. The author's educational experience includes serving as a teacher, coach, and administrator in both middle schools and high schools ranging in size from just over 100 students to over 2000 students. During this experience, it has been observed that the traditional, industrial model of instruction is ineffective with a large segment of students. As an administrator of an at-risk high school with a four-year cohort graduation rate that hovered around 30%, in a state where such a graduation rate is not atypical in schools serving at-risk students, the author has developed a bias toward the traditional, industrial model of instruction.

To reduce the level of influence based on author bias when conducting a study on model transformation several steps were taken to ensure a lack of prejudice. All student surveys were not connected with the researcher when distributed to the student participants. The surveys were distributed to analyze the needs for continuous improvement of the blended, mastery learning model, which is the role for which the MLSPS was designed. All students were also provided the ability to opt out of any participation in survey completion or interviews without penalty (Creswell, 2015). Interviews became another area of primary concern for researcher influence. This concern was accounted for by the utilization of a research assistant to coduct the interviews of students in the school where the primary researcher serves as principal. A focus on peer-reviewed research was utilized throughout all elements of the study to support claims and findings. A final step to reduce bias included review of the completed dissertation by the doctoral committee.

Limitations

Financial resources quickly arose as a key limitation in this study. Securing district monetary support to purchase one-to-one devices for a mastery-based, personalized learning pilot took approximately three years. The process of securing one-to-one devices began with determining device type. District staff, with some building input, selected the Hewlett Packard ProBook Notebook computer, which they negotiated to meet an acceptable price point. During the selection process, it was determined that a laptop device was necessary to meet the production needs required in the blended learning environment. Professional development, which was vital to model transformation, was also limited by finances as well as available time.

State policies for funding and credit achievement were obstacles encountered during the course of this study. In order to gather the flexibility to maneuver within the state polices and stay in accordance with state code, the three high schools in this study were required to appeal to the State Department of Education. This appeal was in the form of a mastery learning waiver that detailed a well-developed plan to award credit based on the mastery of material as opposed to seat time. This process was facilitated by support from a task force enlisted by state governmental officials to make educational improvement recommendations. This task force specified the need for consideration of mastery-based learning pilots within the state and was supported by the legislature. The district where the study took place applied for state grants from the department of education to pilot mastery-based learning. The application from the district of study specified that state funding would be contingent on program access rather than seat time or average daily attendance.

The district where this study took place created various obstacles and limitations to the transformation from the traditional model of instruction to a mastery-based, personalized learning model. During the planning and early implementation stages of the model transformation of this study, it was determined by building principals and district project coordinators that a platform with preloaded content would be required to put the pilot in place in a timely manner. This determination was made based on the amount of time and cost it would require to develop staff to digitize district curriculum in a quality manner. The decision was supported by the rapidly increasing availability of content-rich personalized learning platforms. Teaching in the digital environment requires extended competencies that are not instilled in the majority of teacher preparation programs (DiPietro et al., 2008; Duncan & Barnett, 2009; He, 2014; Lane, 2013; McQuiggan, 2012; Tsai, 2012; Vasquez & Serianni, 2012). Curriculum in the district of study is firmly established for the courses taught throughout the district at the secondary level. However, the scope and sequence of the adopted district curriculum did not match perfectly with the content available in the personalized learning platform selected for the mastery learning pilot. This discrepancy required the district curriculum department to be flexible with the courses vetted by the platform provider and to enable teachers to design courses when fully vetted courses were not available. District assessment staff became involved in the project to ensure clear criteria were established to document and justify mastery of course materials. The ability to access course assignments, pretests, summative exams, and formative assessments provided a digital portfolio to ensure mastery of materials and justification to award credit. The financial department of the district presented an obstacle because of the requirements of proper reporting of average daily attendance (ADA) to the state department and possible issues with ensuring stable district funding. Information for funding was exchanged with the district and state department through enrollment and attendance in the student information management system PowerSchool. The enrollment status of students in PowerSchool proved to be an issue due to the lack of flexibility of PowerSchool to enroll and shift students based on mastery of course material. The PowerSchool system is designed to batch students' course movements at quarter or semester transitions which is based on the Carnegie Unit. This issue was handled by enrolling students in place-holder designations within the management system, as specified in the mastery-based learning state waiver filed with the state department of education. The district Informational Technology department (IT) created issues during the course of the study primarily due to overregulation of internet access and limited staffing to properly facilitate technology support. Internet access was heavily regulated for student and staff access. The high level of regulated access and restriction to multiple educational resources led to issues with staff being able to access educational tools and students being unable to access the full range of available resources incorporated into the PLP. Some of the obstacles encountered included a period of restriction from all YouTube access, specification toward Microsoft products rather than Google resources, and issues surrounding the ability to take school laptops home to allow access to educational material at student convenience. The district staffing assignment led to IT coverage issues because placement of IT staff was based on enrolled students in a building rather than on the number of devices in a building. During the time span of this study, other limitations impacting the pilot included the resignation of a long-term district superintendent which resulted in district reorganization, unrest and turnover on the school board. In addition, the district faced a budget crisis, the reduction of professional development days, and state-level fluctuations in education policy and teacher compensation.

Chapter IV

Results

Introduction

As the 21st century progresses, a call for educational reform and redesign is mounting as instructional technology evolves (Chubb, 2012; Florian & Zimmerman, 2015; Mirriahi et al., 2015; Uche, Kaegon, & Okata, 2016; Yapici & Akbayin, 2012a). While many peer reviewed articles have been published on the blended learning delivery model, the majority of these articles are limited to the delivery of only one subject (Chang et al., 2014; Kazu & Demirkol, 2014; Yapici & Akbayin, 2012a). Many other articles on blended learning focus solely on one aspect of blended learning, such as student perception, teacher training, or design approach (Alammary et al., 2014; Bissell, 2012; Freeman & Tremblay, 2013; Kenney & Newcombe, 2011; Mirriahi et al., 2015; Vickers et al., 2015). Scholarly research articles on mastery or competency education are currently less numerous than blended learning articles and have similar limited scope (Lin et al., 2013; Sinner, 2015). The lack of breadth in current published work on the topic of blended learning has researchers requesting increased exploration (Calderon et al., 2012; Chang et al., 2014; Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Kazu &Demirkol, 2014; Yapici & Akbayin, 2012). The scope of this research study was designed to encompass a more holistic view of the impact on students of transitioning from a traditional, industrial model of instruction to a mastery-based, personalized instructional model delivered through blended instruction. This study includes data from every course offered in three alternative high schools serving at-risk students. It also includes data from all students enrolled in the three high schools that met the criteria needed to conduct accurate statistical analysis. The only students excluded from completing student perception surveys were those who did not submit consent to participate forms. In the area of academic achievement, students who were not enrolled in the three high schools during both semesters of data collection were excluded from the study. The data in this study also focuses on three major aspects of the complex adaptive system of a mastery-based, personalized model of instruction utilizing blended instruction for delivery, behavior, academics, and perception to answer the three research questions of this study:

1. What impact does mastery-based, personalized learning have on the behavior of at-risk students?
2. What is the impact of a mastery-based, personalized learning instructional model on student academic achievement?
3. What is the student perception of a shift to a mastery-based, personalized instructional model with delivery through blended learning?

By including all courses, all student demographic groups, and multiple elements of the complex adaptive system, this data comprises a more robust view of how students were impacted by the educational model transformation that took place in the three high schools of study.

Research Question #1: Impact on Student Behavior

The first research question of this study focuses on the number of behavior infractions administrators logged into the student data management system (SDMS), PowerSchool, over the first semester of the 2016-2017 school year, after full implementation of a mastery-based, personalized instructional model delivered through blended learning. The number of behavior infractions which were logged into the SDMS during the first semester of the 2016-2017 school year were compared to the number of infractions logged into the SDMS during the first semester of the 2015-2016 school year prior to transforming educational models. In order to make valid comparisons between grade levels, only students who were enrolled in the district where the study took place during the first semester of both school years were included in the data. Students who were not enrolled in the district during both the first semester of 2015-2016 and the first semester of 2016-2017 were excluded due to lack of discipline data during the semesters of data collection and lack of knowledge of the educational model in which they were enrolled prior to entering the district of study. Dependent *t*-testing for paired samples was utilized to determine if there were statistically significant differences in the recorded infraction rates between grade level groups of students enrolled in the schools of study while they utilized a traditional instructional model as compared to the same students enrolled in a mastery-based, personalized instructional model delivered via blended instruction. Behavior incidents for students who were enrolled in a traditional instructional model during first semester of 8^{th} grade during first semester of the 2015-2016 school year were compared to behavior incidents among the same group of students after their first semester as 9^{th} graders during the 2016-2017 school year. The same comparison was done between those students who moved from 9^{th}, 10^{th}, and 11^{th} grades during first semester of 2015-2016 into 10^{th}, 11^{th}, and 12^{th} grades respectively during first semester of 2016-2017. The district of study classifies students according to the number of years enrolled in high school. A first year high school student is always placed in 9^{th} grade, a second year student in 10^{th} grade, a third year student in 11^{th} grade and a fourth year student is always placed in the 12^{th} grade, regardless of credits earned or graduation status. This disaggregation creates a scenario where students in the at-risk schools of study are frequently placed into a 12^{th} grade classification for multiple years until graduation requirements are achieved. In this study, the behavior infractions of students enrolled as seniors during the first semester of the 2015-2016 school year in a traditional model were also analyzed in a paired cohort if they remained enrolled during the first semester of the 2016-2017 school year after model transformation. Students who continued enrollment in the senior group of students into the Fall of 2016 are labeled as 12R, or reclassified senior students. In Table 3, the number of students who were not enrolled in the district during part of the study and are excluded from the comparison data are recorded as well as the student population that made up the comparison data.

Table 3

Student Numbers: Behavior Data Analysis

Grade Level	Status	Building 1	Building 2	Building 3	*n*
9th					
	Enrolled	19	22	42	
	Excluded	1	3	1	
	n	18	19	41	78
10th					
	Enrolled	31	36	32	
	Excluded	2	10	2	
	n	29	26	30	85
11th					
	Enrolled	41	36	42	
	Excluded	4	3	3	
	n	37	33	39	109
12th					
	Enrolled	35	45	35	
	Excluded	2	4	3	
	n	33	41	33	107
12R					
	Enrolled	12	13	11	
	Excluded	0	2	0	
	n	12	11	11	34

Looking at the mean in descriptive statistics (Table 4) allows for determining trends in the data (Creswell, 2015). In this particular instance, the mean for behavioral incidents articulates the rate at which problem behaviors are logged into the SDMS based on the number of students in each grade level, both prior to and after the model shift. The remaining descriptive statistics (e.g., the standard deviation and standard error of the mean) in Table 4 provide valuable tendencies in the data (Creswell, 2015). The descriptive statistics in Table 4 provide the important information needed to carry out further statistical review, such as determination of statistically significant impact on behavior due to model transformation (Creswell, 2015). A review of mean data shows a reduction in recorded infractions after model transformation in each student cohort pairing. Students were placed into cohort pairs for behavioral and academic analysis to allow paired *t*-testing, which eliminates between-group differences and accounts for pre-existing differences between groups (Tanner, 2012). Paired *t*-tests allow subjects to be analyzed statistically to determine the impact of the independent variable, transformation of instructional model, in a manner that reduces error based on other influences (Tanner, 2012). The reduction in means fluctuates between cohort student pairs (Table 4) providing a sound need to conduct paired *t*-testing to determine if differences in the mean are statistically significant. The data for standard deviations between student cohort pairings provides a variability measure (Cresswell, 2015). In this case, standard deviation values for behavior infraction rates are large in comparison to mean behavior infraction rates, indicating a high level of variability in the data. The standard error of the mean in Table 4 gauges the variability in the distribution of the student pairing population means, an instrumental value needed to carry out the *t*-testing to determine impact of the independent variable (Tanner, 2012).

Table 4

Incident Descriptive Statistics by Grade Level Across All Schools

Pairing	Category	*M*	*n*	*SD*	*SEM*	*Cohen's d*
1	8^{th} Incidents 2015-2016	0.51	78	1.38	0.16	
	9^{th} Incidents 2016-2017	0.14	78	0.42	0.05	0.36
2	9^{th} Incidents 2015-2016	0.25	85	0.60	0.06	
	10^{th} Incidents 2016-2017	0.12	85	0.36	0.04	0.26
3	10^{th} Incidents 2015-2016	0.09	109	0.35	0.03	
	11^{th} Incidents 2016-2017	0.03	109	0.16	0.02	0.24
4	11^{th} Incidents 2015-2016	0.06	107	0.23	0.02	
	12^{th} Incidents 2016-2017	0.05	107	0.25	0.02	0.04
5	12R Incidents 2015-2016	0.18	34	0.46	0.08	
	12R Incidents 2016-2017	0.00	34	0.00	0.00	N/A

Note. All incidents occurred during first semester of the 2015-2016 school year or the first semester of the 2016-2017 school year, respectively.

Using SPSS to perform paired sample *t*-tests between each established pairing provided *t* values, degrees of freedom, and *p* values (Table 5), which determine statistical significance between incident rates after model transformation. While 8^{th} grade is not a high school grade level or a grade level offered in the three high schools of study, the students in 8^{th} grade during first semester of the 2015-2016 school year were included in the first student cohort pairing. The incident data on 8^{th} grade students was included because they were enrolled in schools within the district of study. These schools utilized traditional models of instruction and thus provided a valid comparison between traditional instruction and mastery-based instruction.

Table 5

Incident Values of Paired t-testing for Each Grade Level Cohort

Pair	Cohort	*M*	*SD*	*t*	*df*	Sig. (2-tailed)
1	8^{th} to 9th	0.37	1.24	2.65	77	**.010**
2	9^{th} to 10^{th}	0.13	0.48	2.47	84	**.015**
3	10^{th} to 11^{th}	0.06	0.28	2.38	108	**.019**
4	11^{th} to 12^{th}	0.01	0.22	0.45	106	.657
5	12^{th} to 12R	0.18	0.46	2.24	33	**.032**

Note. Confidence interval set at 95% in SPSS software

Using an alpha of 0.05 to determine statistical significance, the *p* values in Table 5 indicate that cohort pairs 1, 2, 3, and 5 demonstrate a statistically significant reduction of logged incidents in the SDMS after full implementation of a mastery-based, personalized instructional model delivered through blended instruction. Pair 4, which consists of the students who were in 11^{th} grade during the first semester of 2015-2016 and 12^{th} grade during the first semester of 2016-2017, do not show a statistically significant drop in incidents recorded after the transformation of the educational model. Although the mean number of incidents does reduce in pair 4 after model transformation, the level is not significant enough to fall out of the possibility that this difference is due to error or chance (Tanner, 2012).

