View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by UNL | Libraries

University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Educational Administration: Theses, Dissertations, and Student Research

Educational Administration, Department of

8-2016

Teacher + Technology = Blended Learning: How Important is the Teacher in this Equation?

Catherine A. Doom
University of Nebraska-Lincoln, drcarriedoom@gmail.com

Follow this and additional works at: http://digitalcommons.unl.edu/cehsedaddiss

Part of the Educational Administration and Supervision Commons, and the Educational Leadership Commons

Doom, Catherine A., "Teacher + Technology = Blended Learning: How Important is the Teacher in this Equation?" (2016). *Educational Administration: Theses, Dissertations, and Student Research*. 271.
http://digitalcommons.unl.edu/cehsedaddiss/271

This Article is brought to you for free and open access by the Educational Administration, Department of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Educational Administration: Theses, Dissertations, and Student Research by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Teacher + Technology = Blended Learning:

How Important is the Teacher in this Equation?

by

Catherine A. Doom

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Education

Major: Educational Administration (UNL-UNO)

Under the Supervision of Professor Jody Isernhagen

Lincoln, Nebraska

August, 2016

Teacher + Technology = Blended Learning:

How Important is the Teacher in this Equation?

Catherine A. Doom, Ed.D.

University of Nebraska, 2016

Adviser: Jody Isernhagen

This mixed method study investigates teacher belief, knowledge action and technology adoption rate in a blended learning setting and the impact those variables have on student comprehension measures. Surveys and data collected from the blended learning program were used to gather data in pursuit of answers to the following research questions: (a) Does the teacher's adoption of technology rate impact reading comprehension growth in a blended learning environment? (b) Does the teacher's knowledge, belief and action in a blended learning environment impact student reading comprehension growth? (c) Does the teacher's adoption of technology rate combined with the teacher's knowledge, attitude, and actions impact reading comprehension growth in a blended learning environment?

Literature on teacher perception of blended learning and the impact that perception has on students in a K-5 setting is limited. This study provides additional information to add to that body of literature. Results for this data set indicated that there is no significant impact on student reading comprehension outcomes in relation to a teacher's knowledge, belief, actions or any combination of these variables.

Acknowledgements

I am so very grateful to have completed this journey. The process shed light on those I learn from, lean on, look to, and love.

Thank you to Jody Isernhagen, my advisor and committee chair. Without you, I would still be wandering through the process. You gave me a path, organization and a deadline.

To my committee, Dixie Sanger, Kent Mann and Shavonna Holman, thank you for your expertise and your guidance. I am honored to have worked with each one of you.

To those amazing people that I surround myself with each day at Voyager Sopris Learning, I am lucky to learn from you on a daily basis. Thanks so much to Theresa McKee who continually went above and beyond to help me; to Paty Sak, Bonnie Kurtz, Jeff Bodin, and Lory Heron for opening doors to help me work with some amazing folks. Thank you to Karon Brown, Marcia Boone and Polly Stansell for breathing life into this endeavor. It was about a year ago that you helped to spark this project and I am grateful for your expertise and support along the way.

I am truly grateful for amazing leaders and know that I have that in both of you, Leslie Jolissant and Kurt Grefe. Kurt, your calm presence and team building ability are things that I take with me on the road. Attitude is everything……I've picked a good one, I promise. Leslie, you lift me up, cheer me on and work to ensure that not only me, but my family, is empowered. I have learned a great deal about the power of a positive outlook and fitting in some fun alongside hard work. I am forever grateful for your support over the last two years.

Janet Macpherson, there's truly no greater mentor. You have been there to push me, to be my sounding board, to cheer me on, and to talk it through. I learn from you daily! Thanks for being my guiding light and the voice of reason.

Nika Fabienke, your brilliance is an inspiration to me. I value your friendship, the life you model, your professionalism, your expertise and your eloquence.

Thanks so much to those friends, Lorena Hendricks and Tara Ebert, that helped me with drafts, editing, and making sense. You both are a blessing in my life.

Finally, I am thankful to my family for their unwavering support. Herb and Judy Dixon--you taught us long ago that you gave me roots to know where I come from and to develop a strong sense of self and wings to accomplish all that I am capable of and to visit as often as we can. Thanks for the endless hours. You have shaped my life into something amazing and I will work daily to create a legacy of which you are proud

Lisa Dixon, your reason and ability to see a bigger pictures are lessons that I take with me. Thanks so much for your ideas, clarifying questions and reminders to stick with it little sister.

Sherry, Stasia and Matz Doom, I am thankful for the hours of caring for Dixon while I wrote, studied, researched and coded.

To my husband, Damian, I am in awe of your endless drive. Thank you for being my biggest cheerleader, my partner and my best friend. I am looking forward to all of the adventures that are to come! Love you for always. And finally to my son, Dixon, you weren't even in the picture when all of this started. You are a continual inspiration to me and I love seeing the world through your eyes. Thanks for letting mommy write and read and research. Now it's time for play and adventures and fun!

Table of Contents

List of Tables

List of Appendices

Chapter 1

Overview

Introduction

> Will machines replace teachers? On the contrary, they are capital equipment to be used by teachers to save time and labor. In assigning certain mechanizable functions to machines, the teacher emerges in his proper role as an indispensable human being. He may teach more students than heretofore—this is probably inevitable if the world-wide demand for education is to be satisfied—but he will do so in fewer hours and with fewer burdensome chores. (Skinner, 1953, p. 156)

> Generative Adaptation recognizes and optimized the critical role of the teacher, who happens to be the single greatest determinant of student success inside schools. If you want to help struggling students succeed, then adaptivity needs to be designed to enhance teaching, not bypass it. Zoran Popovic (Gottlieb, 2015, para. 3)

Statement of the Problem

Technology continues to advance and provide options to make tasks easier. Education is not exempt from the innovations and has not been for decades. The problem seems to be how to blend the technology and the teaching to develop the right formula for successful schools, teachers and students. This problem is exacerbated by the lack of research in the K-12 setting; particularly in K-5. Building a practical framework for teachers to impact students is needed to move forward in making blended learning an effective practice. Additional research needs to be provided on how the teacher actions, beliefs and knowledge of blended learning impact student achievement.

The researcher works in an educational publishing institution that develops supplemental and intervention curricula and supports K-12 schools in implementing intervention curricula through consulting, coaching, systems building and data analysis. Given the technology trends, consultants and coaches that support schools are being asked to support blended learning environments. Teachers, administrators and coaches are struggling to navigate classroom environments that have been asked to transition from print to the use of technology like smart boards, tablets, etc. to technology designed to supplement practice activities for students and now to a blended learning model that integrates direct instruction from both the teacher and the technology. These environments are not always familiar to the consultants, districts, schools or teachers. This study explored the impact of receiving blended learning instruction using *Velocity*®, an educational program currently in development through a partnership between Voyager Sopris Learning and Enlearn, on student reading gains using *Lexile*® measures.

Velocity® is an adaptive blended learning solution that utilizes machine learning. Machine learning is

> a subset of artificial intelligence, is an effort to program computers to identify patterns in data to inform algorithms that can make data-driven predictions or decisions. As we interact with computers, we're continuously teaching them what we are like. The more data, the smarter the algorithms become. (Vander Ark, 2015)

This machine learning generates a continuous stream of new content in real time that best meets the learning needs of each individual student in every learning moment (Gottlieb, 2015, para. 5). This machine learning innovation is based on the six years of research at the University of Washington's Center for Game Science (CGS). The adaptation of the curricula is specific to the thought process level and invokes hints and scaffolding to provide opportunities for the students to learn new skills. "*Velocity*® breaks down the learning process to a new level of granularity using dozens of discrete yet interwoven thought processes that underlie each skill competency" (*Velocity*® *Toolbox,* 2017, p. 5). The Enlearn educational platform that Velocity uses to power the machine learning behind the adaptive engine

> differentiates itself by continuously monitoring each student's understanding of countless subtle learning concepts and adapting the entire classroom ecosystem. Rather than moving forward as other engines do in a branching model with siloed content, the engine uses a specific type of machine learning to curate and generate new problems and personal learning pathways for each and every student. The platform can even curate pathways never before traveled by another learner. (Brian, 2016, para. 3)

Enlearn first implemented this technology in an effort to help scientists uncover proteins and enzymes needed to further health care. Proteins and enzymes are built on patterns and new discoveries are made when the patterns are uncovered. It takes many years for scientists to uncover these using traditional approaches. However, when Enlearn was able to apply machine learning to the discovery of these patterns, new proteins and enzymes were quickly discovered (Gray, 2011). The same machine learning and adaptive engine produced by Enlearn has been shown to help students achieve in math through

> an average mastery rate of 94.5% in solving linear equations after 1.5 hours versus less than 30% in the non-adaptive version of the content. Although the content was 7th grade, the result was achieved by all participating K-12 classrooms, including early elementary. (Gottlieb, 2015, para. 6)

Gottlieb (2015) quoted Popovic to explain that "students solved 4.5 times more problems in the class utilizing generative adaptation and teachers were able to assist students three times more frequently compared to using the paper version of the same curriculum" (Gottlieb, 2015, para. 7). The research initially centered on math is expanding into reading as well with the development of *Velocity*® and the use of the generative adaptive engine. Applied to English Language Arts content, *Velocity*® will provide this same opportunity to help accelerate student learning. This innovation is able to cover the breadth of learning paths unique to each student regardless of the text or courseware, given the adaptation that happens with each key stroke by the student. It also allows for real time reporting to the teacher, instead of having to wait to grade an assignment or assessment, then report that information back to the student, plan a differentiation activity, deliver the new activity and finally reassess.

Purpose Statement

The purpose of this study is to examine how a student's achievement in literacy is impacted in a blended learning environment. Given the importance of the teacher (Gottlieb, 2015; Skinner, 1953), this study examined the impact on student reading comprehension by examining blended learning in relation to the teacher attitude, knowledge and actions. To support the analysis, teachers will be categorized using Roger's Diffusion of Innovation technology adoption categories (Rogers' DOI) (Rogers, 2003).

Research Questions

1. Does the teacher's adoption of technology rate impact reading comprehension growth in a blended learning environment?
2. Does the teacher's knowledge, belief and action in a blended learning environment impact student reading comprehension growth?
3. Does the teacher's adoption of technology rate combined with the teacher's knowledge, belief, and actions impact reading comprehension growth in a blended learning environment?

Research Methodology

Both qualitative and quantitative data regarding teacher knowledge, actions and attitude about blended learning as well as the technology adoption categories were collected in this mixed method approach. Data was collected from teachers who were piloting the blended learning program, *Velocity*®. The pilot program was implemented in April, 2016 and ran through June, 2016. Teachers included in this study were from seven districts in six states.

Survey Description

The first survey gathered demographic information as well as general information about the teacher's perception of knowledge, attitude, technology adoption categories, experience and barriers. Section One of the survey captured demographic information about the teachers' professional experience. Section Two asked teachers to respond to several statements about their knowledge of blended learning and the attitude toward blended learning and its impact on student achievement. In Section Three, teachers were asked to respond to statements about technology adoption categories related to Rogers DOI (Rogers, 2003). Finally, Section Four asked teachers to respond to multi-select and open ended questions focused on experience and barriers.

The completed teacher surveys were coded as high knowledge/low knowledge; high belief/low belief; early adopters/late adopters. Teachers categorized as High Knowledge indicated that they perceived themselves as knowledgeable of blended learning and had participated in the blended learning professional development session designed to prepare them to implement the program. These teachers scored at least 12 out of a possible 15 points on the Likert scale on the initial survey.

Teachers categorized as High Belief indicated that they agreed with positive belief statements in relation to blended learning. These teachers scored at least 28 out of a possible 40 points.

Teachers were categorized according to their level of technology acceptance as Early Adopters or Late Adopters based on Rogers (2003) DOI. The survey was originally used in the dissertation, *Innovators or Laggards: Surveying Diffusion of Innovations by Public Relations Practitioners* (Savery, 2005). The survey includes multiple choice and Likert scale questions.

The Post survey was delivered at the end of the implementation. This survey served to capture additional qualitative information about the teacher perceptions and student response to blended learning. Section One serves to capture name and school information to correlate with the previous survey. Section Two will capture any changes in teacher knowledge and attitude toward blended learning by revisiting the pre-implementation statements on these topics and expand through open-ended questions focused on teachers' perceptions regarding professional development and the use of blended learning. The final section will revisit barriers and experiences that teachers have encountered while implementing in a blended learning setting.

Definition of Terms

Action—Teacher monitoring and teacher led instruction designed in response to the online program includes logging into the dashboard, downloading a teacher directed lesson, viewing student's activity history, or acknowledging the actionable alerts on the teacher dashboard.

ANCOVA—Analysis of Covariance

> is a useful tool in both experimental and nonexperimental research. It's a statistical technique used when a researcher wishes to examine the relationships among at least two quantitative variables and at least one additional categorical (qualitative) variable. This then allows the researcher to examine the relationship in question "controlling" for this confounding categorical variable. (Wildt & Ahtola, 1978, p. 5)

ANOVA—Analysis of Variance is used to compare the means of two or more samples or to compare mean in factorial designs (those with more than one independent variable (Teddlie & Tashakkori, 2009, p. 259).

Attitude—Teacher's perception of blended learning either positive or negative.

Blended Learning—is

> a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path and/or pace and at least part at a supervised brick and mortar location away from home. (Horn & Staker, 2015, para. 34)

Brick and Mortar/ Traditional Instruction—is a structured education program that focuses on face-to-face teacher-centered instruction, including teacher-led discussion and teacher knowledge imparted to students (Horn & Staker, 2011).

Early Adopters—Individuals that are not on the top forefront but are close behind to adopt innovations. These individuals are leaders and role models for others (Rogers, 2003).

Early Majority—Individuals that adopt the innovation just before the other half of their peers adopt it (Rogers, 2003).

Enlearn—A nonprofit Seattle based company founded by the Gates Foundation with the focus to leverage technology to support education.

Innovation—"An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12).

Innovators—Those willing to experience new ideas sometimes encountering unsuccessful innovations. The population is made up of 2.5% of individuals (Rogers, 2003).

Knowledge—Teacher's base of experience and understanding of the curriculum and framework for instruction in blended learning.

Knowledge Map—A component of *Velocity*® showing the skills that a student is accessing through the generative adaptive engine and how those skills are interrelated.

Laggards—Those individuals with a traditional view and reticent to adopt innovations (Rogers, 2003).

Late Majority—Includes one third of all members of the society who wait until most of their peers have adopted an innovation (Rogers, 2003).

Lexile—"A Unit of measurement used when determining the difficulty of text and the reading level of readers. A Lexile is equivalent to 1/1000th of the difference between the comprehensibility of basal primers (the midpoint of first-grade text) and the comprehensibility of an electronic encyclopedia (the midpoint of workplace text) (Lexile Infographic, 2014, para. 2).

Machine learning—

> a subset of artificial intelligence, is an effort to program computers to identify patterns in data to inform algorithms that can make data-driven predictions or decisions. As we interact with computers, we're continuously teaching them what we are like. The more data, the smarter the algorithms become. (Vander Ark, 2015, para. 2)

Quality of Correctness—A term used in *Velocity*® reporting to share the proficiency of the activity including the amount of hints and scaffolds (i.e.: audio support, taking away answer choices). Students earning 70% Quality of Correctness have completed the activity with minimal additional supports. At 70% the student has the opportunity to consider or change the answer without additional hints or supports.

Rogers' Continuum of the Diffusion of Innovation Technology Adoption/Technology Classifications—A theoretical framework and continuum of adopting an innovation used to study the adoption or non-adoption of technologies across multiple disciplines. This framework classifies adopters as Innovators, Early Adopters, Early Majority, Late Majority or Laggards based on the following criteria: innovation, time, communication channels, and social system (Rogers, 2003).

Velocity®—An adaptive blended learning program developed by Voyager Sopris Learning using machine learning (*Velocity Toolbox*, 2017).

VPORT—Voyager Professional Online Resources and Tools is a data management system used by Voyager Sopris Learning™.

Delimitation of the Study

The researcher chose to limit the study to focus on blended learning in a traditional K-5 setting rather than the larger topic of online learning. Furthermore, the choice was made to focus on the blended learning program, *Velocity*®. The researcher specifically chose to investigate the impact of the teacher in this setting.

The study included those districts across the nation participating in the pilot of the blended learning solution, *Velocity*® in spring of 2016 following the public launch in April that had students that had completed comprehension activities with 70% Quality of Correctness.

The researcher limited the scope of the study to comprehension scores only as a measure of reading comprehension growth. Unmatched comprehension scores were eliminated in order to include only multiple data points for comprehension.

Limitations

This study was conducted based on the comprehension data collected by the *Velocity*® program. The instructional path, scope, and sequence are determined by machine learning so there is no way to ensure that all students receive instruction in any particular strand. Therefore, determining the population to target for district participation was a challenge. Given that the product was in development at the time of the study, this may not be a challenge to overcome in the future. Additionally, looking more holistically at literacy skills and including the remainder of the instructional strands, foundational skills, word study and language as well as the focus for this study, comprehension would lessen the scope of this limitation.

In addition, survey response rate is a limitation of this study. Districts often overestimate the number of teachers that will be included in an intervention implementation. This is often a practice used to ensure that enough materials are purchased and available. Looking at the entire population qualitatively in an anonymous fashion and then drilling down to correlate the results to teachers and the district leaders willing to participate may be an avenue worth pursuing in this area.

Teacher self-perception is another limitation that needs to be considered. Teacher may over or under estimate their knowledge or beliefs. It may be interesting to monitor additional perceptions from administrators regarding particular teachers to provide an additional data point for consideration.

This study was conducted on a product that was in development by districts who volunteered to participate in implementations. Future studies that utilize *Velocity*® as the blended learning program will not encounter this development factor as the product has been officially launched to the public.

The teacher categories of low belief/high action and low knowledge/high belief had no teachers in those groups. Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) are measures that are sensitive to empty groups so a regression was run to ensure that a Type 1 error was not committed.

Chapter 2

Literature Review

Introduction

It is nearly impossible to talk about the future of educational technology without reflecting back to where we have been. American classroom technology has a long history that has changed dramatically over the past hundred years. These innovations started with the delivery of content and a supplement to the practice of teaching to models that integrate technology into direct teaching.

Section 1: Delivery of Content

One of the first innovations that "married pedagogy with content was the hornbook, introduced in 1467" (Ferster, 2014). Pilgrims brought these wooden paddles from England. The paddle was covered by horn, used as a lamination substance, to keep the children from soiling the lessons tacked to it. The 1700s brought the student centered technology of the goose-quill pen, ink and paper for student use. These materials were expensive and often inefficient to use. The ink, boiled from the bark of trees was difficult to read. Paper for poorer schools was "unruled birch bark cut into 13 x 17 sheets, known as foolscap size. The students folded the sheets down into a more manageable size with the rough bark section as the outside cover" (Ferster, 2014, p. 2). The 19th century shifted focus from technologies for student use to those of the teacher. The chalkboard was one of the first notable innovations in 1890 (Hughes & Nguyen, 2013). Between 1920 and 1980, audiovisual technology dominated the innovations with the development of film, filmstrips, projectors, and the invention of desktop computers (Cuban, 1986; Ferster, 2014; Hughes & Nguyen, 2013).

The innovation of textbooks also plays a primary role in education and instructional delivery. The New England Primer was used in New England by English settlers. This Primer was published between 1687 and 1690 by Benjamin Harris, (Roberts, 2010). Following that innovation, Noah Webster's 1783 spellers served as some of the first widely used textbooks in the United States. These texts were designed to provide users with strategies for breaking apart longer words, rules for pronunciation. Grammar was added as well as reading selections. Webster currently has 385 editions. More than 60 million copies alone were sold by 1890 (Ferster, 2014, p. 4).

Schools replaced Webster's readers with a new age of textbooks in the 1920s. These texts "had less emphasis on myths and fables and increasingly included stories about idealized white middle class families, like Dick and Jane" (Ferster, 2014, p. 5). These texts also included graded practice tasks, suggestions for differentiation and bibliographies.

Section 2: Student Response and Performance

Public and private colleges expanded in the mid-19th century to meet the increasing demand for teachers as public schools became a standard system in communities across America (Ferster, 2014). Cohen and Kisker (2010) called this transformation "the Mass Higher Education Era" that was "marked by augmented student access and increased reliance on federal funding" (p. 6) in order to meet the needs of the country. Colleges often followed a child centered, exploratory approach to learning; rather than rote memorization. This approach was known as object teaching and was developed by Swiss educator, Johann Pestalozzi (Frester, 2014; Null, 2004).

Innovations continued to develop as they moved from delivery of the content to allowing students a way to practice skills; mostly those basic facts that could be memorized and required fluency to complete. Halcyon Skinner served to be one of the first to develop a mechanized way to deliver instruction with his Apparatus for Teaching Spelling (Watters, 2014, p. 6). Between 1866 and the 1930s there were "estimated to be 600-700 patents filed on the subject of teaching and learning" (Watters, 2014, p. 6). As innovations grew, educational psychologists worked to define what an effective teaching machine included. They defined "teaching machine" as one that: content is broken down into small testable units; immediate feedback is given; students move at their own pace; automation (Watters, 2014, p. 6).

Sidney Pressey, American Psychologist, is credited with developing the first teaching machine in 1924 (Petrina, 2004). His technology was made up of a drum that rotated paper allowing the student to see a multiple choice question. The question was answered by choosing a response by pushing one of four buttons. The machine would not progress to the next question until the correct response was chosen. The machine was equipped with a teach mode that allowed the student to select answers until the correct one was chosen and a test mode that recorded the responses without feedback. Pressey also included a "reward dial" that dispensed candy for each correct response (Watters, 2014). Much like the innovations of today, Pressey hoped the teaching machine would benefit students and teachers by garnering more time with individual students (Petrina, 2004).

In 1954, B.F. Skinner, after visiting his daughter's fourth grade class, was propelled to address the inefficiencies that he witnessed (Watters, 2014). His machine differed from Pressey's in that it did not ask students to press buttons but rather they were required to formulate their answers through writing on an exposed strip of paper. Once a response was given, the student operated the machine by sliding a mechanism to provide the answer. This allowed students to move at their own pace (Watters, 2014).

B. F. Skinner believed that schools were flawed in their ability to give immediate feedback to students and the pacing that was required for all students to move through the same lesson at the same time. This self-paced, immediate feedback mode of instruction was known to current day's educational technology proponents as "personalization" (Watters, 2014).

Section 3: Blended Learning Development

Technology then developed to the point where the classroom could be impacted by instruction both delivered on the computer and by the teacher. This allowed for adaptation in learning pathways. Personalization is currently a driving factor in educational innovation and is a key aspect in the use of technology in the classroom. In fact, the United States Department of Education listed personalized learning as the top priority in the competition for Race to the Top funding (Evans, 2012). Technology use in classrooms is on the rise to support this personalization effort.

Additionally, technology use for instruction in education is on the rise as enrollment in online and blended learning continues to increase throughout the K-12 population (Barbour & Reeves, 2009; Graham, 2006, 2013; Picciano, Seaman, Shea, & Swan, 2012; Staker & Horn, 2012; Watson, 2008; Watson, Pape, Murin, Gemin, & Vashaw, 2014). Picciano et al. (2012) reported "online and blended learning grew by 47% between 2005-2006 and 2007-2008" (p. 135) in a K-12 setting. Approximately

6.7 million students, about one-third of post-secondary population, are enrolled in a fully online course in American colleges and universities according to Allen and Seaman (2013). This innovation started small with roughly 45,000 K-12 students taking an online course in 2000. In 2010, that number had risen to over 4 million students that participated in some type of online learning (Staker, 2011, p. 1). By 2019, it's estimated that 50% of all high school courses will be delivered in an online format according to Horn and Staker (2011). This analysis shows that "virtual schooling will not substitute for mainstream schooling" (Horn & Staker, 2011, p. 2).

Online learning in a K-12 setting originated as a format used to serve students in which there were no other options such as; credit recovery, advanced courses, home school and homebound students. Horn and Staker (2015) identified these circumstances as areas of "nonconsumption" in which the alternative is not receiving instruction. Online and blended learning courses offered districts a way to support needs in specific subject areas and geographical locations as well as broaden the course offerings for students (Hughes, McLeod, Brown, Maeda, & Choi, 2007; O'Dwyer, Carey, & Kleiman, 2007). Picciano et al. (2012) surveyed K-12 school administrators and reported

> five major reasons for online and blended learning course offerings: offering courses not otherwise available at the school, meeting the needs of specific groups of students, offering Advanced Placement or college-level courses, permitting students who failed a course to take it again (e.g., credit recovery), reducing scheduling conflicts for students. (p. 128)

Watson et al. (2015) noted that "nearly all school districts are using online learning at some level. Most of this usage is of supplemental online courses, with smaller numbers of students in hybrid and fully online schools" (p. 13) The International Association for K-12 Online Learning, iNACOL, estimated that 1.5 million K-12 students were involved in online learning for the 2009-2010 school year (Wicks, 2010, p. 6). The swift spread of this innovation seems to be occurring for a number of reasons. Woeful budget constraints are one reason schools are looking to do more with less. This problem is perpetuated with looming teacher shortages. No Child Left Behind legislation mandated student's individual comparison of proficiency in core subjects. This pressure to perform was also exacerbated with the competition to retain students as charter schools, virtual academies, home schooling and alternative education options have become more prevalent (Staker, 2011; Wicks, 2010).

Technology's expanding presence has not been without challenge. Roberts, Keley, and Medlin (2007) noted that while technology has exploded the integration into the curriculum remained a slow process.

In addition, student's current access to digital technology, the speed of internet and the engaging format have made for the perfect storm of technology. More K-12 students are continuing to attend a brick and mortar school as well as access online learning. This traditional instruction collision with technology has brought on a new phenomenon called blended learning.