When the rates of in-school suspension and out-of-school suspension are viewed, the general statistics provide the information needed to determine how much time, in days, the average student spent in in-school suspension during the first semester of the 2015-2016 school year prior to model change (Table 6). Table 6 also shows the mean, or rate of in-school suspension in days, for students in each paired cohort after instructional model transformation. The equivalent information for out-of-school suspension is also included in Table 6 as well as the number of students in each student subpopulation, the standard deviation and standard error of the mean.

Table 6

Suspension Descriptive Statistics by Grade Level Across All Schools

Pairing	In-School Suspensions	*M*	*n*	*SD*	*SEM*	*Cohen's d*
1	8th ISS 2015-2016	0.14	78	0.48	0.05	
	9th ISS 2016-2017	0.12	78	0.51	0.06	0.05
2	9th ISS 2015-2016	0.01	85	0.11	0.01	
	10th ISS 2016-2017	0.02	85	0.22	0.02	0.07
3	10th ISS 2015-2016	0.02	109	0.19	0.02	
	11th ISS 2016-2017	0.00	109	0.00	0.00	N/A
4	11th ISS 2015-2016	0.00	107	0.00	0.00	
	12th ISS 2016-2017	0.01	107	0.10	0.01	N/A
5	12R ISS 2015-2016	0.16	34	0.86	0.15	
	12R ISS 2016-2017	0.00	34	0.00	0.00	N/A
	Out-of-School Suspensions					
1	8th OSS 2015-2016	0.03	78	0.23	0.03	
	9th OSS 2016-2017	0.15	78	0.67	0.08	0.26
2	9th OSS 2015-2016	0.02	85	0.22	0.02	
	10th OSS 2016-2017	0.15	85	0.57	0.06	0.30
3	10th OSS 2015-2016	0.09	109	0.79	0.08	
	11th OSS 2016-2017	0.06	109	0.43	0.04	0.06
4	11th OSS 2015-2016	0.00	107	0.00	0.00	
	12th OSS 2016-2017	0.10	107	0.60	0.06	N/A
5	12R OSS 2015-2016	0.03	34	0.17	0.03	
	12R OSS 2016-2017	0.00	34	0.00	0.00	N/A

Note. All suspensions occurred during first semester of the 2015-2016 school year or the first semester of the 2016-2017 school year respectively and are reported in days.

The descriptive statistics (Table 6) show variances in several of the means, with the largest variance being between reclassified seniors placed in in-school suspension. Paired *t*-testing through SPSS resulted in the values recorded on Table 7, and *p* values in the final column demonstrate that no statistically significant increase or decrease in either in-school or out-of-school suspension rates occurred due to the transformation of models. In some categories (e.g., 9th ISS 2015-2016 to 10th ISS 2016-2017 and 8th OSS 2015-2016 to 9th OSS 2016-2017) in-school and out-of-school suspension rates increased after model transformation, but in no category was a statistically significant *p* value present. Out-of-school suspension in cohort pairing 2 was the value that most closely approached statistical significance with a value of .055. The difference in means between cohort paring 2 was based on an increase in the out-of-school suspension rate among students enrolled in 10th grade after model transformation when compared to suspension rates for the same students prior to model transformation.

Table 7

Suspension Values of Paired t-testing for Each Grade Level Cohort

Pair	Cohort	*M*	*SD*	*t*	*df*	Sig. (2-tailed)
1	8th to 9th ISS	0.03	0.66	0.34	77	.734
	8th to 9th OSS	-0.13	0.67	-1.69	77	.096
2	9th to 10th ISS	-0.01	0.24	-0.45	84	.657
	9th to 10th OSS	-0.13	0.61	-1.95	84	.055
3	10th to 11th ISS	0.02	0.19	1.00	108	.320
	10th to 11th OSS	0.04	0.90	0.43	108	.672
4	11th to 12th ISS	-0.01	0.10	-1.00	106	.320
	11th to 12th OSS	-0.10	0.60	-1.78	106	.078
5	12th to 12R ISS	0.16	0.86	1.10	33	.280
	12th to 12R OSS	0.03	0.17	1.00	33	.325

Note: Confidence interval set at 95% in SPSS software

Research Question #2: Impact on Student Academic Achievement

The presence of academic achievement data is frequently used in research studies on blended, mastery, and personalized learning (Bissell, 2012; Chang et al., 2014; Florian & Zimmerman, 2015; Flumerfelt & Green, 2013; Kazu & Demirkol, 2014; Lin et al., 2013; Mitee & Obaitan, 2015; Stewart et al., 2011; Wilder & Berry, 2016; Yapici & Akbayin, 2012a). A great deal of this academic achievement data takes the form of assessment data rather than course achievement levels (Bissell, 2012; Chang et al., 2014; Florian & Zimmerman, 2015; Kazu & Demirkol, 2014; Lin et al., 2013; Mitee & Obaitan, 2015; Yapici & Akbayin, 2012a). The primary method in the traditional instructional model to track movement toward graduation and to establish graduation has been achieved is through course completion (Silva & White, 2015). After extensive inspection of peer-reviewed literature, credit completion rates are lacking in current research primarily due to reliance on assessment data (Bissell, 2012; Chang et al., 2014; Florian & Zimmerman, 2015; Kazu & Demirkol, 2014; Lin et al., 2013; Mitee & Obaitan, 2015; Yapici & Akbayin, 2012a).

To determine the impact of model transformation on credit completion rates in the three high schools of study, only students who were continuously enrolled during both the Fall of 2015 and the Fall of 2016 were included in the data collection population. In the district of study, credit completion determines progress toward graduation. Therefore, a large impact due to model change could affect the movement of students toward high school completion. This potential impact makes credit completion an important factor to consider. As seen in Table 8, the mean credits earned for each group of students reduces after model transformation from over six credits earned per student during first semester of 2015-2016 to less than two credits earned per student during first semester of 2016-2017. The means in Table 8 also indicate a general decrease in credit completion as grade level increases, both prior to and following model transformation. The only exception to this trend is the increase in credit completion rate by 11th graders in pair 2 when compared to other grade level post instructional model transformation means. Standard deviations for each pair both prior to transformation and after transformation show a great variance of credit completion among each population, especially among students after transformation where the standard deviation approaches the mean value for credit completion rate.

Table 8

Credits Earned Descriptive Statistics by Grade Level Across All Schools

Pair	Cohort	*M*	*n*	*SD*	*SEM*	*Cohen's d*
1	9th Credits Earned 2015-2016	6.71	52	1.73	0.24	
	10th Credits Earned 2016-2017	1.73	52	1.21	0.17	3.34
2	10th Credits Earned 2015-2016	6.56	70	1.68	0.20	
	11th Credits Earned 2016-2017	1.80	70	1.25	0.15	3.21
3	11th Credits Earned 2015-2016	6.53	80	1.65	0.18	
	12th Credits Earned 2016-2017	1.70	80	1.58	0.18	2.99
4	12th Credits Earned 2015-2016	6.11	36	1.80	0.30	
	12R Credits Earned 2016-2017	1.50	36	1.42	0.24	2.84

Note. All credits were earned during first semester of the 2015-2016 school year or the first semester of the 2016-2017 school year, respectively.

By utilizing SPSS software to conduct 2-tailed paired *t*-testing of each cohort student group, the difference in means results in a statistically significant *p* value less than .05 (Table 9). After model transformation, each cohort group of students experienced a statistically significant reduction in credit achievement rate utilizing a confidence interval of 95%. Table 9 also provides the *t* value and degrees of freedom used to calculate the *p* value and determine statistical significance.

Table 9

Credits Earned Paired t-testing for Each Grade Level Cohort

Pair	Cohort	Mean Difference	*SD*	*t*	*df*	Sig. (2-tailed)
1	9th to 10th	4.98077	1.80946	19.850	51	**<.001**
2	10th to 11th	4.75714	1.87613	21.214	69	**<.001**
3	11th to 12th	4.82500	2.09747	20.575	79	**<.001**
4	12th to 12R	4.61111	2.10140	13.166	35	**<.001**

Note. Confidence interval set at 95% in SPSS software

Grade point average (GPA) allows determination of success level in the majority of traditional instructional systems that award credits. The grade scale in use in the district of study was based on a letter grade of “A” being equal to 4 grade points, a letter grade of “B” being equal to 3 grade points, a letter grade of “C” being equal to 2 grade points, a letter grade of “D” being equal to 1 grade point, and a letter grade of “F” being equal to 0 grade points. The calculation of grade point average for purposes of this study was to sum the grade points for all grades received during the semesters of study and calculate the mean of those grade points. Table 10 contains the mean grade point averages for each of the grade level pairs during their first semester of 2015-2016 and the first semester of 2016-2017. The mean averages in Table 10 were then compared in SPSS through *t*-testing to determine statistically significant impact on GPA (Table 11). Table 10 also contains the student subpopulation numbers used to determine the mean in each pairing (n) as well as the standard deviation and standard error of mean during the specific semester of accumulated data. Table 10 shows a reduction in mean among each pairing after model transformation, with the exception of the 2015-2016 students in grade 10 who experienced a slight increase in mean GPA. The means for each population group in Table 10 was above 2.0, the GPA value of the letter grade “C”. The mean values in Table 10 indicate that when the data for all 3 school is analyzed in congregate, both prior to and after model transformation, GPA values fall between 2.0 and 3.0 grade points. With a mean grade point average between 2.0 and 3.0, these mean values specify that, on average, GPAs in all three schools fall in the range between the letter grades of “C” and “B”. The standard deviations in Table 10 show a greater level of variance from the mean after model transformation.

Table 10

Grade Point Average Descriptive Statistics by Grade Level Across All Schools

Pair	Category	*M*	*n*	*SD*	*SEM*	*Cohen's d*
1	9^{th} GPA 2015-2016	2.53	52	0.82	0.11	
	10^{th} GPA 2016-2017	2.35	52	1.40	0.20	0.16
2	10^{th} GPA 2015-2016	2.48	70	0.80	0.10	
	11^{th} GPA 2016-2017	2.68	70	1.30	0.16	0.19
3	11^{th} GPA 2015-2016	2.59	80	0.73	0.08	
	12^{th} GPA 2016-2017	2.25	80	1.56	0.17	0.28
4	12R GPA 2015-2016	2.15	36	0.89	0.15	
	12R GPA 2016-2017	2.09	36	1.60	0.27	0.05

Note: All credits earned during first semester of the 2015-2016 school year or the first semester of the 2016-2017 school year, respectively.

To determine the impact on GPA of transforming the three high schools of study from traditional instructional models into mastery-based, personalized models which deliver instruction through a blended format, *p* values for paired *t*-tests are provided in Table 11. Paired *t*-testing through SPSS determined *p* values in every pairing larger than .05, demonstrating that a statistically significant change in grade point average did not occur in any subpopulation pairing. Pairing 3, composed of students in 11^{th} grade during 2015-2016 and 12^{th} grade during 2016-2017, have a *p* value of .058, which approaches statistical significance with a mean difference of .336, making this group the most dramatically impacted group statistically. Pair 2, which was comprised of students in 10^{th} grade during 2015-2016 and 11^{th} grade during 2016-2017, had a mean difference of -.2076. This group was the only pairing that experienced an increase in GPA after model transformation while every other pairing experienced a decrease in mean GPA. The values for standard deviation, *t*, and degrees of freedom from the SPSS output of the four pairs tested are provided in Table 11 for reference purposes and to detail the results of paired *t*-testing.

Table 11

Grade Point Average Paired t-testing for Each Grade Level Cohort

Pair	Cohort	Mean Difference	*SD*	*t*	*df*	Sig. (2-tailed)
1	9th to 10th	0.18	1.48	0.89	51	.379
2	10th to 11th	-0.21	1.51	-1.15	69	.252
3	11th to 12th	0.34	1.56	1.93	79	.058
4	12th to 12R	0.06	1.78	0.20	35	.843

Note: Confidence interval set at 95% in SPSS software

Research Question #3: Student Perception

When conducting research on academic achievement, student perception needs to be considered (Alkharusi, 2016). Student perception is derived from student motivational beliefs and affects effort (Alkharusi, 2016). The third research question of this study is directed toward gathering both quantitative and qualitative research data on student perception to provide a more robust view. The quantitative data for this question was drawn from the Mastery-based Learning Student Perception Survey (MLSPS) given to all students, who provided consent to participate in the three high schools of study. Table 12 provides the general participant data, consisting of the number and percentage of students who provided consent and completed the Mastery-based Learning Student Perception Survey. Participation rates on the MLSPS varied between buildings, from 45.4% to 63.6%, with a total student participation of 245 students from all three schools and a total participation rate of 54.2%.

Table 12

Student Participants: Mastery-based Learning Student Perception Survey

Status	Building 1	Building 2	Building 3	Total
Enrolled	138	152	162	452
No Consent/ Completion	65	83	59	207
n	73	69	103	245
Completion %	52.9%	45.4%	63.6%	54.2%

When gathering the perception of students, knowledge of the background of those students helps better understand the population, which is the source of the research data. In order to better understand the composition of the students who completed the MLSPS, ten general items were added to the survey to gather school location, gender, and favorite and least favorite subjects. Student self-perception on their academic success as well as parents' college attendance and student post-high school educational plans were also investigated in the first ten items of the MLSPS. Data show that the majority (60%) of students enrolled in the high schools of study were male. A higher enrollment of male students is not uncommon at schools which serve students identified as at-risk (Borg, 2015; Wilkerson et al., 2016). The preference for certain subjects or dislike for certain subjects varied widely by building location, with Art being selected as the most preferred course across the three buildings and math being selected as the least preferred course (Table 13). Over 70% of students in each building identified themselves as receiving good grades with very little fluctuation between buildings and a mean of 72.92%. Parent participation in or completion of college was 65.80% and 53.05%, respectively. Nearly 80% (79.57%) of students across the three high schools indicated intentions to pursue a college education, while less than 10% did not indicate a plan to pursue post high school education (9.63%).