Blended Learning is

> any formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace and at least part at a supervised brick-and-mortar location away from home. (Horn & Staker, 2015, p. 34-35)

Traditional schools originated with a factory make up in which there was a standard way to teach and test students based on age level (Christenson et al., 2008; Horn & Staker, 2015). This tradition did not take into account differentiation and customization for students nor teachers. These aspects make blended learning an alluring avenue for districts, schools, teachers and parents to meet the needs of students while still taking on the custodial role that school plays in watching over students while parents are at work (Horn & Staker, 2015; Waters, 2011).

Furthermore, teachers are constantly looking for ways to engage and encourage all students to grow academically. Eighty-six percent (86%) of teachers surveyed were seeking ways to engage students based on instructional needs (Bill and Melinda Gates Foundation, 2014, p. 9). In a classroom of 20-30 students, differentiation is a very difficult task. Additionally, teachers "identified six instructional purposes for which digital tools are useful: delivering instruction directly to students, diagnosis student learning needs, varying the delivery method of instruction, tailoring the learning experience to meet individual student needs, supporting student collaboration and providing interactive experiences and fostering independent practice of specific skills" according to a recent survey of more than 3100 educators (Bill and Melinda Gates Foundation, 2015, p. 2). Teachers engaged in this survey also went on to say that

> standards gaps exist where the resources to help educators teach college and career ready standards are not available or sufficient and don't exist in digital form. Teachers reported four areas with the greatest deficit of instructional resources available, sufficient to teach the standards and in digital form: elementary school English language arts (K-5); high school math (9-12); middle school social studies (6-8); all grade level science (K-12). (Bill and Melinda Gates Foundation, 2015, p. 2)

Overseeing the implementation of both the brick and mortar elements and the technological elements of blended learning is the classroom teacher. Teachers have a varying degree of implementation fidelity, success, and trust in technology as an educational tool. There is a long history to support effective teachers and their positive impact on student achievement in a brick and mortar setting (Darling-Hammond, 2006, 2010; Snow, Burns, & Griffin, 1998; Wendel, 2000). Drysdale, Graham, Spring, and Halverson (2013) note that "research on design subtopics such as implementation, evaluation, and environment could be beneficial" in relation to blended learning to assist in determining how teachers impact student achievement (p. 96).

Section 4: Diffusion of Innovation

Rogers (2003) described technology adoption in his Diffusion of Innovation (DOI) continuum (p. 270) by describing technology users as Innovators, Early Adopters, Early Majority, Late Majority and Traditionalists. These five major categories are summarized into two main categories: Early Adopters encompassing the first three categories and Late Adopters capturing the final two (Rogers, 2003). This framework will be used to describe teachers' technology adoption rate.

Diving into the teacher's knowledge and trust of the use of a blended intervention and cross referencing that to student outcomes will allow districts to shape the way professional development is delivered as well as provide a data component to allow teachers to see the impact on student knowledge acquisition, performance and the need for differentiation. Barkley (2010) noted that there is a need for additional research to determine if blended learning can potentially improve teacher effectiveness. Teachers would benefit from understanding how to use technology as an instructional tool. Currently, schools struggle with providing the infrastructure, strategies, data understanding and trust in this developing format and there is little research in a K-5 setting to support.

Rogers' Diffusion of Innovation theory is the most appropriate for investigating the adoption of technology in higher education and educational environments (Medlin, 2001; Parisot, 1995). This determination is based on the way that Rogers defined adoption using the following four categories: innovation, communication channels, time and social system. Rogers (2003) noted that education diffusion is especially challenging based on the collective decision making that needs to be made in an educational institution (p. 61).

Adopting new innovations has been studied for almost 40 years (Rogers, 2003). Rogers' *Diffusion of Innovations* (DOI) was first published in 1962 (2003, p. 39). This theoretical framework and continuum of adopting an innovation has been used to study the adoption or non-adoption of technologies across multiple disciplines. In fact, Rogers' uses technology and innovation as synonyms (Rogers, 2003).

The continuum of adoption of an innovation ranges from adoption, "full use of an innovation as the best course of action available" to non-adoption or rejection, "decision not to adopt an innovation" (Rogers, 2003, p. 177). Adoption of innovation happens through a process of diffusion. Rogers (2003) defined diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). The definition outlines the four key elements to the diffusion of innovations: innovation, communication channels, time and social system (p. 11). Rogers (2003) defined innovations as "an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (p. 12). To adopt an innovation, one has to weigh the consequences by looking at the advantages and disadvantages. Rogers (2003) defined consequences as "changes that occur in an individual or a social system as a result of adoption or rejection of an innovation" (p. 436). In looking at the advantages and disadvantages, they are revealed through the second element of the diffusion definition, communication channels. Rogers (2003) defined communication as "a process in which participants create and share information with one another in order to reach a mutual understanding" (p. 5). The communication channel happens when an innovation is the topic of conversation between individuals or groups and may be delivered by a channel; mass media, technology or interpersonal communication. Ignored by many others; Rogers included the element of time in the framework and highlights it as one of the strengths. The adopter categories, innovation-diffusion process and rate of adoption all have time elements attached to them. Finally, the social system is included in the diffusion process. The social system impacts the way individuals make adoption decisions and is a key element in the process for categorizing adopters.

Research Background

The research on blended learning is integrated into the larger topic of online learning. Most studies are focused on the larger topic and drill down to blended learning as an option. These studies mainly focus on college and universities where blended learning has a longer history and a greater usage (O'Dwyer et al., 2007). Yu Chen et al. (2012) noted that according to their meta-analysis "research samples in '*Higher education'* were utilized the most (n = 399.8), followed by '*Non-specified'* (n = 301.1), '*Junior and Senior High School*' (n = 104.4), '*Elementary School*' (n = 98.1), and '*Teachers'"* (n = 90.2)" (p. 360). These studies provided a framework for the K-12 setting. The struggle remains with the lack of empirical evidence specifically focused on K-12 settings given the rate at which blended and online learning is growing in this area. Picciano and Seaman (2009) focused a study on K-12 blended and online learning. Of the "1,030,000 students enrolled in an online or blended learning course, representing 2%

of the K-12 population; 70% of those enrolled were in secondary" (p.128). Cherry (2010) focused her research on the lack of evidence on secondary education and noted that while blended learning was a growing trend; little research has been done on K-12 campuses. These studies illustrated the lack of evidence in a K-5 setting. Additionally, the research was centered upon online and distance learning and often in the narrow context of student satisfaction (Lewis & Abdul-Hamid, 2006; O'Dwyer et al., 2007). Kohl (2014) noted that the K-12 studies focused on blended or online learning were "either preliminary findings or not generalizable" (p. 2). Cavanaugh (2001) conducted a meta-analysis of 19 research studies focused on K-12 online programs. This study focused on online learning in distance education and analyzed published works to support this topic from 1980 through 1998. Cavanaugh (2001) utilized studies that would yield an effect size. These studies indicated that students who receive online instruction achieve comparably to those receiving face-to-face instruction.

Additionally, a meta-analysis of 232 studies conducted by Ungerleider and Burns (2002) focused on K-12 online learning. Ungerleider and Burns (2002) had a broader focus for the inclusion of their studies and looks at each subject area as well as factors such as student motivation, student attitude, and usability. The authors were working to answer questions to help guide Canadian policy and determined,

> Simply put, we don't know enough about the impact of the use of ICTs (information and communication technologies) in elementary and secondary schooling, and what we do know if sufficiently complex that there should be serious effort to support systematic, programmatic research capable of providing policy alternatives to which costs can be attached. (Underleider & Burns, 2002, p. 17)

The U.S. Department of Education sponsored a meta-analysis which reviewed the contrasts of online and traditional face-to-face learning and "found the small number of rigorous published studies contrasting online and face-to-face learning conditions for K-12 students. Within this study Means, Tomyama, Murphy, Bakia and Jones noted, 'Studies that directly compared online and blended learning conditions found no significant differences in student learning'" (Means, Tomyama, Murphy, Bakia, & Jones, 2009, p. 38). They summarized, "In light of this small corpus, caution is required in generalizing to the K-12 population because the results derived for the most part from studies in other settings (e.g., medical, training, higher education)" (Means et al., 2009, p. ix).

Research in this area seems to focus on purely online learning or the comparison of online to face to face. The delivery in a blended fashion is designed to take advantage of the best part of both of those worlds. Drysdale et al. (2013) focused solely on blended learning in their analysis and identification of over 200 theses and dissertations on the topic (p. 90). This team found that "graduate research has increased steadily since 2001" (p. 91). Of the 200 studies focused on blended learning

> seventy-seven percent were conducted in higher education contexts, more than all other context combined. K-12 environments were only studied in 8% of the theses and dissertations, revealing a significant gap in the research. In fact this context (K-12 environments) wasn't consistently present in the research until 2008. (p. 92)

Additionally, very few studies explored what the teacher knows, believes or does in a blended learning model as well as comparing this aspect to learner outcomes. Drysdale et al. (2013) identified "learner outcomes as the primary topic of 51.7% of the dissertation and theses work surrounding blended learning followed by disposition, perception, attitudes, preferences, student expectations, and learning styles in 38.5%" (p. 95). Over one third of the studies analyzed were focused on disposition. Of those studies, "10.2% focused on faculty perceptions" of blended learning and "2% focused on faculty attitudes" toward blended learning (Baglien, 2009; Drysdale et al., 2013, p. 95; Gonzalez-Castillo, 2008).

This study will serve to add to the research base for K-5 blended learning and focus on the aspect of teacher's attitude, knowledge and belief, categorized as disposition by Drysdale et al. (2013) and the impact on student achievement.

Search Strategies

Blended learning is interchangeable with "hybrid learning," "mixed mode learning" and "technology-mediated/enhanced learning." These terms, along with "online learning," were used to discover the majority of the body of evidence for this study. In addition, "adaptive engine," "adaptive technology" and "machine learning" were also used. Roger's Diffusion of Innovation (2003) and Roger's "Diffusion of Innovation Survey Questions" were used to support the search.

Chapter 3

Methodology

Introduction

The purpose of this mixed methods study is to explore the relationship of teacher's knowledge, beliefs and actions regarding technology use using the blended intervention solution, *Velocity*® and the impact it has on student's progress as measured by *Lexile*® gains. This will take into account the quantitative "outcomes based evaluation, where the emphasis is on whether a program met its overall goals" (Teddlie & Tashakkori, 2009, p. 9) as well as the qualitative "process-based evaluation, where the focus is on how the program is implemented and how it is currently operating or functioning" (Teddlie & Tashakkori, 2009, p. 10). A parallel mixed method is the best avenue for this study to help determine the context of the *Lexile*® gains in relation to teacher knowledge, attitude and actions by collecting "qualitative and quantitative data separately (in parallel) and following by a meta inference process" (p. 12). This triangulation process will allow a broader picture of what is happening with the curriculum and give insight into why it happens (Plano Clark & Creswell, 2008; Teddlie & Tashakkori, 2009). Creswell (2014) agrees with this statement by adding,

> triangulate different data sources of information by examining evidence from the sources and using it to build coherent justification for themes. If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study. (p. 201)

Quantitative and Qualitative Data Collection and Analysis Procedures

Student comprehension scores were captured in the *Velocity*® program during student work sessions. The text *Lexiles*® were determined using the *Lexile*® Framework developed by Metametrics™ (2014). These independent comprehension scores were included in the study because the student has completed an activity at 70% Quality of Correctness or above in the *Velocity*® program. Students earning 70% Quality of Correctness are completing comprehension activities with minimal supports. Students earning a 70% Quality of Correctness score would have the opportunity to check the answer and resubmit if he/she determines the answer needs adjusting. No additional hints or supports are provided.

Voyager Sopris Learning™, the publisher of *Velocity*®, has agreed to provide a list of the scores with identifiable student data removed (student name) and randomly assign an ID number to allow the researcher to cross reference the student information with teacher actions, knowledge, beliefs and adoption rate. A master list of the randomly assigned ID numbers will be kept in an encrypted file in the research office at Voyager Sopris Learning by the head of the research department. The list will be provided following transfer of the data file in May 2016.

Lexile® data will be collected based on the passages that students encounter in the *Velocity*®. Data will be analyzed through an Analysis of Covariance, ANCOVA, for the student Lexile results related to the teacher technology adoption categories, teacher attitude and knowledge of blended learning and action in the blended learning environment. The ANCOVA will account for the different skills as students begin the program and allow for the focus on student gains. The startup activity used as the covariate will help to determine students with like skill sets. These activities are based on skills that are linked to the standards expected at each grade level.

> When groups differ in baseline, ANCOVA may be used to control for these differences. The usual way to do this ANCOVA is to use the posttest score as the dependent variable, and the pretest score as the covariate. By removing the variance explained by the pretest from the posttest, the residual is variation that reflects the change from the pretest. (Jamieson, 2004, p. 277)

The focus for this study is on *Lexile*® gain so the ANCOVA will use the *Lexile*® score average as the dependent variable and the start-up activity percentage as the covariate. The average *Lexile*® score can then be compared to the knowledge, belief and adoption rate based on Rogers DOI categories and level of teacher action.