Table 13

Mastery-based Learning Student Perception Survey: General Information

Item		Building 1	Building 2	Building 3	*M*
Gender	Female	42.47%	34.78%	42.72%	39.99%
	Male	57.53%	65.22%	57.28%	60.01%
Favorite Subject[a]	Art	34.25%	34.78%	44.66%	37.90%
	PE/Health	41.10%	27.54%	25.24%	31.29%
	Science	28.77%	20.29%	12.62%	20.56%
	Math	24.66%	13.04%	19.42%	19.04%
	English	13.70%	17.39%	22.33%	17.81%
	Social Studies	16.44%	11.59%	13.59%	13.87%
	Computers/Business	10.96%	5.8%	9.71%	8.82%
	Professional	5.48%	5.80%	12.62%	7.97%
	No Answer	2.74%	0%	0.97%	1.24%
Least Favorite Subject[a]	Math	45.21%	56.52%	50.49%	50.74%
	English	45.21%	15.94%	24.27%	28.47%
	Science	21.92%	20.29%	29.13%	23.78%
	Social Studies	15.07%	20.29%	23.30%	19.55%
	Computers/Business	19.18%	11.59%	17.48%	16.08%
	PE/Health	9.59%	7.25%	21.36%	12.73%
	Professional	12.33%	4.35%	9.71%	8.80%
	Art	1.37%	8.70%	4.85%	4.97%
	No Answer	1.37%	1.45%	0.97%	1.26%
I get good grades in school.	Yes	73.97%	71.01%	73.79%	72.92%
	No	26.03%	27.54%	26.21%	26.59%
	No Answer	0%	1.45%	0%	.48%
Did either parent attend college?	Yes	58.90%	69.57%	68.93%	65.80%
	No	36.99%	27.54%	31.07%	31.87%
	No Answer	4.11%	2.90%	0%	2.34%

Did either parent graduate from college?	Yes	50.68%	55.07%	53.40%	53.05%
	No	43.84%	42.03%	44.66%	43.51%
	No Answer	5.48%	2.90%	1.94%	3.44%
Do you plan to attend college?	Yes	72.60%	82.61%	83.50%	79.57%
	No	27.40%	15.94%	14.56%	19.30%
	No Answer	0%	1.45%	1.94%	1.13%
I plan to continue my education	Yes	89.04%	91.30%	87.38%	89.24%
	No	10.96%	7.25%	10.68%	9.63%
	No Answer	0%	1.45%	1.94%	1.13%

[a]Participants allowed to select more than one answer (response percentage exceeds 100%)

The remaining thirty-five items on the survey were student perception items based on the work on student engagement conducted by Zepke and Leach (2010). Each of the four strands Zepke and Leach (2010) identified on a review of literature on engagement made up the categories of the survey, and the conceptual organizer the authors developed was utilized as a general guide to develop survey items. Surveys were delivered via school district created student email accounts to each student who had consent to participate. The 5-point Likert design of the survey provided ordinal data based on the following scale: 1 – “Strongly Disagree”; 2 – “Disagree”; 3 – “Neutral”; 4 – “Agree”; 5 – “Strongly Agree.”

Member checking by individuals with experience in the field of study is often used to provide validation in educational research (Creswell, 2015). To determine the validity of the survey, a copy of the MLSPS was sent to members of the staff and administration in the schools of study as well as to several individuals who have experience working in either a mastery-based, blended, or personalized learning environment through email (Appendix L). Suggestions on the MLSPS included the incorporation of open-ended questions to determine what could be done from a student perspective to improve the model transformation taking place in the three schools of study, concern over the length of the survey tool, and language clarification suggestions on individual items. Open-ended questions were not added to the survey due to the interview portion included in the study. Several questions were reviewed to ensure inclusion of the item was correlated to the research questions. Questions that were similar to other items or not focused on answering research question 3 were omitted to reduce instrument length. Survey verbiage was considered, and minor changes were made based on validation feedback or during the piloting of the survey with students of similar age not enrolled in one of the three high schools of study.

Likert scale survey responses are ordinal data; however, the statistical procedures and tests to use when dealing with Likert scale data continue to be debated by researchers (Clason & Dormody, 1994; Creswell, 2015; Norman, 2010). Some researchers assert that ordinal data that is properly structured with a uniform scale can be analyzed with statistical tests designed for use with parametric data (Creswell, 2015; Norman, 2010). Other researchers press that ordinal data from Likert scale tools has no specified measure and that the indicators in a Likert scale contain too much distance between categories to classify the data as parametric (Clason & Dormody, 1994; Creswell, 2015; Tanner, 2012). For the sake of this study, the calculation of Cronbach's Alpha to determine reliability of the survey instrument using SPSS provides the ability to include the mean, standard deviation, and item correlation (Table 14) in the output results (Norman, 2010). Therefore, this information is included as descriptive statistical data, which provides insight into the survey items as well as allows comparison to the nonparametric data presented in Table 15. Reliability testing through determination of the Cronbach's alpha value resulted in a Cronbach's alpha of .85 in the category of motivation and agency, .82 in the category of transactional engagement, and .88 in the category of institutional support. For the category of active citizenship, a Cronbach's alpha value of .55 resulted from the two questions included in this category. While the Cronbach's alpha value used to establish reliability fluctuates depending on the reference and the application from .6 to .95, the reliability of the first three categories establishes those categories as reliable under most value determinations (Bonett & Wright, 2015; Creswell, 2015; Vaske, Beaman, & Sponarski, 2017). The final category, active citizenship, resulted in a Cronbach's alpha value below what would be commonly considered reliable at .55 (Bonett & Wright, 2015; Creswell, 2015; Vaske et al., 2017). The active citizenship category on the MLSPS was only composed of two items, while the other three categories were composed of 9 to 14 survey items, thus providing a less robust measure and likely significantly impacting the Cronbach's alpha value (Vaske et al., 2017). Means for each category fell in the neutral to agree portion of the Likert-scale, with a value between 3.0 and 4.0 with a few exceptions. Survey item 15, *my teachers and/or mentors push me to work hard*, had a mean value of 4.02, the highest overall mean. Items 19 and 31 had mean values of 2.96 and 2.82, respectively. Item 19 makes direct reference to group work opportunities students are provided, and item 31 references the frequency that students met with a staff member to discuss careers or college.

Table 14

MLSPS: Combined Three School Likert Scale Data - Parametric

Survey Category	Survey Item	*M*	*SD*	Corrected Item Correlation	Cronbach's Alpha if item deleted	Cronbach's Alpha for Category
Motivation and Agency[a]	1	3.48	0.91	0.44	0.84	
	2	3.56	1.04	0.62	0.83	
	3	3.80	0.85	0.57	0.83	
	4	3.84	0.85	0.57	0.83	
	5	3.74	0.80	0.70	0.82	
	6	3.71	0.87	0.67	0.82	
	7	3.68	0.84	0.58	0.83	
	8	3.92	0.79	0.47	0.84	
	9	3.52	0.96	0.66	0.82	
	10	3.71	0.97	0.50	0.83	
	11	3.88	0.79	0.59	0.83	
	12	3.17	1.01	0.63	0.82	
	13	3.46	0.98	-0.55	0.90	
	14	3.80	1.00	0.62	0.83	
	Scale Total	51.26	7.33			0.85
Transactional Engagement[b]	15	4.02	0.86	0.63	0.80	
	16	3.82	0.88	0.66	0.79	
	17	3.99	0.78	0.50	0.81	
	18	3.72	0.82	0.57	0.80	
	19	2.96	1.04	0.38	0.82	
	20	3.78	0.93	0.61	0.79	
	21	3.66	1.04	0.28	0.83	
	22	3.94	0.97	0.54	0.80	
	23	3.61	1.17	0.62	0.79	

	Scale Total	33.50	5.49			0.82
Institutional Support[c]	24	3.44	0.94	0.62	0.87	
	25	3.76	0.93	0.71	0.86	
	26	3.71	0.96	0.67	0.86	
	27	3.56	1.12	0.62	0.87	
	28	3.94	0.76	0.52	0.87	
	29	3.86	0.79	0.67	0.87	
	30	3.82	0.86	0.54	0.87	
	31	2.82	1.14	0.47	0.88	
	32	3.36	1.04	0.65	0.86	
	33	3.35	1.01	0.66	0.86	
	Scale Total	35.62	6.68			0.88
Active Citizenship[d]	34	3.93	0.78	0.39		
	35	3.70	0.97	0.39		
	Scale Total	7.63	1.47			0.55

[a]N = 231. [b]N = 230 [c]N = 234. [d]N = 237.

While parametric statistical procedures are used in the majority of research when dealing with Likert-type data, the level of individual rankings in a Likert-type scale are difficult to determine (Clason & Dormody, 1994; Cresswell, 2015; Tanner, 2012). Although parametric data for each survey item is available in Table 14, the actual percentage of category response is also provided in Table 15. Due to the large variance between each of the Likert-type variables, the response percentages provide greater detail, especially in the areas of Neutral and Agree, allowing responses to be evaluated more clearly than the means in Table 14 allow. Creswell (2015) describes Likert scale data as “quasi-interval,” specifying that statistical methods used should depend on the distance between values on the Likert scale (p. 165). In the 5-point Likert scale used in this study, there were equal intervals; however, scale choices provide for a great deal of potential variability (Creswell, 2015). Potential large variability led to the decision to use both parametric and nonparametric statistical methods. Survey items 6, 10, and 26 are excellent examples of why nonparametric data can provide a look at student perception data that cannot be gathered through review of the means listed in Table 14. Although items 6, 10, and 26 all have identical means, they vary in participant response levels. Item 6, 10, and 26 had student response rates in the “strongly disagree” and “disagree” zones on the Likert-scale, which varied from 6.54% to 10.21%. The same items had a response rate that varied from 60.28% to 64.08% in the “agree” and “strongly agree” zones. Item 10, *I set goals with the help of my teachers and/or mentor*, had both the highest response rates on the upper and lower end of the survey, indicating a stronger student perception on this item. Item 6, *I get lots of opportunities to use feedback to improve my work*, had the lowest response rates of the three items in the upper and lower ends of the scale, and a larger number of students who selected “neutral,” demonstrating that student perception was significantly less partisan. The data in Table 15 allows a view of student perception data that the mean and standard deviation cannot accurately depict and which accounts for the large differences between Likert scale selection options. However, as the means indicate in Table 14, those items with the highest means indicate items with the strongest response rates in the “agree” and “strongly agree” categories, while those with the lowest means have the strongest response rates in the “disagree” and “strongly disagree” categories. Student perception of survey item 8, *I know precisely what quality work looks like*, showed high response levels on the upper end of the scale, with 183 (74.69%) students selecting “agree” or “strongly agree”. Survey item 15, *my teachers and/or mentors push me to work hard*, had the strongest overall response percentage in the “agree” and “strongly agree” categories, with 186 (75.92%) students indicating they are pressed consistently by their teachers and/or mentors. Students shared a strong perception that the expectation in the three high schools was to not waste time (item 17), with 186 (75.91%) indicating an understanding of this expectation. The MLSPS indicated high levels of excitement among students about the future due to interaction with staff in the three schools of study, with 174 (71.02%) students indicating “agree” or “strongly agree” on survey item 22. Survey item 28, *my teachers or mentors check in with me on a regular basis*, demonstrated strong student perception in the “agree” and “strongly agree” categories (*n* = 183 or 74.69%). The importance of developing time management skills was strongly reported among students, with 185 (75.52%) selecting “agree” or “strongly agree” on survey item 34. Student perception in the “disagree” and “strongly disagree” levels of the survey did not indicate nearly as high of response levels as those in the “agree” and “strongly agree” categories on the majority of survey items; however, a few areas did show higher response levels on the lower point range of the survey. Item 12 had a relatively high response level of “disagree” and “strongly disagree”, with 53 (21.64%) students indicated concern about the level of interest in lessons delivered in the three schools of study. A lack of regular opportunities for group work, item 19, was indicated by students with a relatively low mean (Table 14), and response levels greater in the “disagree” and “strongly disagree” indicators than the majority of survey items (*n* = 73 or 29.80%). The lowest mean, 2.82, and highest “disagree-strongly disagree” selection rates (105 students, or 42.86%), occurred on item 31, which references the regularity of discussion with school staff on careers or college.

Table 15

MLSPS: Combined Three School Likert Scale Data - Nonparametric

Survey Category	Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	No Response
Motivation and Agency	1	7 (2.86%)	24 (9.80%)	78 (31.84%)	112 (45.71%)	23 (9.39%)	1 (.41%)
	2	10 (4.08%)	23 (9.39%)	75 (30.61%)	91 (37.14%)	44 (17.96%)	2 (.82%)
	3	3 (1.23%)	17 (6.94%)	51 (20.82%)	131 (53.47%)	42 (17.14%)	1 (.41%)
	4	0	16 (6.53%)	59 (24.08%)	115 (46.94%)	54 (22.04%)	1 (.41%)
	5	0	14 (5.71%)	77 (31.43%)	113 (46.12%)	40 (16.33%)	1 (.41%)
	6	**3 (1.23%)**	**13 (5.31%)**	77 (31.43%)	**108 (44.08%)**	**41 (16.74%)**	3 (1.23%)
	7	2 (.82%)	17 (6.94%)	74 (30.20%)	112 (45.71%)	39 (15.92%)	1 (.41%)
	8	1 (.41%)	9 (3.67%)	50 (20.41%)	**130 (53.06%)**	**53 (21.63%)**	2 (.82%)
	9	9 (3.67%)	23 (9.39%)	72 (29.39%)	108 (44.08%)	30 (12.25%)	3 (1.23%)
	10	**6 (2.45%)**	**19 (7.76%)**	62 (25.31%)	**107 (43.67%)**	**50 (20.41%)**	1 (.41%)
	11	2 (.82%)	9 (3.67%)	53 (21.63%)	132 (53.88%)	46 (18.78%)	3 (1.23%)
	12	**18 (7.35%)**	**35 (14.29%)**	96 (39.18%)	78 (31.84%)	17 (6.94%)	1 (.41%)
	13	6 (2.45%)	26 (10.61%)	102 (41.63%)	68 (27.76%)	41 (16.74%)	2 (.82%)
	14	7 (2.86%)	19 (7.76%)	55 (22.45%)	101 (41.23%)	62 (25.31%)	1 (.41%)
Transactional	15	3 (1.23%)	9 (3.67%)	45 (18.37%)	**111 (45.31%)**	**75 (30.61%)**	2 (.82%)
Engagement	16	3 (1.23%)	13 (5.31%)	60 (24.49%)	115 (46.94%)	51 (20.82%)	3 (1.23%)
	17	1 (.41%)	6 (2.45%)	49 (20.00%)	**123 (50.20%)**	**63 (25.71%)**	3 (1.23%)
	18	2 (.82%)	15 (6.12%)	75 (30.61%)	113 (46.12%)	38 (15.51%)	2 (.82%)
	19	**27 (11.02%)**	**46 (18.78%)**	96 (39.18%)	61 (24.90%)	12 (4.90%)	3 (1.23%)