1. Knowledge: High Knowledge/Low Knowledge
2. Belief: High Belief/Low Belief
3. Action: High Action/Low Action-from dashboard outside survey
4. Adoption Rate: Early Adopters/Late Adopters

After noticing that the ANCOVA results and regression showed that the startup mean was non-significant as a covariate or a predictor of *Lexile*® mean and significance indicated with to Levene's equal variance test, the researcher augmented the data analysis plan to include a factorial analysis of variance (ANOVA) and regression.

The additional analysis using factorial ANOVA was performed to study the interaction effects among the teacher knowledge, belief, action and technology adoption categories as defined in the original analysis. ANOVA is "used to compare the means of two or more samples or to compare mean in factorial designs (those with more than one independent variable" (Teddlie & Tashakkori, 2009, p. 259).

Survey data was collected using an online survey tool, Qualtrics. The survey was delivered following the launch training April/May 2016 (11 questions) (see Appendix A) and then again at the end of the pilot session May/June 2016 (12 questions) (see

Appendix B). The survey focused on the teacher's actions, technology adoption category, knowledge and beliefs in relation to blended learning. The data was analyzed using descriptive analysis in the following categories.

1. Knowledge: High Knowledge/Low Knowledge
2. Belief: High Belief/Low Belief

In addition, the survey questions related to technology adoption using Rogers DOI (2003) were adapted from the survey questions used in the dissertation, *Innovators or Laggards: Surveying Diffusion of Innovations by Public Relations Practitioners* (Savery, 2005) to determine whether the teacher was an early adopter or a late adopter. The survey included Likert scale questions.

3. Adoption Rate: Early Adopters/Late Adopters

The informed consent form (see appendix C) was delivered during initial training or emailed following the session. Participants signed and scan the form back for documentation. Local teachers were presented the form in person and signed to acknowledge and accept their participation in the study.

The researcher delivered the survey link in person for local sites and through Velocity pilot support personnel at the initial training for remote participants. Teachers who did not complete the survey received a follow email (see appendix D).

Additional data was collected from the VPORT (Voyager Professional Online Resources and Tools) Data management system to capture the actions of teachers. This data was categorized as high action or low action based on the items teachers completed. Actions encompass the teacher logging in, viewing student's activity history, acknowledging the actionable alerts on the teacher dashboard and downloading teacher led lessons for use with the students. Teachers categorized as high action must had at least one action from each category.

Reliability and Validity

The survey questions related to technology adoption using Rogers DOI (2003) were adapted from the survey questions used in the dissertation, *Innovators or Laggards: Surveying Diffusion of Innovations by Public Relations Practitioners* (Savery, 2005). The survey included multiple choice and Likert scale questions.

The survey was tested with a group of 11 teachers and administrators attending a Blended Learning workshop in Gilbert, Arizona on September 17, 2015 and a group of 5 teachers and administrators attending a blended learning webinar on November 10, 2015. In addition, adjustments were made to the survey with the researcher's doctoral committee. Adjustments made to the survey given the 3 proceeding activities were related to the wording of the statements in the knowledge, belief and tech adoption sections, requiring an answer for all questions on the survey, and re-designing the questions regarding barriers and innovations to be multi-select rather than single text to promote deeper responses.

Participants

Teachers utilized the *Velocity*® program with students in Kindergarten through fifth grades. The eligible population included 14 districts. The researcher was unable to contact 2 districts due to company expectations, 1 district's IRB deadline was outside of the study timeline in October 2016, 2 districts did not respond and 1 district and teacher signed the informed consent but the teacher failed to complete the survey. One additional district didn't have enough student comprehension scores to be included in the analysis even though the district and teachers signed the informed consent and completed the surveys.

The final population included 7 districts located in 6 states (see Table 1). Within these 7 districts there were a total of 25 teachers. Eighteen (18) teachers provided consent to participate and completed the study. Two (2) additional teachers did not have enough comprehension scores to be included leaving a total of 16 teachers. This is a total of 64% participation for the final population.

Table 1

Velocity® Schools

District	State	Participating Teachers	Students with Comprehension Scores	Students with Comprehension Scores 70%	Grade Levels
District A	IA	6	39	30	K, 2nd, 3rd, 4th
District B	OR	3	88	36	2nd, 3rd, 4th, 5th
District C	TX	2	30	25	5th
District D	OR	1	10	6	4th
District E	NY	1	9	7	5th, 6th
District F	VA	1	25	2	3rd
District G	MD	2	45	6	3rd

Teachers in the final population were serving approximately 112 students who completed at least 2 comprehension activities with 70% or above Quality of Correctness in the *Velocity®* program. Students earning 70% or above Quality of Correctness are completing the comprehension activity independently with no hints or scaffolds served up by the machine learning engine that powers *Velocity*®.

This population of 16 teachers was primarily female with a resounding 81.25% majority. The experience level was spread evenly across the categories with 3 teachers in each of the first 3 categories 0-3 years, 4-7 years, and 8-12 years; 2 teachers with 12-16 years; the largest population of 4 teachers with 16-20 years of teaching and 1 teacher with 21 or more years of experience. Teachers for the most part matched the number of years of blended learning with the number of years of teaching. Those that had the most teaching experience tended to show less experience in blended learning experience. The total population of teachers reported 0-3 years of experience for 43.75%, 4-7 years for 25% of the population, and 8-12 years of experience for 31.25% of the population (see Table 2).

Table 2

Velocity® Teachers

District	Teaching Experience	Blended Learning Experience
0-3 years	3	7
4-7 years	3	4
8-12 years	3	5
12-16 years	2	0
16-20 years	1	0
21 or more years	1	0

District A was located in Iowa. This district serves over 15,000 students including 17 elementary schools. The Institute of Educational Sciences (IES) considers this district a mid-sized city district (Institute of Education Science's National Center for Education Statistics website, n.d.). District A had a total of 7 teachers implementing *Velocity*®. One (1) teacher did not have multiple comprehension scores for the students that were working in the *Velocity*® program so her survey was removed from the population. The remaining 6 teachers work in 6 separate campuses with students in special education classes. This group was serving a total of 39 students who had multiple comprehension scores. Twenty nine (29) of these students had multiple comprehension scores above 70% quality of correctness.

District A's teacher population consisted of a varied group in experience as well as that of the teacher's knowledge, belief and action. All teachers were considered Early Adopter's according to Rogers DOI technology adoption categories (Rogers, 2003). Two teachers have taught between 0-3 years, two between 4-7 years, one between 8-12 years, and one between 12-16 years. All teachers blended learning experience mimicked the range of their teaching experience except the teacher with 12-16 years of teaching experience reported 0-3 years of blended learning experience (see Table 3).

According to the teachers 50% had high knowledge of blended learning and 50% had low knowledge. Eighty-five percent (85%) reported high belief in blended learning and its impact on students. The teachers were split again on action with 50% being high action teachers and 50% being low action teachers. Interestingly enough, this did not line up with their knowledge categories. All teachers were considered Early Adopters according to Rogers DOI technology adoption categories (Rogers, 2003).

Table 3

District A

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 1	0-3 years	0-3 years	Low	High	Low	Early
Teacher 2	4-7 years	4-7 years	High	High	High	Early
Teacher 3	8-12 years	8-12 years	Low	High	High	Early
Teacher 4	0-3 years	0-3 years	High	High	Low	Early
Teacher 5	4-7 years	4-7 years	High	High	High	Early
Teacher 6	12-16 years	0-3 years	Low	Low	Low	Early

District B was located in a rural farming community in Oregon. IES considers this school a town locale in a distant location (Institute of Education Science’s National Center for Education Statistics website, n.d.). This district served almost 1,000 students. There were a total of four teachers implementing the *Velocity*® program. One teacher completed the informed consent but did not complete the survey. Students served in this implementation were those that were being served for literacy intervention in general education (see Table 4).

District B teachers ranged from 12-16 years of teaching experience down to 0-3 years. Two of the teachers reported 0-3 years of blended learning teaching experience and one teacher reported 8-12 years of experience. District B’s teacher population was more consistent in their teacher knowledge belief and action. All of the teachers reported low knowledge of blended learning, high belief, were considered low

Table 4

District B

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 7	12-16 years	8-12 years	Low	High	Low	Early
Teacher 8	8-12 years	0-3 years	Low	High	Low	Early
Teacher 9	0-3 years	0-3 years	Low	High	Low	Early

action and were Early Adopters according to Rogers DOI technology adoption categories (Rogers, 2003).

District C was a charter elementary school in an urban Texas location according to IES (Institute of Education Science's National Center for Education Statistics website, n.d.). There were three eligible teachers in this school setting but one did not have enough comprehension scores to be included in the population (see Table 5).

Table 5

District C

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 10	16-20 years	8-12 years	High	High	Low	Early
Teacher 11	16-20 years	8-12 years	Low	Low	Low	Early

The remaining two teachers were identical with 16-20 years of teaching experience and 8-12 years of blended learning experience. They differed in their knowledge and belief with one being high and the other low. Both were considered low action and Early Adopters according to Rogers DOI technology adoption categories (Rogers, 2003).

District D was a large suburban district in Oregon according to IES (Institute of Education Science's National Center for Education Statistics website, n.d.). This district has a reputation for cutting edge work in response to intervention and serves approximately 13,000 students (see Table 6).

Table 6

District D

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 12	16-20 years	0-3 years	Low	High	Low	Early

The single teacher in this district has 16-20 years of teaching experience and 0-3 years of experience with blended learning. The teacher self-reported low knowledge, high belief and an Early Adoption rate according to Rogers DOI technology adoption categories (Rogers, 2003). The reports show low action by this teacher.

District E serves nearly 5,000 students and was located on the fringe of a town locale according to IES (Institute of Education Science's National Center for Education Statistics website, n.d.) (see Table 7).

District E had one teacher implementing *Velocity*®. This teacher has 16-20 years of teaching experience, 0-3 years of experience with blended learning and self-reported low knowledge and belief, an Early Adoption rate according to Rogers DOI technology adoption categories (Rogers, 2003). The reports show low action by this teacher.

Table 7

District E

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 13	16-20 years	0-3 years	Low	Low	Low	Early

District F was a mid-sized city district in Virginia serving almost 30,000 students (Institute of Education Science's National Center for Education Statistics website, n.d.) (see Table 8).

Table 8

District F

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 14	21 or more	4-7 years	Low	High	Low	Early

This teacher was the most experienced in terms of years teaching, reported 4-7 years of blended learning experience and low knowledge and high belief. This teacher was considered low action according to the reports and is considered an Early Adopter according to Rogers DOI technology adoption categories (Rogers, 2003).

District G, located in Maryland, serves almost 22,500 students and was considered a mid-sized suburban district by IES (Institute of Education Science's National Center for Education Statistics website, n.d.). Teachers in this district were using *Velocity*® with students in intervention in general education (see Table 9).

Table 9

District G

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 15	8-12 years	8-12 years	High	High	Low	Early
Teacher 16	4-7 years	4-7 years	Low	High	Low	Early

Two teachers responded from the six teachers implementing in this district. These two teachers ranged from 8-12 years of experience to 4-7 years of experience. Their blended learning experience matched the range of teaching experience. Both teachers reported high belief, were low action and Early Adopters according to Rogers DOI technology adoption categories (Rogers, 2003). One teacher self-reported low knowledge while the other reported high knowledge.

The researcher looked at the population as a whole in the data analysis. Eighteen percent (18%) of the teachers taught 0-3 years, 12.5% taught 4-7 years, 18% taught 8-12 years, 12.5% taught 12-16 years, 25% taught 16-20 years, and 6% taught 21 or more years. Teachers identified as high knowledge made up 31% of the population, high belief teachers made up 81%, high action teachers encompassed 18% and 100% of the teachers were early adopters according to Rogers DOI technology adoption categories (Rogers, 2003) (see Table 10).

Combined the population of teachers yielded 31% of teachers with High Knowledge, 81% with High Belief, 18% High Action and 100% Early Technology Adoption according to Rogers DOI technology adoption categories (Rogers, 2003) (see Table 11).

Table 10

All Districts Combined

Teachers	Teaching Experience	Blended Learning Experience	Knowledge	Belief	Action	Technology Adoption
Teacher 1	0-3 years	0-3 years	Low	High	Low	Early
Teacher 2	4-7 years	4-7 years	High	High	High	Early
Teacher 3	8-12 years	8-12 years	Low	High	High	Early
Teacher 4	0-3 years	0-3 years	High	High	Low	Early
Teacher 5	4-7 years	4-7 years	High	High	High	Early
Teacher 6	12-16 years	0-3 years	Low	Low	Low	Early
Teacher 7	12-16 years	8-12 years	Low	High	Low	Early
Teacher 8	8-12 years	0-3 years	Low	High	Low	Early
Teacher 9	0-3 years	0-3 years	Low	High	Low	Early
Teacher 10	16-20 years	8-12 years	High	High	Low	Early
Teacher 11	16-20 years	8-12 years	Low	Low	Low	Early
Teacher 12	16-20 years	0-3 years	Low	High	Low	Early
Teacher 13	16-20 years	0-3 years	Low	Low	Low	Early
Teacher 14	21 or more	4-7 years	Low	High	Low	Early
Teacher 15	8-12 years	8-12 years	High	High	Low	Early
Teacher 16	4-7 years	4-7 years	Low	High	Low	Early

Table 11

Combined Category Population Percentages

Percentage	High Knowledge	High Belief	High Action	Early Technology Adoption
Total	31%	81%	18%	100%

Validation Procedures

The researcher defined coding rules for qualitative questions on the survey related to teacher knowledge of blended learning and teacher belief in blended learning. The following categories were established as themes related to knowledge: teacher led lessons, additional training, and assessment. Belief themes were categorized related to engagement, technical problems, personalized learning, teacher importance, buy in (either positive or negative and by either teacher or student), struggling student, assessment, student gains, and classroom management. A second trained rater reviewed and rated the survey responses for inter-rater reliability.

Chapter 4

Results

Purpose

This mixed-methods study focused on a teacher's technology adoption rate, belief, knowledge and action and the impact those elements have on reading comprehension for students when using blended learning; specifically *Velocity*®. Blended learning is a growing pedagogy in schools. Watson et al. (2013) "estimate more than 75% of districts offer some online or blended options" (p. 17). Given the use of blended learning as an instructional model, data are needed to inform effective practice and design comprehensive professional development.

Research Questions

Data were collected in pursuit of answers to the following research questions:

1. Does the teacher's adoption of technology rate impact reading comprehension growth in a blended learning environment?
2. Does the teacher's knowledge, belief and action in a blended learning environment impact student reading comprehension growth?
3. Does the teacher's adoption of technology rate combined with the teacher's knowledge, attitude, and actions impact reading comprehension growth in a blended learning environment?

Summary of Findings

This chapter will be presented in four parts. The first part is a summary of research methods and data-gathering instruments. The second part is a description of the study participants. Third, is the presentation of data and key findings. Lastly, the conclusion will summarize the results. The data contained in this chapter serves as the basis for the discussion and conclusions found in Chapter 5.

Research Methods

Qualitative and quantitative data were collected in this mixed methods study to determine the impact that a teacher's belief, knowledge, technology adoption rate and actions had on the student's reading comprehension as measure with *Lexiles*®. Data were collected using a pre- and post-survey to capture information on the teachers' belief, knowledge and technology rate as well as gain insight through open ended questions on the post survey for the elements of belief and knowledge.

Data were also collected using VPORT, a data management system bundled with *Velocity*® to record teacher actions: logging into *Velocity*®, downloading a teacher led lesson, acknowledging an actionable teacher alert, and accessing a student record in the system to review data.

Student reading comprehension information was collected to correlate the teacher belief, knowledge, action and technology adoption categories to the students reading comprehension *Lexile*® level with and without the use of the startup mean as the covariate in the ANOVA, ANCOVA, and regression analyses.

Data Instruments

Student reading comprehension levels were calculated based on the *Lexile*® level of the text on which a student achieved 70% Quality of Correctness. This is considered an independent attempt at a comprehension problem. This information was analyzed with the use of the startup mean percentage as a covariate in one analysis. The startup mean is beginning activity for students that is grade level specific and tied to that grades standards. It allows for proper placement in the program. Once in the program, machine learning takes over and creates an individualized path for the student to obtain the quickest route to grade level standards.

The participants were also asked to complete a pre- and post-survey. The survey at the beginning for the implementation serves to capture demographic data from the teacher, perception on the teacher's belief, knowledge and technology adoption rate. The post survey captured belief and knowledge perceptions as well as qualitative information from teachers related to belief and knowledge.

Teacher's action rate was calculated from the VPORT system and was based on the teachers performing the following actions: logging in to the *Velocity*® system, downloading a teacher led lesson, acknowledging an actionable alert and accessing a specific student data record.

Participants

Eligible participants were those teachers who were implementing *Velocity*® following the April 6 public launch of the program who had students that had completed comprehension activities with 70% Quality of Correctness. There were 14 eligible districts. The researcher was unable to contact 2 districts due to company expectation, 1 district's IRB deadline was outside of the study timeline in October 2016, 2 districts did not respond. One additional district and teacher signed the informed consent documents but the teacher failed to complete the survey. Another district did not have enough multiple student comprehension scores to be included in the analysis even though the district and teachers signed the consent forms and the teachers completed the surveys.

The final population of participants included 16 teachers from 7 districts located in 6 states. These 16 teachers made up 64% of the remaining eligible teachers.

Combined, the population of teachers yielded 31% of teachers with High Knowledge, 81% with High Belief, 18% High Action, and 100% Early Technology Adoption according to Rogers DOI technology adoption categories (Rogers, 2003) (see Table 11).

Quantitative Data

Data were analyzed for a total of 112 students working in the *Velocity*® program with 16 teachers distributed throughout 7 districts and 6 states. The data encompassed 30 students in District A, 36 students in District B, 25 students in District C, 6 students in District D, 7 students in District E, 2 students in District F, and 6 students in District G (see Table 1).

Students successfully completed comprehension activities with 70% Quality of Correctness which means that there were little to no supports offered to students. Students achieving 70% Quality of Correctness had the opportunity to check and change an answer before it was submitted. Students completed a series of comprehension tasks at this level. Scores included covered a variety of comprehension skills (i.e., Ask and Answer Literary Questions, Author's Supports within Multiple Paragraphs, Key Details, Setting, and Major Events).

Each task was tagged with a *Lexile*® score. The *Lexile*® scores describe the text level in which the student was successful.

The data was first analyzed using the total population as designed with an ANCOVA with the startup percentage mean as the covariate and *Lexile*® mean as the dependent variable. This analysis showed no significance for the startup mean as a covariate with a significance above 0.05 at .409. The variables of Belief, Knowledge and Action and each combination were non-significant as well (see Table 12).

Table 12

ANCOVA Tests of Between Subject Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	92.529.687	5	18505.937	1.202	.314	.055
Intercept	2867873.599	1	2867873.599	186.256	.000	.642
Startup mean	10562.349	1	10562.349	.686	.409	.007
Knowledge	17319.473	1	17319.473	1.125	.291	.011
Belief	9562.145	1	9562.145	.621	.432	.006
Action	22831.790	1	22831.790	1.483	.226	.014
Knowledge * Belief	0.000	0				0.000
Knowledge * Action	4513.258	1	4513.257	.293	.589	.003
Belief * Action	0.000	0				0.000
Knowledge * Belief * Action	0.000	0				0.000
Error	1601341.424	104	15397.514			
Total	51130525.898	110				
Corrected Total	1693871.111	109				

A regression was also run with the startup mean to ensure that a Type 1 error was not being committed given that Leven’s Test of Equality of Error Variances showed significance at .023 which is below 0.05. The regression showed the startup mean was non-significant as well at 0.226 (see Table 13).

Table 13

ANCOVA Regression

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	88016.430	4	22004.107	1.439	.226
Residual	1605854.681	105	15293.854		
Total	1693871.111	109			

The researcher then looked at grade level specific results using the ANCOVA. The data set included 1 Kindergarten student, 7 second grade students, 57 third grade students, 13 fourth grade students, 32 fifth grade students, and 2 sixth grade students (see Table 14).

Third grade encompassed a population of students that allowed the researcher to use an ANCOVA analysis. The grade specific analysis showed the same trends that the total population displayed. All teachers with students in third grade reported high belief and early adoption so those variables were constant. There was no significance for the startup as the covariate or for the variables of knowledge or action with significance scores all above 0.05 ranging from .304 to .542 (see Table 15).

Given that the first analysis did not show significant results, the researcher used a factorial Analysis of Variance (ANOVA) to determine if the results show significance in this analysis. A regression was also included to ensure a Type I error was not being committed.

Table 14

Grade Level Lexile and Start Up Mean

Student Grade Level		Lexile mean	Startup mean
Kindergarten	Mean	647.500	60.0000
	N	1	
	Standard Deviation		
Second Grade	Mean	559.3558	82.7143
	N	7	7
	Standard Deviation	69.08538	10.91962
Third Grade	Mean	670.3775	71.6667
	N	57	57
	Standard Deviation	145.82234	13.46866
Fourth Grade	Mean	618.8856	62.7692
	N	13	13
	Standard Deviation	84.33089	29.00619
Fifth Grade	Mean	716.3435	62.9688
	N	32	32
	Standard Deviation	80.36543	16.88955
Sixth Grade	Mean	623.0000	
	N	2	
	Standard Deviation	86.26703	
Total	Mean	669.5448	68.6818
	N	112	110
	Standard Deviation	123.96326	17.47183

Table 15

ANCOVA Third Grade Tests of Between Subject Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	88756.642	4	22189.160	1.047	.392	.075
Intercept	372744.071	1	372744.071	17.588	.000	.253
Startup mean	7967.858	1	7967.858	.376	.542	.007
Knowledge	13853.189	1	13853.189	.654	.422	.012
Action	22798.749	1	22.798.749	1.076	.304	.020
Knowledge * Action	423.638	1	423.638	.020	.888	.000
Error	1601341.424	104	15397.514			
Total	51130525.898	110				
Corrected Total	1693871.111	109				

The following paragraphs outline the descriptive statistics around each variable given the ANOVA.

The students of teachers identified as low knowledge earned a mean *Lexile*® level of 675.701 while those students of teachers with a high knowledge successfully completed a task with a lower average of 630.818 *Lexile*® points. The 95% Confidence Interval shows an overlap of the *Lexile*® scores with low knowledge category ranging from 636.432 to 714.970 and the high knowledge teacher's category having a range starting at 583.688 and ending in nearly the middle of the low knowledge category with a *Lexile*® score of 677.947 (see Table 16)

Table 16

Knowledge Descriptive Statistics

Knowledge Level	Lexile Mean	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	675.701	19.809	636.432	714.970
High	630.818	23.774	583.688	677.947

In classes with teachers identified with low belief, students earned a mean *Lexile*® level of 701.634. In classes with teachers identified with high belief, students successfully completed comprehension activities with a mean of 646.776 *Lexile*® level. The high belief mean fell just below the lower bound of the 95% Confidence Interval for the low belief category which started at 650.571 and reached up to 752.698. The high belief 95% Confidence interval ranged from 611.283 to 682.269 (See Table 17).

Table 17

Belief Descriptive Statistics

Belief Level	Lexile Mean	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	701.634	25.759	650.571	752.698
High	646.776	17.904	611.283	682.269

Teachers who exhibited low action had students who achieved a *Lexile*® mean of 679.404 with a 95% Confidence Interval ranging from 653.360 to 705.448. High action teachers worked with students who had a *Lexile*® mean of 625.263 and a 95% Confidence Interval of 560.728 to 689.798 (see Table 18).

Table 18

Action Descriptive Statistics

Action Level	Lexile Mean	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	679.404	13.138	653.360	750.448
High	625.263	32.554	560.728	689.798

Teachers were also studied by looking at a combination of the categories. The first combination of categories that was explored was teachers with low knowledge and low belief. Students with those teachers achieved a mean Lexile® of 701.634 with a 95% Confidence Interval between 650.571 and 752.698. Students receiving instruction from teachers with low knowledge and high belief had a lower Lexile Mean with 662. 734 and a 95% Confidence Interval band between 609.651 and 715.818. There were no teachers that met the criteria to be considered high knowledge and low belief. The final category of high knowledge and high belief had the lowest Lexile mean achieved by students at 630.818 with a 95% confidence Interval that overlapped the previous two categories ranging from 583.688 to 677.947 (see Table 19).

Table 19

Knowledge and Belief Lexile® Means Descriptive Statistics

Level	Low Belief	High Belief	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low Knowledge	701.634		25.75.59	650.571	752.698
Low Knowledge		662.734	26.777	609.651	715.818
High Knowledge	None				
High Knowledge		630.818	23.774	583.688	677.947

The second combination category was knowledge and action. Student receiving instruction from teachers with low knowledge and low action obtained the highest *Lexile*® mean in this category with 687.458 *Lexile*® points and a 95% Confidence Interval of 656.299 to 718.617. Low knowledge/high action teachers yielded students who earned the third highest *Lexile*® mean of 652.187 and a 95% Confidence Interval of 552.210 to 752.164. Students with teachers identified as high knowledge and low action earned the second highest *Lexile*® mean of 663.296 with a 95% Confidence Interval of 616.167 to 710.426. The final combination in this category encompassed students of teachers who identified themselves as high knowledge and were high action teachers. Students of these teachers earned the lowest *Lexile*® mean of 598.339 with a 95% Confidence Interval of 516.709 to 679.970 *Lexile*® points (see Table 20).