	20	3 (1.23%)	19 (7.76%)	64 (26.12%)	103 (42.04%)	55 (22.45%)	1 (.41%)
	21	7 (2.86%)	26 (10.61%)	68 (27.76%)	84 (34.29%)	57 (23.27%)	3 (1.23%)
	22	6 (2.45%)	10 (4.08%)	53 (21.63%)	**96 (39.18%)**	**78 (31.84%)**	2 (.82%)
	23	17 (6.94%)	24 (9.80%)	63 (25.71%)	76 (31.02%)	61 (24.90%)	4 (1.63%)
Institutional Support	24	9 (3.67%)	25 (10.20%)	88 (35.92%)	96 (39.18%)	24 (9.80%)	3 (1.23%)
	25	6 (2.45%)	18 (7.35%)	55 (22.45%)	118 (48.16%)	47 (19.18%)	1 (.41%)
	26	**9 (3.67%)**	**13 (5.31%)**	69 (28.16%)	**105 (42.86%)**	**48 (19.59%)**	1 (.41%)
	27	17 (6.94%)	18 (7.35%)	71 (28.98%)	86 (35.10%)	52 (21.23%)	1 (.41%)
	28	0	9 (3.67%)	50 (20.41%)	**129 (52.65%)**	**54 (22.04%)**	3 (1.23%)
	29	4 (1.63%)	11 (4.49%)	45 (18.37%)	144 (58.78%)	40 (16.33%)	1 (.41%)
	30	4 (1.63%)	10 (4.08%)	61 (24.90%)	119 (48.57%)	48 (19.60%)	3 (1.23%)
	31	**29 (11.84%)**	**76 (31.02%)**	68 (27.76%)	49 (20.00%)	20 (8.16%)	3 (1.23%)
	32	15 (6.13%)	32 (13.06%)	75 (30.61%)	95 (38.78%)	26 (10.61%)	2 (.82%)
	33	16 (6.53%)	25 (10.20%)	84 (34.29%)	95 (38.78%)	22 (8.98%)	3 (1.23%)
Active Citizenship	34	3 (1.23%)	5 (2.04%)	50 (20.41%)	**133 (54.29%)**	**52 (21.23%)**	2 (.82%)
	35	7 (2.86%)	21 (8.57%)	53 (21.63%)	112 (45.71%)	44 (17.96%)	8 (3.27%)

Note. N = 245. All numeric data rounded to the nearest hundredth

Semi-structured interviews with eight students in each high school, two students at each grade level, were conducted and coded, with the most frequently occurring codes indicated in Table 16. Interviews ranged in time from 2 minutes and 1 second to 6 minutes and 26 seconds, with a mean interview time of 3 minutes and 8 seconds. Interviews were conducted by a research assistant in one of the three buildings of study and by the primary researcher in the other two buildings. All interviews were conducted in a quiet office or conference room inside the high school building the students attended. Line-by-line coding was employed to analyze data and provide "a detailed descriptive portrait" of student perceptions of the instructional model transformation (Creswell, 2015, p.18). Line-by-line coding, in the manner referenced as open coding by Marshall and Rossman (2016), indicated two primary themes: the successes of model transformation and the struggles of model transformation. Validation of qualitative data, such as student interviews, can be done in several ways, including employing member checking (Marshall & Rossman, 2016). To establish the interview codes and themes were a valid representation of the student perceptions gathered during interviews, member checking emails (Appendix K) were sent to each interview participant via their student email account. No exceptions or concerns with the indicated themes and frequently identified codes were reported to the researcher by students who participated in interviews.

The most mentioned code overall, as seen in Table 16, was that the transformed educational model worked for students. The ability to work at their own pace was mentioned on 16 occasions during student interviews as a successful aspect of the model after transformation. Other frequent codes included the ability to work from home, the provision of student choice, and a student perception of independence (Table 16). These themes were placed in the successes of model transformation due to the manner in which students expressed them during interviews. The other major theme of the interviews, struggles of model transformation, highlight some of the issues students encountered from the instructional model change. The shift of the majority of instructional material to a digital platform was mentioned on ten occasions when students were provided the ability to discuss challenges they encountered after instructional model transformation. In addition, students reported struggling with distractions and other students' behaviors nine times. Other frequent codes mentioned when students discussed what they would like to see changed about the model or what they struggled within the model included a lack of motivation, access to distractions due to the computer (YouTube and computer games), and a perception that the work was more difficult after model transformation (Table 16).

Table 16

Frequent Codes from Interviews

Successes of Model Change	Number of Responses	Struggles of Model Change	Number of Responses
Model works for me	18	Too much computer/online	10
Ability to work at own pace	16	Other kids are annoying/distraction	9
Can work at/from home	7	Lack of motivation/work ethic/responsibility	7
Freedom/Independence	6	Lots of distractions/YouTube	7
Increase in one-to-one interaction	5	Struggling with model/model not working	4
I have the ability to make choices	4	Work is harder/more work	4

Conclusion

Focusing on the three research questions of this study, both quantitative and qualitative research data was summarized. All quantitative data on behavior incidence and suspension rates was drawn from the student data management system used in the district of study, as was all quantitative data on academic performance and credit achievement. Quantitative data on student perception was collected through the Mastery-based Learning Student Perception Survey (MLSPS) developed for use in this study. All parametric quantitative analysis was conducted through the use of Statistical Package for the Social Sciences (SPSS) software. Qualitative data was collected through 24 semi-structured interviews with students in each building. This data was then coded to find frequencies of content occurrence and determine themes.

Behavioral data analysis showed that the impact on behavior of transforming to a mastery-based, personalized instructional model delivered through blended instruction showed a statistically significant reduction in recorded behavior incidence rates in 4 of 5 cohort student groups. Suspension data showed no statistically significant change in either in-school or out-of-school suspension rates among any grade level student cohort pairing.

Academic achievement data demonstrated that the impact of model transformation on academic achievement included a statistically significant reduction in credits earned during the semesters of study in every student cohort pairing. Academic achievement data further demonstrated that no statistically significant change occurred among any cohort student pairing on course grades. Grade point averages prior to model transformation were not statistically significantly different from grade point averages post model transformation among all student subpopulations.

Student perception quantitative data indicated means above three on 33 of 35 student engagement-related survey items on a five-point Likert scale, ranging from a point value of one for “strongly disagree” to a point value of 5 for “strongly agree”. Cronbach’s alpha testing on the survey tool (MLSPS) demonstrated high levels of reliability among survey questions in 3 of the 4 student engagement categories measured. The categories of motivation and agency, transactional engagement, and institutional support all had Cronbach’s alpha values above .8. The engagement category of active citizenship did not have a Cronbach’s alpha value generally accepted as a sufficient indicator of reliability at $\alpha = .55$ (Creswell, 2015; Vaske et al., 2017). Both parametric and nonparametric data were reported on the survey tool allowing triangulation and cross comparison. Triangulation showed that although parametric data indicated general trends in student perception data, nonparametric data provided greater specifics on student perception between the selection options available on the Likert scale.

Qualitative data from student interviews displayed codes tied to the themes of successful aspects of model transformation and struggles encountered due to model change. The majority of students interviewed reported that the mastery-based, personalized instructional model and delivery through blended learning worked for them. Other successes mentioned included the ability for a student to move at their own pace, the ability of students to have choice over what they study, when they study, and where they work. The codes that fell into the theme of struggles based on model change reflect the issues students faced within the model after transformation. These struggles included learning to manage time, finding locations to work that met their needs, and the difficulty created by students who do not use their time wisely or distract others.

Chapter V

Conclusion

Introduction

The problems associated with the traditional model of instruction have been well documented (Bramante & Colby, 2012; Christensen, Horn, & Johnson, 2011; DuFour, 2015; Flumerfelt & Green, 2013; Francis, 2012; Horn & Staker, 2015; Lehmann & Chase, 2015; Sornson, 2016). These educational model problems include: time as a constant and learning as a variable, teaching to the middle (one-size-fits-all), lack of soft skill development, students' passive role, and a general design of sorting students rather than educating all (Bramante & Colby, 2012; Christensen et al., 2011; Horn & Staker, 2015). Innovative educators and researchers are currently developing technologically-enhanced instructional methods, which utilize mastery, blended, or personalized methods, and comparing results to the traditional instructional model (Bissell, 2012; Erdem & Kibar, 2014; Florian & Zimmerman, 2015; Flumerfelt & Green; Horn & Staker, 2015; Lin et al., 2013; Wilder & Berry, 2016; Yapici & Akbayin, 2012a; Yapici & Akbayin, 2012b). Technology has advanced to the point where teaching to the middle is no longer necessary (Horn & Staker, 2015). Instruction can now be personalized for individual students and, when well-designed, includes a student's individual interests to increase engagement (Bramante & Colby, 2012; Horn & Staker, 2015; Lehmann & Chase, 2015).

Educational models are not static. They are complex and dynamic systems that develop over time. Complex educational models are based on the interactions of multiple components both within and outside the system (Burns & Knox, 2011; Lane, 2013; Wang et al., 2015). The complex adaptive system that comprises an educational model makes transformation difficult and requires continual adaptation if an educational system is to survive and meet the demand of the agents it serves (Burns & Knox, 2011; van Bilsen et al., 2010; Wang et al., 2015). As in any complex system, there are both potentially positive and negative outcomes of transformation (Marchi et al., 2014). Mastery-based learning delivered through blended instruction has several challenges, with one of the largest being the changes in roles for the students and instructional staff. The shift of roles for students from passive to active learning and for staff from teacher to facilitator require a large investment in development (Alijani et al., 2014; Bramante & Colby, 2012; Horn & Staker, 2015). The results of this study provide information to consider when determining if school-wide transformation away from a traditional instructional model is appropriate.

Summary of Results

Quantitative methods were used in this study to answer both research questions one and two. Research question one was targeted at determining the impact on student behavior of model transformation from a traditional instructional model to a mastery-based model that utilized blended learning. The results of the analysis of behavioral data logged into the student data management system (SDMS) used in the district of study demonstrated the following:

1. Behavior infraction rates in the three high schools of study were reduced in a statistically significant manner in four out of five grade level cohorts after transformation to a mastery-based learning model.
2. Both in-school and out-of-school suspension rates were not impacted to a statistically significant level due to the educational model transformation in the three high schools of study.

In order to answer research question two, which focused on the impact on student academic achievement, quantitative data from the SDMS was utilized as well. Key findings of the analysis of research data pertaining to research question two indicated the following:

1. Credit completion rates of students after transformation to a mastery-based model utilizing blended instruction were statistically significantly lower than in the traditional instructional model in all grade level cohort pairs.
2. Grade point averages were not impacted in a statistically significant manner among any of the grade level cohort pairings analyzed after educational model transformation.

Research question three, which sought to determine the impact of model change on student perception, was analyzed using both qualitative and quantitative means. Utilization of qualitative methods in combination with quantitative methods provides a more robust view in research and provides opportunity to gather participant voice (Creswell, 2015; Marshall & Rossman, 2016). Key findings of the mixed methods data analysis included the following:

1. The Mastery-based Learning Student Perception Survey (MLSPS) developed to gather student perception data on key elements of engagement was validated by educators with experience in mastery-based instruction, personalized instruction, and blended-learning, with only minor changes suggested.
2. The MLSPS was determined to be reliable in three of the four categories contained in the survey tool through Cronbach's alpha statistical analysis.
3. MLSPS student responses fell in the "neutral" to "agree" category or above on 33 of 35 survey items measured on a 5-point Likert scale.

4. Student interviews determined two major themes: successes of model transformation and struggles due to model transformation.
5. The majority of students indicated in student interviews that their school of attendance “worked for them” after transformation to a mastery-based model.

Quantitative Data

Research Question #1: Impact on Student Behavior

Studies that include behavior data in a mastery-based, personalized, or blended instructional model are few; however, the results have been generally positive and have shown a decrease in negative behavior (Flummerfelt & Green, 2013). Proponents of mastery-based, personalized, and blended learning often report an expectation of reduced negative behavior primarily due to increased engagement, greater flexibility, and the ability to include areas of student interest into their school work (Bramante & Colby, 2012; Horn & Staker, 2015).

In this study, negative behavior rates in the three high schools where data collection occurred was determined by the number of incidents reported in the SDMS, PowerSchool, by the administrators in the buildings. Behavior incidents recorded varied significantly in severity but were utilized to establish the impact of behavior management on educational time. Each time an administrator determines that a behavior should be entered into the SDMS due to its level of severity, educational time has been impacted. This lost educational time may only affect the individual student and the administrator, or it may impact multiple students, an administrator, and one or more teachers. The amount of time lost and severity of educational impact is difficult to determine, but a higher rate of behavior incidents would generally determine a greater loss of instructional time.

Of the five cohort pairings analyzed in dependent sample *t*-testing, only one grade level pairing did not demonstrate a significant impact when behavior incident rates were compared prior to model change with behavior incident rates after model change. The cohort pairing composed of students who were enrolled in 11^{th} grade during the Fall of 2015 and 12^{th} grade during the Fall of 2016 did not reflect a statistically significant decline in logged behavior incident rates (Cohort pairing 4 in Tables 4 and 5). When incident rates are reviewed from Table 4, a decline in incident rates did occur in the 11^{th} to 12^{th} grade cohort, but the mean difference was not large enough to ensure statistical significance with a 95% confidence interval. The data on behavioral incidents demonstrates that the proponents of mastery-based, personalized, and blended instruction were correct to anticipate reductions in overall negative behavior. The decline in incident rates is particularly encouraging when considering the classification of all of the students in the study as at-risk of not graduating. Included in the factors that determine if a student in the state of study meets the requirements required to be classified as at-risk are multiple criteria either directly linked or strongly connected to behavioral issues (Appendix B). These criteria include lack of attendance, failing grades, substance abuse, pregnancy, dropout, emotional problems, court referral, or disruptive behavior. Most of the criteria are normally handled through punitive discipline consequences, are created by discipline issues, or precipitate increased discipline rates (Benner, Kutash, Nelson, & Fisher, 2013; Flower et al., 2011; Simonsen & Sugai, 2013; Tobin & Sprague, 1999). Determining the cause of the statistically significant decline in behavior incident rates is much less straight-forward. However, if the behavior incident rates are reviewed in combination with the results of the MLSPS and student interviews, some connections appear. Overall responses on the MLSPS indicated high response levels in the “agree” and “strongly agree” sections of the survey’s Likert-scale, which indicates a generally high level of engagement. Leach and Zepke (2011), whose conceptual organizer for student engagement from which the MLSPS was designed, specify that high engagement increases educationally-related activity rates. High levels of engagement generally serves as a protective factor from risk-taking behavior and promotes academic success (Francis, 2012; Jonson-Reid, 2010). Individual survey items can provide even greater insight into what may have caused the significant decline in behavior infractions. When students were asked on survey item one about the input they had in the topics they study in school, 55% reported that they "agree" or "strongly agree" that they have some level of control over what is studied. Only 12.66% of students indicated that they "disagree" or "strongly disagree" that they make decisions about what they study. Survey item two had a response level of 55.10% in the "agree" and "strongly agree" categories (17.96% in "strongly agree") compared to a response rate of 13.47% in the lower "disagree" and "strongly disagree" portion of the Likert-scale. Survey item two asked students if they were able to learn in their school environment in a way that suits them. Survey item three asked students if they were able to work at the times that work best for them, and 70.61% indicated that they "agree" or "strongly agree". These three survey items demonstrate support for the assertions of several authors that mastery-based, personalized learning increases engagement through greater student control of the topics of study, learning methods, and time of work completion (Bramante & Colby, 2012; Horn & Staker, 2015). These findings have potentially dramatic importance when it comes to developing programs for at-risk students or transforming existing programs that serve this population of students. The data collected in this study spanning three different high schools with separate staffs and differences in implementation methods clearly demonstrate that blended, mastery-based educational programs significantly reduce negative behavior among at-risk students. This data is supported by the findings of Flumerfelt & Green (2013) who reported a 66% reduction in discipline events among at-risk students when blended learning was implemented for a single grade level.