Table 20

Knowledge and Action Lexile® Means Descriptive Statistics

Level	Low Action	High Action	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low Knowledge	687.458		15.718	656.299	718.617
Low Knowledge		652.187	50.433	552.210	752.164
High Knowledge	663.296		23.774	616.167	710.426
High Knowledge		598.339	41.178	516.709	679.970

The third combination described student *Lexile*® means from teacher's belief and action categories. Students who had teachers identified with low belief and low action earned the highest *Lexile*® mean of 701.634 with a 95% Confidence Interval of 650.571 to 752.698. There were no teachers identified as low belief and high action. In classes with teachers identified as high belief and low action, students earned a *Lexile*® mean of 668.289 with a 95% Confidence Interval of 638.721 to 697.858. The final combination was high belief and high action. Students in these classes achieved a *Lexile*® mean of 625.263 and a 95% Confidence Interval of 560 to 689.798 (see Table 21).

One hundred percent (100%) of the 95% Confidence Intervals overlapped supporting the results indicating that the categories and each combination thereof was non-significant. Given that the significance level is above 0.05 for each category and each combination of categories, there is no significant difference between the means in any of the groups.

Table 21

Belief and Action Lexile® Means Descriptive Statistics

Level	Low Action	High Action	Standard Deviation	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low Belief	701.634		25.759	650.571	752.698
Low Belief		None			
High Belief	668.289		14.916	638.721	697.858
High Belief		625.263	32.554	560.728	689.798

Qualitative Data

In analyzing the qualitative survey responses, the researcher identified the following knowledge category themes: teacher led lessons, assessment and additional professional development.

Two teachers in each category requested additional time and supports with the teacher led lesson component of *Velocity*®. One teacher comments that she was interested in "looking more into the teacher led lessons for each grade level." One teacher in each category wanted additional information and supports around assessments in and out of the program. A high knowledge/high belief teacher noted that she would "like more information on how I can assess the students outside of the program to make sure they are retaining the information they learn on *Velocity*®." Teachers with high knowledge of blended learning were nearly as likely to request additional professional development as those that had low knowledge of blended learning with 50% of teachers in the low knowledge category requesting additional professional development and 40% of those in the high knowledge category requesting additional professional development.

Qualitative themes were also analyzed for the belief section of the survey. The following themes were developed: engagement, personalized learning, buy in (either positive or negative for either teachers or students), student gains and technology problems.

Engagement of students in blended learning was a theme and was mentioned six times by high belief teachers but only twice by low belief teachers. One high belief teacher noted that, “It helped me engage my students more and there is room in the classroom for this type of learning.” Another high belief teacher said, “Their desire to learn improved.” A low belief teacher stated, “Student increase in motivation and engagement” was a factor that was an impact on students.

Personalized learning was a strong theme throughout both the high and low belief groups. One high belief teacher stated, “Blended learning has impacted me as a teacher by helping me see different ways my students learn and more skill levels that I need to work on with them.” Another high belief teacher mentioned that “it gives me time to work with kids individually while others are working on reading skills. I can see what they are doing. They are held accountable.” A low belief teacher saw personalized learning as well stating, “(blended learning) addresses individual student needs.”

Buy-in by teachers and students made up the third theme displayed in the survey comments by blended learning teachers. This theme was by far the most prevalent with 28 occurrences. Of the low belief teachers, one self-reported that she was high belief by the end of the instructional period. She reported “*Velocity*® addressed individual student needs and helped students make gains.”

The two remaining low belief teachers made the following comments. One reported that she was “still open to it (blended learning).” While the other teacher reported, “Direct instruction is impacted using blended learning. The students are getting less of ‘me’ time and more computer based instruction.” She went on to say, “The implementation was fine and easy. The program is easy to use and all the information is right there. My personal impact reinforces that students need direct instruction.”

> I was not really sure what to think about the blended learning before I used it, but now I feel that it is a good resource to add to our learning programs for part of the day. I feel that it helps the students have some time where they get learning at their individual learning level instead of being in a group where their skill levels may be somewhat different from each other. (a high belief teacher)

Student gains was a theme noted by three teachers; one of them being low belief at the beginning of the implementation and changing to high belief by the end. One low belief teacher noted that *Velocity*® “helped students make gains.” Another high belief teacher stated, “My students have made tremendous gains.”

Overall, teachers with low belief seemed to encounter just as many technology problems as those with high belief. A low belief teacher noted, “*Velocity*® had kinks in it so I never had a chance to teach small group lessons.” While a high belief teacher explained, “Computer trouble was a barrier as well as lessons running out. Students would also pretend that *Velocity*® did not work so they could log into another program.”

Only two teachers made adjustments to the categories that they related with from the beginning of the implementation to the end. One teacher changed from low belief to high belief by the end of the implementation. One other teacher changed from low knowledge to high knowledge by the end of the implementation.

In addition to looking at the teacher reports related to belief, the researcher also obtained the district vision and mission statements for analysis. Six out of the seven districts (87%) included statements that contained the phrase "all students." Achieving utmost potential was included in 42% of the mission statements of the participating districts, one district noted building on individual strengths. The theme with all students makes up 87% of the districts and closely matches the 86% of teachers with high belief in blended learning. There is not enough data to make a connection between the belief of the teacher and the vision and mission of the district.

Key Findings

The data were analyzed to answer the following research questions:

1. Does the teacher's adoption of technology rate impact reading comprehension growth in a blended learning environment?

All teachers in this data set were considered early adopters according to their survey responses. The research does not provide data to answer this question.

2. Does the teacher's knowledge, belief and action in a blended learning environment impact student reading comprehension growth?

The current data set yields no indication that a teacher's knowledge, belief or action impacted student reading comprehension growth as evidenced with the ANOVA, ANCOVA, and regression results. The data set indicated students who had teachers with a low perception (knowledge or belief), low action or combination in any variable yielded higher *Lexile*® means. One hundred percent (100%) of the 95% Confidence Intervals overlapped supporting the results indicating that the categories and each combination thereof was non-significant. Given that the significance level was above 0.05 for each category and each combination of categories, there was no significant difference between the means in any of the groups.

There were two teachers that shifted in their teacher perception by the end of the implementation. One shifted from low belief to high belief. She stated that her students, "increased student motivation, student scores improved and students made gains." This qualitative information confirms the data in this study indicating that low belief does not have an impact on student outcomes.

One other teacher shifted from low knowledge to high knowledge during the implementation. He indicated that he "liked how it (*Velocity*®) found weaknesses and addressed them for the most part."

3. Does the teacher's adoption of technology rate combined with the teacher's knowledge, attitude, and actions impact reading comprehension growth in a blended learning environment?

Given that the data set includes all early adopting teachers this question is not able to be answered. The research did explore the combination of the additional variables and the combinations did not yield a significant effect on the reading comprehension outcomes of the students that they served.

Conclusion

The data from this small population of teachers, students and districts across the country served as an addition to the current research on blended learning in the K-12 context. Results from this data set indicated that a teacher's beliefs, action, and knowledge of blended learning do not have significant impact on student reading comprehension outcomes.

Teachers indicated a belief in the instructional model using blended learning at 81%. The student outcomes for low belief teachers had a higher *Lexile®* mean than high belief teachers and a solidly overlapping 95% Confidence Interval. Perception may be a greater driving force.

Chapter 5

Conclusion and Recommendations

Summary

Schools work toward ensuring that all students reach their upmost potential. One way schools and districts are working to address that goal is through the use of blended learning. Barkley (2010) noted that there is a need for additional research to determine if blended learning can potentially improve teacher effectiveness. This instructional delivery needs to have more research specifically in a K-5 education setting.

This study was performed in an effort to add to the current research base and inform current practitioners to create and support more effective blended learning implementations.

The study included 7 districts across 6 states; 16 teachers and 112 students. Participating teachers were asked to complete a survey at the beginning of the implementation soliciting information related to teacher demographic and capturing teacher perception on the their belief, knowledge and technology adoption rate according to Rogers DOI technology adoption categories (Rogers, 2003).

A post survey was collected from the participants as well to review their belief and knowledge and elicit qualitative feedback related to belief and knowledge.

In addition to survey data, the researcher collected teacher action data from the VPORT data management system to determine if teachers were taking part in four areas: logging in to the *Velocity*® system, downloading teacher lessons, acknowledging actionable teacher alerts, looking at specific student information.

All information was then analyzed using ANCOVA, ANOVA, regression, and descriptive statistics.

Summary of Qualitative and Quantitative Findings

In response to survey items and data collected on actions and student outcomes, participants provided qualitative and quantitative data that described their perception of teacher knowledge, belief, action and technology rate on student reading comprehension outcomes.

The following key findings emerged:

1. Does the teacher's adoption of technology rate impact reading comprehension growth in a blended learning environment?

All teachers in this data set were considered early adopters according to their survey responses. The research did not provide data to answer this question.

2. Does the teacher's knowledge, belief and action in a blended learning environment impact student reading comprehension growth?

The current data set yields no indication that a teacher's knowledge, belief or action impact student reading comprehension growth as evidenced with the ANOVA, ANCOVA, and regression results. The data set indicated students who have teachers with a low perception (knowledge or belief), low action or combination in any variable yield higher *Lexile*® means. One hundred percent (100%) of the 95% Confidence Intervals overlapped supporting the results indicating that the categories and each combination thereof was non-significant. Given that the significance level is above 0.05 for each category and each combination of categories, there is no significant difference between the means in any of the groups.

There were two teachers that shifted in their teacher perception by the end of the implementation. One shifted from low belief to high belief. She stated that her students, "increased student motivation, student scores improved and students made gains" This qualitative information confirms the data in this study indicating that low belief does not have an impact on student outcomes.

One other teacher shifted from low knowledge to high knowledge during the implementation. He indicated that he "liked how it (*Velocity*®) found weaknesses and addressed them for the most part."

3. Does the teacher's adoption of technology rate combined with the teacher's knowledge, attitude, and actions impact reading comprehension growth in a blended learning environment?

Given that the data set includes all early adopting teachers this question is not able to be answered. The research did explore the combination of the additional variables and the combinations did not yield a significant effect on the reading comprehension outcomes of the students that they served.

Discussion

The *Lexile*® means for the low belief, low knowledge, low action teachers and any combination thereof was the result of this data set. The 95% Confidence Interval allowed for a deeper look at the data to determine that the means are really not different given that 100% of the Confidence Intervals for a single variable or any combination of variables overlap. The regression confirms the lack of significance. The researcher reflected on several aspects to help explain the current outcomes: development of product, limited technology adoption categories, small student population and limited time frame. The following paragraphs explore these areas.

Because this research was conducted on a population that was implementing a developing product, it attracted early adopting districts and teachers. This limited the scope of teachers that were included particularly in the technology adoption category. As the implementations increase, research will include a wider range of teachers including those that demonstrate resistance to technology adoption and include those that have not volunteered for the implementation opportunity. Such study might reveal a different outcome.

Velocity® launched publically to a national audience on April 6, 2016. The program had developed the machine learning engine but there were still technology issues that teachers and students encountered. This emerged as a theme in the qualitative results. It is not known to what extent this aspect had on the results of this study.

A larger population of students with comprehension scores at the 70% Quality of Correctness model will emerge with the expansion of *Velocity*® during the fall of 2016. Expanding the time frames for student and teacher use and the continued development to minimize any technical problems may yield a different data story.

Recommendations

A worthwhile follow up analysis could be conducted by investigating all the data in the system for the total population regardless of volunteer status. Those data could then be drilled down to those participating in the study.

Follow up research could also center on interviews with a more broad sample of participating teachers to capture a more complete picture of the implementation and determine if perspective is a greater driving force.

Future Research

Leveraging technology for use with education is a hot topic not only in education but also in philanthropy. The rate at which technology is changing is faster than ever even as leaders and practitioners continue to struggle to define its most effective role and understand its impact on teachers and students. Blended learning solutions, like *Velocity*®, have advanced to the point of offering initial instruction to students with embedded scaffold supports and hints. This leads researchers down an endless path of possibilities for future research.

The hard work of teaching and learning happens in a classroom setting and that trend should continue when it comes to research as well. If we are looking to change practice in order to achieve more powerful results with our students then we need to invest time and resources within the walls of the classroom.

Additional studies on this topic could include using the additional literacy strands of foundational skills, word study and language alongside comprehension. Multilevel data analysis across literacy strands would develop a more complete picture of the impact of blended learning on reading ability. A multi-level data set in which categories are layered within each corresponding teacher could also include elements like engagement, use of scaffolds, use of hints, time on task, student perception of blended learning and student outcomes. This would require a much bigger data set and may be a great place to layer in the additional literacy strands to take a broader look at this topic. Potential research questions include:

- Is the impact of teacher technology adoption, beliefs, knowledge, and action in foundational skills different than the impact on comprehension skills?

- Are some content areas more or less vulnerable to the impact?
- Are some grade levels more or less vulnerable to the impact?
- Is the impact affected by the number of concurrent implementations or they breadth of the content areas included?
- How does blended learning using machine learning versus traditional instruction impact students reading abilities?