Research Question #2: Impact on Student Academic Achievement

Student academic achievement was measured using two separate indicators. The first indicator was the rate of credit achievement after model transformation as compared to the credit achievement rates before model change. This indicator was selected due to the importance of credit achievement in the district and state of study. If students do not earn credits at an acceptable rate, the opportunity to graduate on time with their four-year cohort diminishes. In the state where this study took place, 46 semester credits is the minimum total required to receive a high school diploma. In order to award a credit, high schools are required to ensure 60 hours of educational seat time has been completed by students. The framework around the Carnegie Unit is embedded in state legislative code and not only determines graduation, but, through the use of seat time, also controls school funding. The schools involved in this study filed for a waiver through the state department of education for release from the 60-hour Carnegie Unit seat requirement to award credit. However, graduation credit requirements, educational hours of operation, and seat time requirements, in the form of average daily attendance, were still required by the state. These requirements created a situation in which the schools in this study were still required to utilize a time-based system, which contradicted one of the primary characteristics of a mastery learning system, time as a variable. This combination of factors made credit achievement rate a key indicator of academic success in the transformed model, serving as a clear representation of the effect model change created on student graduation progress. The effect of the model change in the three schools of study on graduation progress was very pronounced. Mean credits earned during first semester of the 2015-2016 school year, prior to model change, was over six credits per semester in every grade level cohort pair (values ranged from 6.11 credits per semester to 6.71 credits per semester). Mean credits earned during first semester of the 2016-2017 school year, after model transformation, was under two credits per semester in every grade level cohort pair (values ranged from 1.50 credits per semester to 1.80 credits per semester). A review of Table 8 clearly demonstrates that mean student credit achievement rate was reduced markedly due to model transformation. Table 9 reinforces this finding by displaying the *p* values after dependent pair *t*-testing for each group, which all fall below .000 ($p < .001$). Every cohort grade level population pairing experienced a statistically significant reduction in credit achievement rates. A review of literature makes the reduction in credit completion difficult to interpret. The premise of mastery-based learning is movement from time as a constant to time as a variable to shift learning from a variable into a constant (Bramante & Colby, 2012 & Horn & Staker, 2015; Lin et al., 2013; Oyugi, 2015). Therefore, a short-term time-based comparison of credit completion spanning a short period of time has been shown to be incongruent with the mastery-based model transformation. As Sinner (2015) pointed out in her research, longitudinal study is warranted when determining the success of mastery learning but is absent from current literature. When students are provided the ability to self-pace or work at the level they best develop, such as in a blended or mastery-based environment, the development of skills should be the factor measured (Bramante & Colby, 2012; Horn & Staker, 2015; Lin et al., 2013; Oyugi, 2015; Sinner, 2015). This creates an unnatural comparison between mastery-based and traditional educational models where level of mastery in a fixed amount of time is the objective (Lin et al., 2013). However, it is important to note that the results from this study clearly demonstrate that educators looking to embrace the strengths of blended, mastery-based learning need to account for the ability of students to work within their individual zones of development.

The second academic indicator selected for quantitative analysis in this study was grade point average (GPA). As movement to mastery-based learning continues to gain momentum and schools strategically plan to transform, the movement away from a traditional grade scale and use of competencies rather than standards will need to be items to consider (Bramante & Colby, 2012). During the transition to personalized learning, the schools in this study made a purposeful decision to mitigate the changes in order to ease the transition for parents, students, and school staff. A decision to continue to use a traditional grade scale provided data that could be statistically compared to the same form of data prior to transformation to indicate changes in student course grades. GPA data from Table 10 and Table 11 indicated little variance after model transformation when compared to GPA data prior to model change. Although mean GPA's reduced in three of four cohort student population pairings, Table 11 indicates that no statistically significant change occurred in GPA's due to model transformation. The only group that showed an increase in mean GPA's after model transformation was population pairing two, which was composed of 10th grade students Fall of 2015 who moved into 11th grade for the Fall of 2016. This group was also the cohort pairing that earned the highest credit achievement rate among grade level cohorts (1.8 credits per semester) after model transformation. The cohort category that was most impacted was student cohort 3, composed of 11th graders during the first semester of 2015-2016 who moved into 12th grade for the first semester of model transformation. This group had a *p* value of .058, with a confidence interval of 95%, indicating they were close to reaching a statistically significant reduction in GPA's due to model transformation. Again, when we examine GPA data the differences in model objectives between mastery-based and traditional become clear. Mastery-models have consistently shown better academic results in students when compared to traditional educational models (Bramante & Colby, 2012; Lin et al., 2013; Oyugi, 2015; Sinner, 2015). However, this research study was highly dependent on time as a case study providing under six months for students to work at their own pace prior to finalizing data collection. This created a situation where a number of students in each high school, while progressing in their course work, did not establish the level of mastery required to establish credit completion in the mastery-based model. The results of this time-based comparison between models resulted in students operating in the mastery-based model who were awarded no credits and therefore strongly influenced the mean due to a lack of grade point average. Under the same circumstances students in the traditional model were awarded credits at the conclusion of the semester regardless of full content mastery in their courses making the lack of a GPA an exceptional occurrence (Lin et al, 2013). Staff in all three schools clearly communicated that students who had completed courses had clearly shown higher levels of content mastery than the same students achieved in the traditional model of instruction which is apparent in the data and supported in research (Bramante & Colby, 2012; Lin et al., 2013; Oyugi, 2015; Sinner, 2015).

Research Question #3: Student Perception

The unique nature of the MLSPS required validity and reliability analysis to ensure results were usable in the research study. To test validity, the MLSPS was sent to several school staff and administrators who had experience working in one of the three primary components of the model change in the three high schools of study (i.e., mastery-based learning, personalized learning, or blended/hybrid learning models). The results of validity feedback allowed refinement of questions and reduction in the number of survey items. General feedback on the survey indicated confidence that student perception could be accurately measured using the categories of engagement on which the survey was based. Two respondents indicated a desire to see open-ended questions added to the survey tool, however, they were not aware that a qualitative interview portion of this survey was designed to gather student voice. Other suggestions from experienced educators included relatively minor language changes to enhance student understanding of survey items. Student understanding was accounted for, using this input, during the pilot of the MLSPS prior to data collection among similar-aged students not involved in the research study.

Results of the MLSPS support a claim that the mastery-based, personalized instructional model delivered through blended instruction, as designed in the schools of study, provided students with the elements needed to foster high levels of student engagement (Leach & Zepke, 2011). Results of the survey also suggest that group work opportunities (item 19) and career and college counseling (item 31) are areas of need in the transformed educational model.

Alkharusi (2016) asserts the importance of considering student perception when analyzing student achievement as well as when implementing learning tasks and learning strategies. Using the survey results to triangulate with the data from other sections of this study has provided a more robust view of the CAS through the use of student perception than included in currently available research. As mentioned above, a relatively direct link was drawn between survey items one, two, and three and the statistically significant drop in student behavior infractions in three of four grade level cohorts (Benner et al., 2013; Georges et al., 2012; Hirschfield & Gasper, 2011; Jonson-Reid, 2010; Wilson et al., 2011). A similar connection is possible when the engagement category of transactional engagement is compared to academic data. Transactional engagement includes many of the engagement factors that promote student academic success, such as teacher-mentor support level, expectation to use time wisely, belief in the value of the education the school provides, and general connection to the school (Russell & Slater, 2011; Zepke & Leach, 2010). In the category of transactional engagement, eight of nine survey items had mean values above 3.50 and high response rates in the “agree” and “strongly agree” scale items (ranging from 55.92% to 75.92%). Transactional engagement contained the three highest response rates on the “strongly agree” portion of the Likert scale on survey items 15, 17, and 22 (31.84% to 25.71%). Items 15, 17, and 22 are directly related to connection with mentors/teachers and school expectations. It is apparent that the schools involved in this study did particularly well at building relationships between teachers and students and clearly expressing an expectation to use time wisely through the early stages of the model transformation. This data is particularly important due to the difficulty “at-risk” students often have with connecting with the culture often present in traditional schools (Wilson et al., 2011). In light of the strong connection to school and staff, it highlights that other factors, such as the specified objective differences between traditional and mastery based, must have been involved to create the statistically significant reduction in credit achievement rates.

When the data from the MLSPS is triangulated with the behavioral and academic data also contained in this study the importance of looking at educational models holistically through the lens of a complex adaptive system becomes clear (Wang, et al., 2015). The MLSPS clearly shows the students in the three high schools of study strongly perceive that the elements of engagement are soundly in place in the blended, mastery-based models implemented. Research specifies that students, especially those at-risk, who are engaged at school do not misbehave at the same rate as disengaged students (Benner et al., 2013; Georges et al., 2012; Hirschfield & Gasper, 2011; Jonson-Reid, 2010; Wilson et al., 2011). The link between engagement and increased academic performance is as clear as the link between engagement and behavior in the literature (Alkharusi, 2016; Bramante & Colby, 2012; Horn & Staker, 2015; Jonson-Reid; 2010; Leach & Zepke, 2009; Leach & Zepke, 2011; Russell & Slater, 2011; Wilson et al., 2011; Zepke & Leach, 2010). By collecting data on perceived engagement, behavior, and academic achievement in a school-wide transformation to mastery-based learning delivered through blended instruction this study provides the holistic view of the CAS missing in all currently available research. Flumerfelt and Green (2013) reported both behavioral incident decreases and academic increases in blended classrooms for a single government classroom pilot that expanded to encompass an entire 9th grade level of students in a single school. While their study did involve at-risk students it was not carried out in a mastery-based model, did not include student perception data, nor did it report results related to full-school implementation (Flumerfelt & Green, 2013). By collecting and analyzing data in three school-wide implementations and on multiple facets of the CAS this study provides a more holistic view supporting the implementation of a blended, mastery model in public schools than any current literature.

Qualitative Data

Research Question #3: Student Perception

To provide a cross-sectional view of student perception, 24 students were randomly selected for semi-structured interviews and included two students from each grade level from each building. Five of the six interview questions (Appendix H) were written to gather student input on what worked for students after transformation to a mastery-based model delivered through blended instruction and with what students were struggling. The most frequent codes fell into two general themes: successful aspects of the mastery-based model and struggles of the mastery-based model. The sixth interview question focused on student attendance to gather information for the district, but it falls outside the scope of this research study. The student input from interview question six, '*what typically causes you to be absent from school?*', did not generally fall into either of the themes indicated after coding. Interview question number six was also not directly related to the three research questions of this study; therefore, student responses were omitted.

While the majority of codes fell into the two primary themes, it is of interest to note that some of the codes that showed up did not fall cleanly into one of these two themes. This presence of hard-to-classify themes is not unusual and is described by Creswell (2015) as one of the major theme categories expected when conducting qualitative research. One of the hard-to-classify codes included the need for students to have blended-instructional delivery and mastery-based instruction defined for them. Three students interviewed had been participating in the transformed instructional model for over three months, but were unsure of the language used to describe the model. A second hard-to-classify code included four students who were undecided on the comfort level they have with the new model. When asked if the school works for a student in building 2, he commented, "Sort of. I was used to being in a situation where it's like, this is what you need to do." Both of these hard-to-classify codes likely appeared due to the short exposure to the model that students had prior to their interviews. The three schools began the school year with the mastery-based, personalized instructional model delivered through blended instruction in late August of 2016, and all interviews were held in December of 2016.

Theme One: Successes of the Mastery-based Learning Model

The codes that fell into the theme of successes of model transformation support the advantages of the mastery-based and blended learning models cited by a number of authors and researchers. These advantages indicated by multiple authors include the ability for students to have some level of choice over the pace that they work, the location they work, input on the time that works best for the student to carry out educational work, and the ability to be involved in selecting the subject matter studied (Bissell, 2012; Bramante & Colby, 2012; Grant & Basye, 2014; Horn & Staker, 2015; Kazu & Demirkol, 2014; Vickers et al., 2015; Yapici & Akbayin, 2012a). Each of these elements showed up in the frequently used codes from the semi-structured interviews. “I feel like this school works for me because it helps me work at my own pace” was a quote from an interviewed student in building 3. A student in building 1 shared, “I like how I am able to work at my own pace compared to a force of pace, like how last year was.” The ability for students to work at their own pace fosters elements of engagement measured on the MLSPS in the category of motivation and agency (Leach & Zepke, 2011). As seen in the prominent codes in Table 16, the student’s ability to choose where to work was a frequent comment as well as an overall feeling of freedom and independence. “We have freedom, and we’re growing and not just staying the same way we were before” was input provided by a student in building 3. A student in building 2 shared, “There’s a little more freedom. I’m not used to having that much freedom.” These student quotes show that freedom can empower students and provide educational choice which increases engagement (Bramante & Colby, 2012; Horn & Staker, 2015; Leach & Zepke, 2011). However, student choice can also lend itself to some of the codes we see appearing in the struggles column of Table 16, such as distraction and apathy. A student in building 1 shared, “I can do what I want to do that day. I have choice.” In building 2, a student commented, “A lot of times, I’ll just stay home and work and then come in late.” Additionally, a student in building 3 reported, “It seems easier in a way ‘cause it’s easier to study. You can take it home and work on it.” A review of the frequent codes in Table 16 appearing in the successes column directly coincide with a student-centered model design, which is highlighted by various authors when mastery, blended, or personalized learning are discussed (Bramante & Colby, 2012; Florian & Zimmerman, 2015; Grant & Basye, 2014; Horn & Staker, 2015; Wilder & Berry, 2016). The results of student interviews are further supported when triangulated with the data from the MLSPS. Survey items one through three are directly related to student choice over topics of study, how learning is completed, and when learning takes place (Leach & Zepke, 2011). The combined response rates in the "agree" and "strongly agree" scale sections for survey items one through three ranged from 55.10% to 70.61%, with mean values of 3.48, 3.56, and 3.80, respectively. Students clearly voiced a recognition that the elements of engagement were in place in the three schools just as data from the MLSPS demonstrated and the resulting reduction in behavior infractions support (Benner et al., 2013; Bramante & Colby, 2012; Georges et al., 2012; Hirschfield & Gasper, 2011; Horn & Staker, 2015; Jonson-Reid, 2010; Leach & Zepke, 2011; Wilson et al., 2011).