Further study should include districts that implement *Velocity*® district-wide to account for a varying degree of tech adoption categories and more teachers that may have low knowledge and belief in blended learning. Within districts researchers also have the opportunity to document trends regarding professional development and ongoing support for blended learning environments. Giving instruction in this environment is a change in pedagogy from traditional instruction, researching whether outcomes for students or teacher perceptions change with the amount, type and location (in classroom/out of classroom) of professional development may be an area to investigate. Potential research questions might include:

- How does pre-implementation professional development impact technology adoption rates, teacher beliefs, knowledge and action?
- How does ongoing professional development impact technology adoption rates, teacher beliefs, knowledge and action?
- What are the professional development needs of teacher demonstrating different levels of technology adoption rates?
- What administrator actions cultivate the most effective teacher beliefs, knowledge, action and technology adoption rate?

- What professional development supports are of greatest impact to teachers during a blended learning implementation?

Innovation is constant as is the need for scalable research on the impact on education. Technology is a moving target that we may forever be chasing with research.

References

Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States*. Retrieved from http://sloanconsortium.org.publications/suvey/changing_course_2012

Baglien, V. G. (2009). *Implementation of blended instruction: A case study of secondary family and consumer sciences* (Doctoral dissertation). Retrieved from http://lib.dr.iastate.edu.cgi/veiwcontent.cgi?article=2004&context=etd

Barbour, M. K., & Reeves, T. C. (2009). The reality of virtual schools: A review of the literature. *Computers and Education*, *52*(2), 402-416. Retrieved from https://www.academia.edu/2311478/Barbour_M._K._and_Reeves_T._C._2009_._The_reality_of_virtual_schools_A_review_of_the_literature._Computers_and_Education_52_2_402-416

Barkley, B. W. (2010). *The effects of blended online versus face-to-face learning environments on student outcomes for eighth grade algebra I students* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (3413019)

Bill and Melinda Gates Foundation. (2014). *Teachers know best: What educators want from digital instructional tools*. Retrieved from http://collegeready.gatesfoundation.org/wp-content/uploads/2015/04/Teachers-Know-Best_0.pdf

Bill and Melinda Gates Foundation. (2015). *Teachers know best: Making data work for teachers and students*. Retrieved from http://collegeready.gatesfoundation.org/wp-content/uploads/2015/06/TeachersKnowBest-MakingDataWork.compressed.pdf

Brian. (2016, April 5, 2016). *Voyager Sopris launches Velocity powered by Enlearn* [Blog post]. Retrieved from http://www.enlearn.org/voyager-sopris-launches-velocity-powered-by-enlearn-3/

Cavanaugh, C. (2001). The effectiveness of interactive distance education technologies in K-12 learning: A meta-analysis. *International Journal of Educational Telecommunications*, *17*(1), 73-88. Retrieved from http://faculty.education.ufl.edu/cathycavanaugh/docs/CavanaughIJET01.pdf

Cherry, L. D. (2010). *Blended learning: An examination of online learning's impact on face-to-face instruction in high school classrooms* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (230909406)

Christenson, C. M., Horn, M. B., & Johnson, C. W. (2008). *Disrupting class: How disruptive innovation will change the way the world learns*. New York: McGraw-Hill.

Cohen, A. M., & Kisker, C. B. (2010). *The shaping of American higher education: Emergence and growth of the contemporary system* (2nd ed.). San Francisco, CA: Jossey-Bass.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles, CA: SAGE.

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York: Teachers College Press.

Darling-Hammond, L. (2006). *Powerful teacher education: Lessons from exemplary programs*. San Francisco, CA: John Wiley & Sons.

Darling-Hammond, L. (2010). *Evaluating teacher effectiveness: How teacher performance assessments can measure and improve teaching*. Retrieved from Center for American Progress website: http://0-files.eric.ed.gov.library.unl.edu/fulltext/ED535859.pdf

Drysdale, J. S., Graham, C. R., Spring, K. J., & Halverson, L. R. (2013). An analysis of research trends in dissertations and theses studying blended learning. *Internet and Higher Education*, *17*, 90-100. Retrieved from http://www.sciencedirect.com/science/article/pii/S1096751612000814

Evans, M. (2012). *A guide to personalizing learning: Suggestions for the Race to the Top district competition*. An education white paper. Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/09/A-guide-to-personalizing-learning.pdf

Ferster, B. (2014). *Teaching machines: Learning from the intersection of education and technology*. Baltimore, MD: The John Hopkins University Press.

Gonzalez-Castillo, D. (2008). *An exploratory study of faculty attitudes regarding hybrid course effectiveness in an urban community college system* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database. (304419293)

Gottlieb, S. (2015, MARCH 9, 2015). *Zoran Popovic to address the SXSWedu conference festival* [Press release]. Retrieved from Street Insider website:

http://www.streetinsider.com/Press+Releases/Zoran+Popovi%C4%87+to+Address+the+SXSWedu%C2%AE+Conference+%26amp%3B+Festival/10351908.html

Graham, C. R. (2006). Blended learning systems: Definition, current trends and future directions. In *The handbook of blended learning: Global perspectives, local designs* (1st ed., pp. 3-21). San Francisco, CA: Pfeiffer.

Graham, C. R. (2013). Emerging practice and research in blended learning. In *Handbook of distance education* (3rd ed., pp. 333-350). New York, NY: Routledge.

Gray, L. (2011, September 19). *Gamers succeed where scientists fail* [News release]. Retrieved from www.washington.edu

Horn, M., & Staker, H. (2011). *The rise of K-12 blended learning*. Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2011/05/The-Rise-of-K-12-Blended-Learning.pdf

Horn, M. B., & Staker, H. (2015). *Blended: Using disruptive innovation to improve schools*. San Francisco, CA: Jossey-Bass.

Hughes, J. E., McLeod, S., Brown, R., Maeda, Y., & Choi, J. (2007). Academic achievement and perceptions of the learning environment in virtual and traditional secondary mathematics classrooms. *American Journal of Distance Education*, *21*(4), 199-214. http://dx.doi.org/10.1080/08923640701595365

Hughes, J., & Nguyen, B. (2013). *The history of classroom technology*. Retrieved from http://www.avatargeneration.come/2013/04/the-history-of-classroom-technology-infographic/

Institute of Education Science's National Center for Education Statistics website. (n.d.). NCES.ed.gov/ccd/schoolsearch

Jamieson, J. (2004). Analysis of covariance (ANCOVA) with difference scores. *International Journal of Psychophysiology*, *52*, 277-283. Retrieved from http://www.sciencedirect.com/science/article/pii/S0167876003002757

Kohl, H. M. (2014). *Student academic outcomes and administrator attitudes regarding online and blended learning modalities in Charlotte-Mecklenburg Schools* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database. (3641137)

Lewis, C. C., & Abdul-Hamid, H. (2006). Implementing effective online teaching practices: Voices of exemplary faculty. *Innovative Higher Education*, *3*(2), 83-98. http://dx.doi.org/20.1007/s10755-006-9010-z

Lexile Infographic (The). (2014). *The Lexile Infographic.* Retrieved from https://www.lexile.com/about-lexile/lexile-overview/lexile-infographic/

Means, B., Tomyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies* (USDOE Rep. No. 505824). Retrieved from U.S. Department of Education website: http://findit.ed.gov/search?utf8=%E2%9C%93&affiliate=ed.gov&query=evaluation+of+evidence+based+practices+in+online+learning

Medlin, B. D. (2001). *The factors that may influence a faculty member's decision to adopt electronic technologies in instruction* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database. (3095210)

Metametics (2014). *The Lexile Infographic*. Retrieved from https://www.lexile.com/about-lexile/lexile-overview/lexile-infographic/

Null, J. W. (2004). Is constructivism traditional? Historical and practical perspectives on a popular advocacy. *The Educational Forum*, *68*(2), 180-188. Retrieved from http://files.eric.ed.gov/fulltext/EJ724882.pdf

O'Dwyer, L. M., Carey, R., & Kleiman, G. (2007). A study of the effectiveness of the Louisiana algebra I course. *Journal of Research on Technology in Education*, *39*(3), 289-306. Retrieved from http://files.eric.ed.gov/fulltext/EJ768882.pdf

Parisot, A. H. (1995). *Technology and teaching: The adoption and diffusion of technological innovations by community college faculty* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database. (9542260)

Petrina, S. (2004). Sidney Pressey and the automation of education, 1924-1934. *Technology & Culture, 45*(2), 305-330. http://dx.doi.org/10.1353/tech.2004.0085

Picciano, A. G., & Seaman, J. (2009). *K-12 online learning: A 2008 follow up of the survey of U.S. school district administrators*. Retrieved from Online Learning Consortium website: http://olc.onlinelearningconsortium.org/publications/survey/K-12_06

Picciano, A. G., Seaman, J., Shea, P., & Swan, K. (2012). Examining the extent and nature of online learning in American K-12 education: The research initiative of the Alfred P. Sloan Foundation. *The Internet and Higher Education*, *15*(2), 127-135. http://dx.doi.org/10.1016/j.iheduc.2011.07.004

Plano Clark, V. L., & Creswell, J. W. (2008). *The mixed methods reader*. Thousand Oaks, CA: Sage.

Roberts, F. D., Kelley, C. L., & Medlin, B. D. (2007). Factors influencing accounting faculty members' decision to adopt technology in the classroom. *College Student*

Journal, *41*(2), 423-435. Retrieved from http://0-eds.a.ebscohost.com.library.unl.edu/ehost/detail/detail?sid=2c121df4-0658-4807-b5ec-ae55d7255691%40sessionmgr4005&vid=4&hid=4213&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#AN=25093218&db=aph

Roberts, K. B. (2010). Rethinking The New-England Primer. *The Papers of the Bibligraphical Society of America*, *104*(4), 489-523. http://dx.doi.org/10.1086/680973

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Savery, C. A. (2005). *Innovators or laggards: Surveying diffusion of innovations by public relation practitioners* (Master's thesis). Retrieved from https://etd.ohiolink.edu

Skinner, B. F. (1953). *Teaching machines*. San Francisco, CA: Freeman.

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Staker, H. (2011). *The rise of K-12 blended learning: Profiles of emerging models*. Retrieved from Innosight Institute website: http://www.innosightinstitute.org/innosight/wp-content/uploads/2011/05/The-Rise-of-K-12-Blended-Learning.pdf

Staker, H., & Horn, M. (2012). *Classifying K-12 blended learning*. Retrieved from The Innosight Institute website: http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/05/Classifying-K-12-blended-learning2.pdf

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Thousand Oaks, CA: Sage.

Ungerleider, C. S., & Burns, T. C. (2002). *Information and communication technologies in elementary and secondary education: A state of the art review*. Paper presented at the Pan-Canadian Education Research, Montreal, Quebec. Retrieved from http://www.cesc.ca/pceradocs/2002/papers/CUngerleider_OEN.pdf

Vander Ark, T. (2015). *8 ways machine learning will improve education*. Retrieved from http://gettingsmart.com/2015/11/8-ways-machine-learning-will-improve-education/

Velocity toolbox. (2017). Dallas, TX: Voyager Sopris Learning.

Waters, J. K. (2011). Competing for the virtual student. *T.H.E. Journal*, *38*(7), 28-35. Retrieved from https://thejournal.com/articles/2011/07/26/competing-for-the-virtual-student.aspx

Watson, J. (2008). *Promising practices in online learning: Blended learning-The convergence of online and face-to-face education*. Retrieved from International Association for K-12 Online Learning website: http://www.inacol.org/resource/promising-practices-in-online-learning-blended-learning-the-convergence-of-online-and-face-to-face-education/

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2013). *Keeping pace with K-12 online and blended learning: An annual review of policy and practice.* Retrieved from Keeping Pace with K-12 Digital Learning website: http://www.kpk12.com/

Watson, J., Pape, L., Murin, A., Gemin, B., & Vashaw, L. (2014). *Keeping pace with K-12 digital learning: An annual review of policy and practice*. Retrieved from Keeping Pace with K-12 Digital Learning website: http://www.kpk12.com/

Watson, J., Pape, L. A., Gemin, B., & Vashaw, L. (2015). *Keeping pace with K-12 digital learning: An annual review of policy and practice*. Retrieved from Keeping Pace with K-12 Digital Learning website: http://www.kpk12.com/

Watters, A. (2014, September). *Teaching machines: A brief history of "teaching at scale."* Paper presented at the #t509massive, London, England. Retrieved from http://hackeducation.com/2014/09/10/teaching-machines-teaching-at-scale/

Wendel, T. (2000). *Creating equity and quality: A literature review of school effectiveness and improvement. SAEE research series #6*. Retrieved from Society for Advancement of Excellence in Education website: http://saee.bc.ca

Wicks, M. (2010). *A national primer on K-12 online learning (2nd edition)*. Retrieved from International Association of K-12 Online Learning website: http://www.inacol.org/resource/a-national-primer-on-k-12-online-learning-2nd-edition/

Wildt, A. R., & Ahtola, O. T. (1978). *Analysis of covariance*. Newberry Park, CA: Sage.