Theme Two: Struggles in the Mastery-based Learning Model

When asked what they like least about blended, mastery learning (interview question 4), a student in building 2 stated, "How online it is. I'm not very computer savvy, so it's kind of confusing for me most of the time." Similarly, when a student in building 1 was asked what they would change, he commented, "The computer, definitely the computer. I liked it better last year because we were not on the computer at all." These student responses highlight the struggle encountered by multiple students when instruction was digitized to a much larger degree, as is required to successfully implement blended instructional delivery (Alammary, et al., 2014; Horn & Staker, 2015; Napier et al., 2011). Each student in the three schools of study was loaned a laptop for educational use, and the majority of educational content was only accessible through the learning management system. The only exception to the primarily digital content was in the subject of math, where the majority of content remained paper and pencil. The extreme shift of content delivery from primarily all paper and pencil in the traditional model to primarily all digital for blended instructional delivery was the most common code indicated by students as an area of struggle. While the technology utilized in blended learning provides the flexibility in the delivery model the struggles with technology and in some cases a preference for face-to-face instruction was included by several researchers as a concern with the instructional model (Calderon et al., 2012; Erdem & Kibar, 2014; Florian & Zimmerman, 2015; Lin et al., 2016; Napier, et al., 2011; Yapici & Akbayin, 2012). This contrasts with the assertion of some authors that students are digital natives who have moved beyond the struggles of technology and prefer to work in the medium (Alijani et al., 2014; Mirriahi et al., 2015). The results of student interviews correspond with the former perspective, however, an understanding of the need to develop technological skills to function effectively in the 21st century must also play into model change decisions (Bramante & Colby, 2012; Erdem & Kibar, 2014; Horn & Staker, 2015; Kazu & Demirkol, 2014; Mirriahi et al., 2015; Yapici & Akbayin, 2012)

The provision of computers and student input on instructional use of time led to the second most mentioned item with which students struggled in the transformed educational model, which was distraction. A student in building 3 shared, “It gives people more time to slack off and not get anything done,” when asked what they least liked about blended, mastery learning. Another student in the same building commented, “With all the free time, I can get a little off task every now and then.” A student who was struggling with the model reported that his biggest challenge was getting distracted. The student reported, “I was getting distracted, not going to some of my classes or doing all of the work I’m supposed to.” A student in building 2 reported bluntly, “People are abusing it. I need a quieter place to work separate from the loud people." These struggles with time management and self-regulation are mentioned by multiple authors as skills student need to be successful in blended learning environments or that they need to develop in order to be successful (Calderon et al., 2012; Horn & Staker, 2015; Ma'arop & Embi; 2016; Napier et al., 2011). All three buildings serve at-risk students who have historically demonstrated a lack of time-management and self-regulation so staff anticipated the presence of distractions in the blended instructional delivery of the transformed model and took steps to provide student support in this area (Archambault et al., 2010; Benner et al., 2013; Georges et al., 2012; Hodge, 2014; Simonsen & Sugai, 2013; Tobin & Sprague, 1999). Rather than shy away from the implementation of a model that requires students to self-manage the staff of the three schools embraced the need to develop these skills in their at-risk students to better enable them to be prepared for career or college (Bramante & Colby, 2012; Horn & Staker, 2015; Vickers et al., 2015). The strong student perception response rates on MLSPS item 17, *the expectation in this school is not to waste time*, indicated that the schools were successful in expressing the importance of time management. Item 17 had the second highest mean value (3.99) and second highest percentage of students who selected either "agree" or "strongly agree" (75.91%) on the Likert-scale out of the 33 survey items deemed valid and reliable.

A review of the codes which fell into the theme, *struggles of model change*, directly parallel the areas of skill development cited by proponents of mastery-based instructional models and blended learning instruction (Bramante & Colby, 2012; Horn & Staker, 2015; Vickers et al., 2015). The development of technological skills, time-management, and self-regulation are cited as areas of skill development provided in the mastery-based and blended instruction environment, which are not as readily available in the traditional instructional environment (Bramante & Colby, 2012; Flumerfelt & Green, 2013; Horn & Staker, 2015). Student perception indicates that these areas of skill development needs exist and create a great deal of discomfort and struggle for at-risk students. The implementation of a blended, mastery-based instructional model was viewed as essential by the schools of study to develop their at-risk population of students into self-managing young adults with the skills to be career or college ready (Bramante & Colby, 2012; Flumerfelt & Green, 2013; Horn & Staker, 2015; Vickers et al., 2015). Through strategic utilization of interactions between school staff and students in the complex adaptive educational system the interactions and educational strategies were designed to influence self-regulation (Wang et al, 2015). Through review of the high positive response rates in the MLSPS category of transactional engagement it is clear that staff were successful in promoting the ideas of time-management and self-regulation.

Conclusions

> "The primary variable in public education is achievement. America's educational system is not designed to bring students to mastery. It is designed with time-based starts and stops, and, at the end of each stop, each student is judged to date by the acquisition of knowledge based, in large part, on some combination of subjective factors that varies from teacher to teacher" (Bramante & Colby, 2012, p. 68).

Bramante and Colby (2012) provide sound reason for changes to the present educational system utilized in the United States. Rapid advances in technology, competition, and on-going research have created a need for schools to reform to stay relevant in the 21st century (Florian & Zimmerman, 2015; Flumerfelt & Green, 2013). Working to answer the three research questions of this study:

1. What impact does mastery-based, personalized learning have on the behavior of at-risk students?

2. What is the impact of a mastery-based, personalized learning instructional model on student academic achievement?
3. What is the student perception of a shift to a mastery-based, personalized instructional model with delivery through blended learning?

The work carried out in the three schools of this study to not only reform, but to transform away from the traditional educational model to a personalized, student-centered model serves as a reminder of the importance of keeping accurate data during any action research-based change process (Creswell, 2015). School systems are complex, adaptive systems with multiple elements and influential interactions that dynamically impact the system in ways that are not always easily predicted (Wang et al., 2015). The data in this study focused on three specific areas that both influence and are influenced by the multiple agents inside the complex adaptive educational system (Burns & Knox, 2011; Wang et all, 2015). The data collected during the transformation process of these three school provides insight for other schools seeking to make themselves relevant in the 21st century and to evolve to better serve students at an individual level (Flumerfelt & Green, 2013).

Behavioral data indicates that transforming to a mastery-based, personalized learning model delivered through blended instruction has the ability to reduce the behavior infraction rates of at-risk high school students. The work of Flumerfelt and Green (2013) as the only published research article located through extensive research on the impact of blended instruction on at-risk students supports the results of this study. Behavior infraction rates among the grade level cohort pairings in the three high schools involved in this study all declined with statistically significant reductions in four of the five student cohort pairings. In a related study on the impact of blended learning on 9th grade students a 66% reduction in behavioral occurrences was observed (Flumerfelt & Green, 2013). While Flumerfelt and Green (2013) were able to report data on academic achievement and behavioral occurrence among at-risk students the scope falls short of this study focused on a more holistic view of a CAS through inclusion of student perception data and school-wide implementation in three separate high schools serving at-risk students.

Behavioral data collected during the two semesters of study also indicate that transforming to a mastery-based model delivered through blended instruction does not significantly impact educational exclusion rates for at-risk students due to in-school and out-of-school suspensions. No other currently published research was located that contained data on exclusion rate changes due to transformation to a mastery-based, personalized, or blended model of instruction. Research available on student engagement supports that if the provision of the components of a CAS which enhance engagement are provided behavioral infractions will reduce (Benner et al., 2013; Georges et al., 2012; Hirschfield & Gasper, 2011; Jonson-Reid, 2010; Wilson et al., 2011). While mean suspension rates fluctuated at this early stage of model implementation no statistically significant change in suspension rates occurred even when students labeled “at-risk” were provided greater freedom of choice. Reinforcing that engagement is a preventive element in the deterrence of behavior (Benner et al., 2013; Georges et al., 2012; Hirschfield & Gasper, 2011; Jonson-Reid, 2010; Wilson et al., 2011).

Academic achievement data during the period of collection demonstrated a pronounced reduction in credit achievement rates in every grade level cohort across the three high schools. However, this reduction was based on comparison of a two models with expressly different objectives (Bramante & Colby, 2012; Horn & Staker, 2015). Mastery-based models seek to ensure skill development with time viewed as a variable to afford students with the time needed to acquire content mastery (Bramante & Colby, 2012). Credit achievement rates were reduced in a statistically significantly manner among every grade level cohort due to the transformation of educational model. However, research supporting the relatively low skills often seen in at-risk students supports a system that provides students the ability to work at their own pace and continue learning until content mastery is achieved before being forced to move on (Benner et al., 2013, Hirschfield & Gasper, 2011). Mean values of educational achievement rates prior to model change compared to mean values post model transformation indicate that students earned less than a third as many credits during the same period of time in a mastery-based learning model delivered through blended instruction. This reduction alludes to the need to focus on the measurement of skill development through the achievement of competency rather than course completion rates (Bramante & Colby, 2012; Oyugi, 2015).

Grade point averages across all student grade level cohort pairings were not impacted at a statistically significant level due to the model transformation. Although mean grade point averages reduced after model change in three of the four grade level cohort pairings, none of the reductions in mean were significant statistically. It is important to note that while traditional models truncate instruction based on set time limits, mastery-based models provide the time students need to master skill development (Bramante & Colby, 2012; Oyugi, 2015). This resulted in several students in the mastery-based model ending the first semester of 2016-2017 with no grade point average due to continued engagement in course material which dramatically impacted GPA. A review of the numerical GPA data at an individual level and conversations with staff at all three high schools support research that specifies mastery-based models increase student academic success (Bramante & Colby, 2012; Lin et al., 2013; Sinner, 2015). The ability to close achievement gaps provided by mastery-based learning models is an important item for consideration when designing an instructional model for at-risk students, a population often identified as possessing low academic skill levels (Lin et al., 2013; Benner, 2013).

Three of the four sections of the MLSPS were deemed valid and reliable through review by educators with experience in the fields of mastery-based instructional models, personalized learning models, or blended learning and Cronbach's alpha statistical analysis. Results for the fourth section of the MLSPS, active citizenship, is not included in data review other than for reference purposes due to the inability to establish reliability on this section of the MLSPS. Overall, MLSPS results indicated that the factors that establish engagement in a school environment are strongly in place with few exceptions (Leach & Zepke, 2015). In the category of transactional engagement, MLSPS results indicated a need for increased opportunity for students to work collaboratively with their peers on academic work. Due to the importance of collaboration as a 21st century work skill this provides an opportunity for development in the three high schools of study (Florian & Zimmerman, 2015). MLSPS results in the category of institutional support indicated a need for greater career and college counseling. Student perceptions measured on the MLSPS directly support areas researchers report as elements in a mastery-based or blended model that increase engagement (Leach & Zepke, 2015; Russell & Slater, 2011). Students perceive, according to the MLSPS, that they are afforded choice over what is studied, when academic work takes place, and the ability to choose to learn in a way that works for them as an individual (Bramante & Colby, 2012; Horn & Staker, 2015). Students also report strong connections to teachers and mentors as well as clear expectations in the schools they attend which are both elements of a successful educational model designed for at-risk students (Tobin & Sprague, 1999).

Student interviews indicated two primary themes: the successes of model transformation to a mastery-based system with instruction delivered through blended learning and the struggles of model transformation. The areas students perceived as positive aspects of the newly introduced educational model directly align with the aspects of a mastery-based model and blended instruction (Bramante & Colby, 2012; Horn & Staker, 2015). Students indicated that they liked having the ability to work at their own pace, input on where they work, the choice of when they work, and control over what they work on. The struggles student indicated due to the introduced educational model included several of the areas that authors supporting a mastery-based model or blended learning indicated as areas of skill development provided by mastery-based or blended learning (Bramante & Colby, 2012; Horn & Staker, 2015; Vickers et al., 2015). These areas of concern included high levels of distraction, an increase in digitized academic work, and being distracted by other students who were not focused on learning or using time wisely. This student input reinforces that the skills of self-regulation, time management, and the use of technology as an educational tool are issues to consider when implementing a mastery-based learning model utilizing blended learning as a delivery method (Bramante & Colby, 2012; Horn & Staker, 2015; Vickers et al., 2015).

Recommendations for Further Research

Longitudinal research on full school model change to blended, mastery learning.

The primary recommendation for future research centers around the concept of time. While this study was focused on providing the vital data needed to prepare educational institutions for the initial effects of implementation of a mastery-based model with blended learning delivery into a CAS the inclusion of longitudinal research in available research will benefit both educational innovators and researchers.

In order to support the impact of the transformed educational model and confirm it as a long-term result, a longer period of data collection in established models would enhance current research data available on the impact a mastery-based model and blended learning have on behavioral infraction rates academic achievement, and student perception. Initial behavioral impacts of the mastery-based model are impressive, long-term study could indicate whether behavior incident rates rise after students become acquainted with the model or continue at statistically significantly lower rates. If mastery-based learning delivered through blended learning show a long-term increase in engagement and a decrease in behavior incident rates among students labeled as "at-risk", the implications for increased transformation in educational models that cater to this student population could be extremely powerful. A long-term exposure to the elements that enhance engagement is certain to positively influence academic achievement and student learning rates (Alkharusi, 2016; Bramante & Colby, 2012; Horn & Staker, 2015; Jonson-Reid; 2010; Leach & Zepke, 2009; Leach & Zepke, 2011; Russell & Slater, 2011; Wilson et al., 2011; Zepke & Leach, 2010).

Measurement of academic skills in the blended, mastery model that are not time-based.

Academic achievement data showed clearly the difficulty of comparison between models of fundamentally separate designs. The mastery-based model where time functions as a variable and learning as a constant is difficult to compare to the traditional model where time is a constant and learning is the variable (Bramante & Colby, 2012). Further research on student skill development growth may provide increased insight into model transformations impact on academic achievement.

Research on the multiple elements of the complex adaptive system in the blended, mastery educational model.

Due to the complex system in a mastery-based, blended learning model, further research is also recommended to study other elements of the complex system, such as attendance, influence of legislative policy, as well as other agents in the system, such as parents, teachers, and administrators. The complex adaptive system that composes a mastery-based, personalized instructional model delivered using blended instructional methods creates almost limitless future research opportunities.

Modifications to improve the Mastery-based Student Perception Survey.

The MLSPS created an initial tool to collect student perception data. However, for application in further research, some changes to the MLSPS are suggested, such as expanding the active citizenship category to increase internal consistency and resulting reliability. Simply increasing the number of items, even with an equal correlation, increases reliability measure substantially (Vaske et al., 2017). The utilization of only two questions in the engagement category of active citizenship does not provide the breadth and robustness desired to ensure usable data has been acquired through the MLSPS in its present form. The category of active citizenship is critical to ensure students are prepared to function successfully in the work environment as well as function productively as citizens in a challenging global environment (Zepke & Leach, 2010). The addition of questions that involve the use of critical dialogue in the school program offered and/or questions centered around student self-awareness will make the category of active citizenship more robust (Zepke & Leach, 2010). A final suggestion to improve the MLSPS for future research is to remove item 13, *the work I do in school is boring*. The item creates coding difficulty due to the way it is phrased, and data from Table 14 demonstrates removal of the item would improve reliability substantially, from .845 to .895. One of the educational experts who reviewed the MLSPS for validity also suggested removal of item 13 from the survey. The data gathered after analysis of survey responses supports this suggestion.

Implications for Professional Practice

Introduction of a blended, mastery-based instructional model reduces behavior infraction rates in at-risk high school students.

The data gathered during this research study carries several positive implications for the implementation of a mastery-based model combined with blended instructional delivery. Behavioral and student perception data indicates that use of the transformed model may be a way to create higher levels of engagement in at-risk students and reduce behavioral problems in this vulnerable population. However, behavioral data also seems to indicate that educational exclusion rates are not dependent on model design, but potentially hinge on other elements of the complex educational system.

When implementing a blended, mastery-based model a long-term implementation plan is essential.

Academic data supports that when model transformation is implemented having a multifaceted long-term vision is essential (Evans, 2012; Sykes et al., 2014). While keeping elements of the traditional model in place may need to occur to ease transition all facets of the educational model need to be evaluated and continuous improvement plans developed to implement a personalized learning model (Evans, 2012; Johnson et al., 2012). While academic data demonstrates a significant reduction in credit earning rates it is essential to keep in mind that a continuous improvement plan exists in the three schools of study. The three schools of study have developed a five-year implementation and continuous improvement plan and development of a similar long-range plan supports the work of others in the field as best practice (Evans, 2012; Horn & Staker, 2015; Sykes et al., 2014).

A long-term implementation plan must have the full support of the State Department of Education, school district officials, and staff in the school of model transformation. As the data in this study has shown transforming an existing educational model within a district and state educational framework based on the Carnegie unit has potential impacts on credit completion rates. District officials must be prepared to make long-term commitment to support schools in the face of declining credit achievement rates and the problems that can be associated with declining credit achievement rates. Communication plans between school, district, and state officials as well as how parents and other school patrons will be educated about the possible effects of model change must be a part of long-term implementation plans.

Charter schools will not provide a timely method to transform the industrial educational model in the United States, cultural changes in traditional public schools are the answer.

As research was conducted in the three schools of study, one of the most prominent issues that arose and deserves consideration is the development of a school culture that differs in a mastery-based learning model from the culture of a traditional educational model. Christensen (2011), while in support of the implementation of mastery-based learning models, warns that implementing a disruptive model change in a traditional setting "likely condemns it to failure" (p. 236). Through this statement and several others in his writing, Christensen (2011) asserts doubt that the traditional public school system will be able to transform to stay relevant to 21st century learners. However, as of the 2013-2014 school year, over 90% of students in the United

States were educated in public schools (U.S. Department of Education, 2016). Charter schools may be the answer to the shift that needs to take place in education by providing the ability to start fresh in a more adaptable educational design that can cater more specifically to the needs of particular student groups (Christensen, 2011). The difficulty with charters providing the core of educational shift is the fact that public charters made up 6.6 percent of public schools in school year 2013-2014, up from only 3.1 percent in school year 2003-2004 (U.S. Department of Education, 2016). With the current level of growth, the 21st century will likely come to an end prior to charter schools leading us to educational transformation. Realistically, transformation must occur among traditional public schools. However, change is hard, based on the feedback of school staff and student perception data in this study, and indicates a struggle to develop the skills required to be successful in a student-centered educational model. Thus, the struggles these schools have encountered may provide some insight into how schools will need to change to enable transformation.

Professional development is an essential element of educational model transformation.

One of the major challenges the schools involved in this study have encountered, based on interactions with staff in the three schools of study, has been staff development. Several authors have indicated that a high degree of staff development in essential to implement a mastery based instructional model or blended learning (Alammary et al., 2014; Calderon et al., 2012; Freeman & Tremblay, 2013; Horn & Staker, 2015; Napier et al., 2011; Mirriahi et al., 2015). The problem of staff development is compounded when a traditional school transforms due to time limitations, lack of resources, and staff willingness to embrace change. Time is always a precious commodity in a school setting and one which seemingly faces increasing competition as the role of public schools expands (DuFour, 2015). The schools in this study were able to carve time out for professional development in several ways. Prior to the start of staff contract time for the 2015-2016 school year, the schools added an additional two days of staff development to work collectively on a clearer understanding of mastery-based learning, blended instruction, and utilization of one-to-one laptop devices in the school building. During the 2015-2016 school year, administration in each school facilitated individual building professional development through intermittent staff meetings at a rate principals and staff in each building deemed appropriate. Funding for the two additional days of staff development was primarily provided by the school district where the study took place, while staff development in individual buildings occurred during contract time in order to eliminate additional cost. Following the 2015-2016 school year, the three schools as a collective group were awarded a $130,000 grant funded by the state legislature and distributed by the State Department of Education to pilot mastery-based learning during the 2016-2017 school year. The grant application to the State Department of Education included a "no-harm" clause and seat-time waiver, providing secure funding and flexibility for redesign. The grant money was utilized prior to the beginning of the 2016-2017 school year to add two additional days of staff development. Staff were trained in the use of the learning management system (LMS) and focused on the logistics for how to best roll out the school-wide mastery-based educational model in each building for the first day of school. Grant money was also utilized to attend staff training one day each month developed by the State Department of Education on implementation of a mastery-based learning model. Additional professional development during the 2016-2017 school year was scheduled into the work day. The ability to schedule large chunks of professional development into the contract day was provided by the implementation of a blended learning instructional delivery model. All teachers in similar subjects were placed into one of five collaborative groups in the Fall of 2016, and each group was scheduled into a three-hour work session each week. The five collaborative groups were math, electives, science, social studies, and English, with specialists either grouped with electives or the subject group that fit most naturally with what they taught. The three-hour work time provided teachers from all three buildings the ability to continue training and develop courses based on competencies rather than traditional standards. The lack of resources for staff development was a difficult limitation during the early stages of model transformation. Just like time, money is a very limited resource in the majority of public schools. Staff support of transformation to a mastery-based, blended model was a major issue for administration prior to implementation. It continued to be a struggle at the conclusion of the term of this study as well. Staff in all three schools were introduced to the idea of model transformation and provided opportunity to transfer to another school that utilized a traditional model of instruction during the 2015-2016 school year in building one and two and during the end of the 2014-2015 school year in building three. As a result, 25% to 60% of staff in each of the three high schools either transferred or found a new educational career opportunity during the initial planning of model transformation in 2015-2016 or prior to the full model transformation in 2016-2017. However, based on feedback from the current administration in each of the three schools, staff continued to struggle with teachers not invested in model transformation. The difficulty this struggle creates is that people are the essence of an organization, and "changing people can create a positive culture" (Turan & Bektas, 2013, p. 157). Changing people is dependent on the manner in which a group of people interact with one another, the goals and objectives this group of people share, and the atmosphere created (Turan & Bektas, 2013). Having people in an organization who do not share a common vision and do not work toward the establishment of a common culture makes it difficult for a cultural shift to move from vision to action (Turan & Bektas, 2013). While Christensen (2011) may be correct that implementing a model of instruction distinctly different from the model currently in place may decrease opportunity for success, the schools in this study are certainly not the same as they were when the traditional instructional model was entrenched. The schools have changed many staff members, and, through professional development, the staff have changed their understanding, vision, and skills. Turan & Bektas (2013) assert that an organized group with common goals and objectives, guided by a leader with vision, can establish culture. Cultural change aligned with the goals of the organization “improves the probability of successful transformation” (Heckelman, Unger, & Garofano, 2013).

In order for the educational system in the United States to stay relevant, it must transform (Bramante & Colby, 2012; Christensen, 2011; Horn & Staker, 2015). For this change to take place in a reasonable time frame, the public school system that educates the vast majority of our students and future citizens must lead this change. Culture needs to be a key element of consideration in this process to provide the best opportunity of success (Heckelman et al., 2013).

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Appendix A

Permission to use CABLS Figure

Yuping Wang **<#.####@########.###.##>** Feb 18

to me, Xibin

Dear Dustin,
Thanks for your interest in and nice comments on our article. Yes, you have our permission to use the figure.
All the very best to your research
best regards

(Email address of original author omitted, accessible via article in references)

Appendix B

State Administrative Code

ADMINISTRATIVE CODE 08.02.03.110
State Board of Education

110. ALTERNATIVE SECONDARY PROGRAMS (SECTION 33-1002; 33-1002C; 33-1002F).

Alternative secondary programs are those that provide special instructional courses and offer special services to eligible at-risk youth to enable them to earn a high school diploma. Some designated differences must be established between the alternative school programs and the regular secondary school programs. Alternative secondary school programs will include course offerings, teacher/pupil ratios and evidence of teaching strategies that are clearly designed to serve at-risk youth as defined in this section. Alternative high school programs conducted during the regular school year will be located on a separate site from the regular high school facility or be scheduled at a time different from the regular school hours. (4-1-97)

01. Student Qualifications. An at-risk youth is any secondary student grade seven through twelve (7-12) who meets any three (3) of the following criteria, Subsections 110.01.a. through 110.01.f., or any one (1) of criteria in Subsections 110.01.g. through 110.01.m. (3-30-07)

a. Has repeated at least one (1) grade. (4-1-97)
b. Has absenteeism that is greater than ten percent (10%) during the preceding semester. (4-1-97)
c. Has an overall grade point average that is less than 1.5 (4.0 scale) prior to enrolling in an alternative secondary program. (4-1-97)
d. Has failed one (1) or more academic subjects. (4-1-97)
e. Is two (2) or more semester credits per year behind the rate required to graduate. (4-1-97)
f. Is a limited English proficient student who has not been in a program more than three (3) years. (3-30-07)
g. Has substance abuse behavior. (4-1-97)
h. Is pregnant or a parent. (4-1-97)
i. Is an emancipated youth. (4-1-97)
j. Is a previous dropout. (4-1-97)
k. Has serious personal, emotional, or medical problems. (4-1-97)
l. Is a court or agency referral. (4-1-97)
m. Upon recommendation of the school district as determined by locally developed criteria for disruptive student behavior. (4-1-97)

02. Instruction. Special instruction courses for at-risk youth enrolled in an alternative secondary program will include: (4-1-97)

a. Academic skills that include language arts and communication, mathematics, science, and social studies that meet or exceed minimum state standards. (4-1-97)
b. A personal and career counseling component. (4-1-97)
c. A physical fitness/personal health component. (4-1-97)
d. A state division approved vocational-technical component. (4-1-97)
e. A child care component with parenting skills emphasized. (4-1-97)

03. Graduation Credit. Graduation credit may be earned in the following areas: academic subjects, electives, and approved work-based learning experiences. Nonacademic courses, i.e., classroom and office aides do not qualify for credit unless they are approved work-based learning experiences. (4-5-00)

04. Special Services. Special services, where appropriate for at-risk youth enrolled in alternative secondary programs, include the following where appropriate: (4-1-97)
a. A day care center when enrollees are also parents. This center should be staffed by a qualified child care provider. (4-1-97)
b. Direct social services that may include officers of the court, social workers, counselors/ psychologists. (4-1-97)

(State code modified to remove name of state where study took place)

Appendix C

Mastery-based Learning Student Perception Survey

Demographics and other Questions:

1. *School*
   Building: 1, 2, 3 (building names not listed for anonymity purposes)
2. *Age*
   In years:
3. *Gender m/f*
   Male Female Prefer Not to Select
4. *Favorite Subject*
   Art Computers/Business English Math Professional Technical
   Science Social Studies
5. *Least favorite subject*
   Art Computers/Business English Math Professional Technical
   Science Social Studies
6. *I get good grades in school.*
   Yes No
7. *Did either of your parents ever attend college?*
   Yes No
8. *Did either of your parents graduate from college?*
   Yes No
9. *Do you plan to attend college?*
   Yes No
10. *I plan to continue my education in some way following high school.*
    Yes No

Category 1: Motivation and Agency

Survey Items

1. *I make decisions about the topics that I study in school*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
2. *In this school environment, I am able to learn in a way that fits me*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
3. *I am able to engage in school work during times that work best for me*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
4. *I get helpful teacher feedback*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
5. *The feedback I get at this school improves my understanding*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
6. *I get lots of opportunities to use feedback to improve my work*
   Strongly Disagree Disagree Neutral Agree Strongly Agree
7. *I clearly understand the expectations of the lessons I do in this school*

Strongly Disagree Disagree Neutral Agree Strongly Agree

8. *I know precisely what quality work looks like*
Strongly Disagree Disagree Neutral Agree Strongly Agree
9. *I know what we are learning and why*
Strongly Disagree Disagree Neutral Agree Strongly Agree
10. *I set goals with the help of my teachers and/or mentors*
Strongly Disagree Disagree Neutral Agree Strongly Agree
11. *I am provided the opportunity to achieve my goals each day*
Strongly Disagree Disagree Neutral Agree Strongly Agree
12. *Lessons in this school are thought provoking and interest me*
Strongly Disagree Disagree Neutral Agree Strongly Agree
13. *The work I do in school is boring*
Strongly Disagree Disagree Neutral Agree Strongly Agree
14. *I know that what I am doing at this school will help me in the future*
Strongly Disagree Disagree Neutral Agree Strongly Agree

Category 2: Transactional Engagement

15. *My teachers and/or mentors push me to work hard*
Strongly Disagree Disagree Neutral Agree Strongly Agree
16. *I am getting a good education at my school*
Strongly Disagree Disagree Neutral Agree Strongly Agree
17. *The expectation in this school is not to waste time*
Strongly Disagree Disagree Neutral Agree Strongly Agree
18. *I am expected to interact either digitally or face-to-face with others as part of my learning*
Strongly Disagree Disagree Neutral Agree Strongly Agree
19. *Group work is a regular part of my activities*
Strongly Disagree Disagree Neutral Agree Strongly Agree
20. *I feel like my teachers or mentors are available*
Strongly Disagree Disagree Neutral Agree Strongly Agree
21. *Poor student behavior slows down my learning*
Strongly Disagree Disagree Neutral Agree Strongly Agree
22. *I have at least one teacher who makes me excited about the future.*
Strongly Disagree Disagree Neutral Agree Strongly Agree
23. *I am happy to be at my school*
Strongly Disagree Disagree Neutral Agree Strongly Agree

Category 3: Institutional Support

24. *I regularly receive recognition or praise for achieving my learning goals*
Strongly Disagree Disagree Neutral Agree Strongly Agree
25. *This school is committed to building the strengths of each student*
Strongly Disagree Disagree Neutral Agree Strongly Agree
26. *Students in this school are thought of as individuals*

Strongly Disagree Disagree Neutral Agree Strongly Agree

27. *I feel like I "belong" in this school*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
28. *My teachers or mentors check-in with me on a regular basis*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
29. *I know when I achieve my goals in this school*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
30. *The expectation at this school is that all students will be successful after high school*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
31. *I speak regularly with someone from the school about careers or college*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
32. *Students help shape decisions about this school*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
33. *Student suggestions about improving this school are valued*
    Strongly Disagree Disagree Neutral Agree Strongly Agree

Category 4: Active Citizenship

34. *Students at this school are expected to develop time management skills*
    Strongly Disagree Disagree Neutral Agree Strongly Agree
35. *I am learning skills and behaviors that are important for achieving my future goals*
    Strongly Disagree Disagree Neutral Agree Strongly Agree

(Survey categories and items adapted from Leach & Zepke's (2010) conceptual organizer for student engagement)

Appendix D

University HRRC Approval

RE: [Northwest Nazarene University] Submission Protocol #3042016 - A MIXED METHODS STUDY TO MEASURE THE IMPACT OF MASTERY-BASED PERSONALIZED LEARNING ON AT-RISK STUDENT ACHIEVMENT

Northwest Nazarene University **hrrc@nnu.edu via email.submittable.com** Apr 6

to me

Dear Dustin,

The HRRC has reviewed your protocol: Protocol #3042016 - A MIXED METHODS STUDY TO MEASURE THE IMPACT OF MASTERY-BASED PERSONALIZED LEARNING ON AT-RISK STUDENT ACHIEVMENT. You received "Full Approval". Congratulations, you may begin your research. If you have any questions, let me know.

Curtis Garner
Northwest Nazarene University
HRRC Member
623 S University Blvd
Nampa, ID 83686

Appendix E

Parental Informed Consent Form – Student Mastery Survey

DATE: 8/11/16

Dear Parents/Guardians,

This year, I have the opportunity to conduct a research study with your student as a part of my graduate program at Northwest Nazarene University. The study has been reviewed by the Research Review Committee at Northwest Nazarene University and has been successfully approved.

The benefits that may result from the research are: improved flexibility in course selection, the ability for your student to have greater control over the pace of course completion, the ability for your student to have voice or earn voice in when and where they complete course work within certain limits, and increased teacher-student relationship building.

The procedures are as follows:

- The research project will take place over a period of 5 months. During that time, Mr. Dustin Barrett and his educational assistants will collect information on course completion, course grades, and behavior incidents from PowerSchool as well as conduct student surveys and interviews to gather student perceptions of a shift from traditional teaching methods to mastery-based, personalized learning utilizing blended instruction. Information on mastery-based learning, personalized learning, and blended instruction are available on the school websites.
- Data will be collected from August 2016 through January 2017.
- This consent letter directly pertains to providing permission for your student to complete a student survey with 45 questions related to how mastery-based, personalized learning utilizing a blended learning model of instruction was perceived by them during the first quarter of the 2016-2017 school year. Your student has the opportunity to complete this survey due to being a current student enrolled at one of the three academies.

I anticipate that there is minimal risk involved for your student over the course of the study. Instruction will be provided through a combination of face-to-face instruction and computer-based instruction determined by content experts and school administration based on course content and objectives.

Your student's participation on this research survey is completely voluntary. In addition to your permission, your student will also be asked if he or she would like to take part in this project.

Any student may stop taking part at any time. The choice to participate or not will not impact your student's grades or status at school.

All information that is obtained during this research project will be kept strictly secure and will not become a part of your student's school record. The results of this study may be used for a research paper and presentation. Pseudonyms or numerical codes will be substituted for the names of children and the school. This helps protect confidentiality.

In the space at the bottom of this letter, please indicate whether you do or do not want your student to participate in a research survey in connection to the above described study. The second copy is to keep for your records. If you have any questions about this research project, please feel free to contact me either by mail, e-mail, or telephone. Please keep a copy of this form for your records.
The results of my research will be available after August 1, 2017. If you would like to have a copy of the results of my research or have any questions, please contact me at dustinbarrett@nnu.edu or my advisor, Dr. Heidi Curtis, at 208-467-8250.

Sincerely,

Dustin D. Barrett
dustinbarrett@nnu.edu

****
I have read this form. I understand that nothing negative will happen if I do not let my student participate. I know that I can stop his/her participation at any time. I voluntarily agree to let my student participate in this study as follows:

YES ________________________________ may participate in this study.

NO ________________________________ may NOT participate in this study.

Student's printed name: ____

Parent/Guardian printed name: _____________________________________

Parent/Guardian signature: ____

Date: ___________________________

Appendix F

Parental Informed Consent Form – Student Interview

DATE: 8/11/16

Dear Parents/Guardians,

This year, I have the opportunity to conduct a research study with your student as a part of my graduate program at Northwest Nazarene University. The study has been reviewed by the Research Review Committee at Northwest Nazarene University and has been successfully approved.

The benefits that may result from the research are: improved flexibility in course selection, the ability for your student to have greater control over the pace of course completion, the ability for your student to have voice or earn voice in when and where they complete course work within certain limits, and increased teacher-student relationship building.

The procedures are as follows:

- The research project will take place over a period of 5 months. During that time, Mr. Dustin Barrett and his educational assistants will collect information on course completion, course grades, and behavior incidents from PowerSchool as well as conduct student surveys and interviews to gather student perceptions of a shift from traditional teaching methods to mastery-based personalized learning utilizing blended instruction. Information on mastery-based learning, personalized learning, and blended instruction are available on the school websites.
- Data will be collected from August 2016 through January 2017.
- This consent letter directly pertains to providing participation for your student to be involved in a semi-structured interview with the primary researcher, Dustin Barrett. If your student is enrolled at Meridian Academy your student will participate in an interview facilitated by a research assistant to reduce any potential risk. Your student was chosen to participate in an interview through random selection.

I anticipate that there is minimal risk involved for your student over the course of the study and interview. Instruction will be provided through a combination of face-to-face instruction and computer-based instruction determined by content experts and school administration based on course content and objectives.

Your student’s participation in this research interview is completely voluntary. In addition to your permission, your student will also be asked if he or she would like to take part in this project. Any student may stop taking part at any time. The choice to participate or not will not impact your student's grades or status at school.

All information that is obtained during this research project will be kept strictly secure and will not become a part of your student's school record. The results of this study may be used for a research paper and presentation. Pseudonyms or numerical codes will be substituted for the names of children and the school. This helps protect confidentiality.

In the space at the bottom of this letter, please indicate whether you do or do not want your student to participate in a research interview in connection to the above described study. The second copy is to keep for your records. If you have any questions about this research project, please feel free to contact me either by mail, e-mail, or telephone. Please keep a copy of this form for your records.
The results of my research will be available after August 1, 2017. If you would like to have a copy of the results of my research or have any questions, please contact me at dustinbarrett@nnu.edu or my advisor, Dr. Heidi Curtis, at 208-467-8250.

Sincerely,

Dustin D. Barrett
dustinbarrett@nnu.edu

****
I have read this form. I understand that nothing negative will happen if I do not let my student participate. I know that I can stop his/her participation at any time. I voluntarily agree to let my student participate in this study as follows:

YES ________________________________ may participate in this study.

NO ________________________________ may NOT participate in this study.

I give my consent for the interview and discussion to be audio taped in this study:

____ ___________________
Signature of Parent/Guardian **Date**

I give my consent for direct quotes to be used in this study:

____ ___________________
Signature of Parent/Guardian **Date**

Student's printed name: ____

Parent/Guardian printed name: ____________________________________

Parent/Guardian signature: ____

Date: ___________________________

Appendix G

Research Assistant Confidentiality Agreement

RESEARCH ASSISTANT CONFIDENTIALITY AGREEMENT
NORTHWEST NAZARENE UNIVERSITY
A MIXED METHODS
STUDY TO MEASURE
THE IMPACT OF
MASTERY-BASED
PERSONALIZED
LEARNING ON AT-RISK
STUDENT
ACHIEVMENT

I, **________________________________** [name of research assistant], agree to assist the primary investigator with this study by **_______________________________**[list research tasks]. I agree to maintain full confidentiality when performing these tasks.
Specifically, I agree to:

1. keep all research information shared with me confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes, transcripts) with anyone other than the primary investigator;

2. hold in strictest confidence the identification of any individual that may be revealed during the course of performing the research tasks;

3. not make copies of any raw data in any form or format (e.g., disks, tapes, transcripts), unless specifically requested to do so by the primary investigator;

4. keep all raw data that contains identifying information in any form or format (e.g., disks, tapes, transcripts) secure while it is in my possession. This includes:
   - keeping all digitized raw data in computer password-protected files and other raw data in a locked file;
   - closing any computer programs and documents of the raw data when temporarily away from the computer;
   - permanently deleting any e-mail communication containing the data; and
   - using closed headphones if transcribing recordings;

5. give, all raw data in any form or format (e.g., disks, tapes, transcripts) to the primary investigator when I have completed the research tasks;

6. destroy all research information in any form or format that is not returnable to the primary investigator (e.g., information stored on my computer hard drive) upon completion of the research tasks.

Provide the following contact information for research assistant:

Printed name of research assistant____

Address:_________________________

Telephone number:_______________________

Signature of research assistant__________________________ Date __________

Printed name of primary investigator________________________________

Signature of primary investigator_________________________ Date_________

Appendix H

Interview Questions

Note for students: "We are looking to redesign our school based on what works best for students. You have the ability to cause change. We highly value your input and ask that you give serious feedback."

Do you feel like this school "works" for you, why or why not?
What parts of school would you like to see changed?
What do you like most about blended learning?
What do you like least about blended learning?
What are the biggest challenges in the way of your success in school?
What typically causes you to be absent from school?

Appendix I

Student Assent Form

I am currently conducting a study to learn about how students have been affected by the recent change by the high school you attend to a new instructional method of mastery-based personalized learning through us of blended instructional model.
If you agree to be in this study, I will be asking you some questions about how you, personally, have been affected by the recent changes in your high school.
You have the ability to ask any questions related to the study or interview/survey questions at any time during the interview. If you decide at any time that you no longer wish to participate in the study you can ask that the interview be stopped at any time. If you do not feel comfortable answering any questions asked you may ask me to skip the question and move to the next.
The questions I will ask are only about what you think. There are no right or wrong answers to any questions, this is not a test in any form.
If you sign this form, it means that you have read this form and desire to participate in this study. If you do not desire to be a part of this study, do not sign this form. Participating in this study is up to you, completely voluntary, and no one will be upset if you do not sign this form or choose to stop your participation at any time during the interview/survey.

Your Signature: ___________________________________ Date:_______________

Your Printed Name:________________________________ Date:_______________

Signature of Person Obtaining Assent:____
Date:______________

Printed Name of Person Obtaining Assent:______________________________________
Date:______________

Appendix J

Verbatim Interview Instructions

Hello <u>Insert Participants Name</u>

Thank you for being willing to participate in this study. The idea of the interview I would like to conduct with you today is to determine how you have been affected by the changes that have taken place in the high school you attend. Your name will be kept anonymous and will not be shared with school staff in connection to your name at any time. Please feel safe to be honest about your opinions to the questions I ask.

I will be completing a semi-structured, audio-recorded interview with you today. Semi-structured means I will be asking you a specified set of questions but you have the ability to ask any questions you have at any time and I may ask clarifying questions as needed to ensure I understand as clearly as possible. Here is a copy of the questions I will be asking. You can see I have only six specified questions to ask you. As specified in your ascent, or permission, to participate you can choose to stop participation in this interview at any time and have the ability to not answer any questions you do not desire to answer. The interview should take no longer than 30 minutes depending on the number of questions you ask during the process.

Participation in this interview is completely voluntary.

Do you have any concerns regarding the audio recording of our interview?

Do you have any questions or can I clarify anything prior to the interview?

Thank you for your participation.

Appendix K

Member Checking Email

Date

Dear Insert Participant's Name,

Thank you for participating in my research study. I wanted to let you know some of the themes that resulted from the interviews of all participants (please read below). Please let me know if these accurately depicted our conversation. If you have any suggestions or modifications, please let me know as well.

- Successes of model change to a mastery-based educational model delivered through blended learning.
- Struggles of model change to a mastery-based educational model delivered through blended learning.

Thank you again for your valuable input and participation.

Dustin D. Barrett
Doctoral Student
Northwest Nazarene University
dustinbarrett@nnu.edu
HRRC Approval# TBA

Appendix L

Survey Validation Email

Email recipients name,

My name is Dustin Barrett and I am currently working to develop an effective tool to gather perception data from students in a blended (or hybrid), mastery, or personalized learning environment. As a person who has experience in one of these environments your input is extremely valuable to me. I have attached the survey tool our team has created based on the four categories of engagement identified by Nick Zepke & Linda Leach (2011).

I know your time is valuable but with the expressed purpose of working to validate this instrument I would greatly appreciate any feedback, input, advice, etc. that you have with regard to the survey tool. This tool will be used for on-going research in the district in which I work and for my doctoral level research - your expertise is extremely valuable.

Any questions, comments, or survey input can be sent to my email: dustinbarrett@nnu.edu

I greatly appreciate your time and your innovative work with students,

Dustin D. Barrett
Doctoral Student
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