Yu-Chen, H., Hsin Ning, J. H., Chin-Chung, T., Gwo-Jen, H., Hui-Chun, C., Chin-Yeh, W., & Nian-Shing, C. (2012). Research trends in technology based learning from 2000-2009: A content analysis of publications in selected journals. *Journal of Educational Technology & Society*, *15*(2), 354-370. Retrieved from http://www.ifets.info/journals/15_2/30.pdf

Appendices A

Blended Learning Initial Survey

Blended Learning Initial Survey

Q1 Blended learning is online and teacher led instruction. This survey refers to your use of the blended learning solution, Velocity. Please answer the following questions. Gender

- Male (1)
- Female (2)
- Refuse to answer (3)

Q2 Number of Years Teaching

- 0-3 years (1)
- 4-7 years (2)
- 8-12years (3)
- 12-16 years (4)
- 16-20 years (5)
- 21 or more years (6)

Q3 Job Title

- Teacher (1)
- Specialist (2)
- Other (Please specify) (3) ____________________

Q4 Please state the number of years you have used blended learning/online instruction in your classroom.

- 0-3 years (1)
- 4-7 years (2)
- 8-12 years (3)

Q5 Please list the blended/online curriculum that you have utilized in your classroom in the last five years.

Q6 Knowledge of Blended Learning.Blended learning is online and teacher led instruction. This survey refers to your use of the blended learning solution, Velocity.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am comfortable with instruction in a blended learning setting. (1)	❍	❍	❍	❍	❍
I have received adequate professional development in using blended learning to deliver instruction. (2)	❍	❍	❍	❍	❍
I am comfortable with monitoring student progress for students using blended learning instruction. (3)	❍	❍	❍	❍	❍

Q7 Belief Toward Blended Learning

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I believe the teacher is important in influencing student achievement in a blended learning setting. (1)	❍	❍	❍	❍	❍
As a teacher, I believe I must monitor blended learning instruction closely. (2)	❍	❍	❍	❍	❍
I believe blended learning will impact my students' reading skills. (3)	❍	❍	❍	❍	❍
I believe students' reading levels can be impacted by blended learning. (4)	❍	❍	❍	❍	❍
I believe students who are struggling readers can be impacted by blended learning. (5)	❍	❍	❍	❍	❍
I believe students find blended learning engaging. (6)	❍	❍	❍	❍	❍
I believe students think blended learning will help improve their reading skills. (7)	❍	❍	❍	❍	❍

Q8 Technology Adoption Categories

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am venturesome and eager to be the first to try new innovations. (1)	❍	❍	❍	❍	❍
I influence others to adopt innovations. (2)	❍	❍	❍	❍	❍
I am willing to follow the lead of others in adopting innovations. (3)	❍	❍	❍	❍	❍
I need to be convinced of the advantage of innovations by other teachers. (4)	❍	❍	❍	❍	❍
I am suspicious of innovations. (5)	❍	❍	❍	❍	❍
I am always looking for innovations. (6)	❍	❍	❍	❍	❍
My opinion about innovations is respected by other teachers. (7)	❍	❍	❍	❍	❍
I do not attempt to influence others to adopt innovations. (8)	❍	❍	❍	❍	❍
I go along with innovations out of necessity. (9)	❍	❍	❍	❍	❍
I am resistant to adopting innovations. (10)	❍	❍	❍	❍	❍

Q9 Please indicate all the innovations/tools that you have adopted in your work as a teacher. Check all the apply.

- ❑ blended learning (1)
- ❑ online instruction (2)
- ❑ Smart/Promethean or other Interactive White Board technology (3)
- ❑ Response Tools (4)
- ❑ Smartphones (5)
- ❑ Tablets (6)
- ❑ Other (please specify) (7) ____________________
- ❑ None (8)

Q10 Please indicate all the barriers are there to student achievement using a blended learning format? Check all that apply.

- ❑ Budget/Funding (1)
- ❑ Internet access/Bandwidth (2)
- ❑ Computer/Device Access (3)
- ❑ Student Buy In (4)
- ❑ Teacher Buy In (5)
- ❑ Lack of Technical Support (6)
- ❑ Need for Professional Development (7)
- ❑ Other (please specify) (8) ____________________
- ❑ None (9)

Appendix B

Blended Learning Post Survey

Blended Learning Post Survey

Q1 Thanks for your time and expertise.
Blended learning is a balance of online and teacher led instruction. This survey refers to the blended learning solution, Velocity. Knowledge and Belief toward Blended Learning

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am comfortable with instruction in a blended learning format. (1)	❍	❍	❍	❍	❍
I have received adequate continuing professional development in using blended learning to deliver instruction. (2)	❍	❍	❍	❍	❍
I am comfortable with monitoring student progress for students using blended learning. (3)	❍	❍	❍	❍	❍

Q2 What additional professional development would improve the implementation of the blended learning solution, Velocity and your ability to support students?

Q3 Please answer the following questions to the best of your abilities.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I believe the teacher is important in influencing student achievement in a blended learning format. (1)	❍	❍	❍	❍	❍
As a teacher, I believe I must monitor online instruction closely. (2)	❍	❍	❍	❍	❍
I believe blended learning will impact my students' reading skills. (3)	❍	❍	❍	❍	❍
I believe students reading levels can be impacted by blended learning. (4)	❍	❍	❍	❍	❍
I believes students who are weak readers can be impacted by blended learning. (5)	❍	❍	❍	❍	❍
I believe students who are struggling readers can be impacted by blended learning. (6)	❍	❍	❍	❍	❍
I believe students find blended learning engaging. (7)	❍	❍	❍	❍	❍
I believe students think blended learning will help improve their reading skills. (8)	❍	❍	❍	❍	❍

Q4 How would you describe your experience with blended learning in your classroom?

Q5 How was blended learning different from traditional instruction in your classroom?

Q6 How did students respond to blended learning in your classroom?

Q7 How has your perspective changed regarding the use of blended learning?

Q8 What barriers did you encounter using blended learning?

Q9 How have your students been impacted by using blended learning?

Q10 How has implementing blended learning impacted you as a teacher?

Appendix C

Informed Consent

Informed Consent

Dear Potential Research Participant,

This letter is to ask you to considering to participating in my doctoral dissertation research study. You are invited to participate in this study because you are currently piloting *Velocity*®. This research project will aim to determine the impact of teacher's attitude, actions and knowledge of blended learning on student reading comprehension. The title is: Teacher + Technology = Blended Learning: How important is the teacher in this equation?.

You must be 19 years of age or older to participate.

You will be asked to complete a pre and post survey during the course of the 2015-2016 school year in April/May and May/June. The procedures will take no longer than 20 minutes for each survey, and will be conducted through an online survey link provided through a secure licensed account through Qualtrics.com. See the link to the Qualtrics privacy policy that follows: http://www.qualtrics.com/privacy-statement/.

Participants can request a final copy of the research. There are no known risks or discomforts associated with this research.

Any information obtained during this study which could identify you will be kept strictly confidential. The data will be stored in an encoded file and will only be seen by the investigator during the study and maintained for two years after the study is complete. The information obtained in this study may be published in educational or technology journals or presented at educational meetings but the data will be reported as aggregated data only. Participating districts and teachers can request a copy of the final research. A final copy will also be provided to Voyager Sopris Learning.

You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of benefits to which you are otherwise entitled.

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

Thanks so much for considering your participation in this study. By signing below, you agree to participate.

Signature of Participant:

____
____

Signature of Research Participant

Date

Name and Phone number of investigator(s):

Carrie Doom
(702) 595-7613
Fax: (702) 396-9595
drcarriedoom@huskers.unl.edu

Advisor: Jody Isernhagen
Jisernhagen3@unl.edu
(402) 472-1088

Appendix D

Blended Learning Survey Follow Up Email

Blended Learning Survey Follow Up Email

Email Follow Up for Participant Survey who has signed informed consent but not participated in survey

Dear Velocity Partner,

Teachers piloting the blended learning solution, Velocity, have the opportunity to participate in a dissertation research study focused on blended learning.

Please see the informed consent letter that you signed earlier for additional details. We would like to have you participate so that we better understand your thoughts about blended learning.

Please see the link to the survey below. It will take 15-20 minutes to complete.

Your time and expertise are valuable. We appreciate you sharing them with us.

C.Doom

Email Follow Up for Participants that have not been offered the research opportunity

Dear Velocity Partner,

Teachers piloting the blended learning solution, Velocity, will have the opportunity to participate in a dissertation research study focused on blended learning.

Please see the informed consent letter for additional details. We would like to have you participate so that we better understand your thoughts about blended learning.

If you are willing to share your valuable input please sign and return the attached informed consent via email. If you would like to request a physical copy to sign and return, one will be provided on your next scheduled visit.

Thanks so much for your expertise and continued support.

C. Doom

Appendix E

District Level Informed Consent

District Level Informed Consent

Dear District,

This letter is to ask you to considering participating in my doctoral dissertation research study. Your district is invited to participate in this study because you are currently piloting *Velocity*®. This research project will aim to determine the impact of teacher's attitude, actions and knowledge of blended learning on student reading comprehension. The title is: Teacher + Technology = Blended Learning: How important is the teacher in this equation?.

Teachers will be asked to complete a pre and post survey during the course of the 2015-2016 school year in April and May/June. The procedures will take no longer than 20 minutes for each survey, and will be conducted through an online survey link provided through a secure licensed account through Qualtrics.com. See the link to the Qualtrics privacy policy that follows: http://www.qualtrics.com/privacy-statement/. This survey data will be correlated to student reading comprehension scores in the form of lexiles. No identifiable student data will be used in the study. The reading scores file will be encoded prior to use in the research and no identifiable district or student data will be used in the study.

Participants can request a final copy of the research. There are no known risks or discomforts associated with this research.

Any information obtained during this study which could identify you will be kept strictly confidential. The data will be stored in an encoded file and will only be seen by the investigator during the study and maintained for two years after the study is complete. The information obtained in this study may be published in educational or technology journals or presented at educational meetings but the data will be reported as aggregated data only. Participating districts and teachers can request a copy of the final research. A final copy will also be provided to Voyager Sopris Learning.

You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Participation in this study is voluntary. Teachers and districts can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of benefits to which you are otherwise entitled.

You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

Thanks so much for considering your participation in this study. By signing below, you agree to participate.

Signature of Participant:

____

____

Signature of District Representative

Date

Name and Phone number of investigator(s):

Carrie Doom
(702) 595-7613
Fax: (702) 396-9595
drcarriedoom@huskers.unl.edu

Advisor: Jody Isernhagen
Jisernhagen3@unl.edu
(402) 472-1088

Appendix F

SPSS ANCOVA

SPSS ANCOVA

Frequencies

Statistics

Student Grade Level

N	Valid	112
	Missing	0

Student Grade Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2GR	7	6.3	6.3	6.3
	3GR	57	50.9	50.9	57.1
	4GR	13	11.6	11.6	68.8
	5GR	32	28.6	28.6	97.3
	6GR	2	1.8	1.8	99.1
	K	1	.9	.9	100.0
	Total	112	100.0	100.0	

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
Knowledge	.00	Low	74
	1.00	High	36
Belief	.00	Low	21
	1.00	High	89
Action	.00	Low	95
	1.00	High	15

Descriptive Statistics

Dependent Variable: Lexile_mean

Knowledge			Mean	Std. Deviation	N
Low	Low	Low	709.1233	80.30359	21
		Total	709.1233	80.30359	21
	High	Low	673.2818	142.16899	47
		High	652.1869	120.56699	6
		Total	670.8937	139.00766	53
	Total	Low	684.3505	126.80766	68
		High	652.1869	120.56699	6
		Total	681.7426	125.82647	74
High	High	Low	663.2966	117.89592	27
		High	598.3391	122.01935	9
		Total	647.0572	120.59102	36
	Total	Low	663.2966	117.89592	27
		High	598.3391	122.01935	9
		Total	647.0572	120.59102	36
Total	Low	Low	709.1233	80.30359	21
		Total	709.1233	80.30359	21
	High	Low	669.6385	133.07988	74
		High	619.8782	120.18743	15
		Total	661.2520	131.68317	89
	Total	Low	678.3667	124.08493	95
		High	619.8782	120.18743	15
		Total	670.3910	124.65995	110

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Lexile_mean

F	df1	df2	Sig.
2.952	4	105	.023

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + StartUp_mean + Knowledge + Belief + Action + Knowledge * Belief + Knowledge * Action + Belief * Action + Knowledge * Belief * Action

Tests of Between-Subjects Effects

Dependent Variable: Lexile_mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	92529.687[a]	5	18505.937	1.202	.314	.055
Intercept	2867873.599	1	2867873.599	186.256	.000	.642
StartUp_mean	10562.349	1	10562.349	.686	.409	.007
Knowledge	17319.478	1	17319.478	1.125	.291	.011
Belief	9562.145	1	9562.145	.621	.432	.006
Action	22831.790	1	22831.790	1.483	.226	.014
Knowledge * Belief	0.000	0				0.000
Knowledge * Action	4513.257	1	4513.257	.293	.589	.003
Belief * Action	0.000	0				0.000
Knowledge * Belief * Action	0.000	0				0.000
Error	1601341.424	104	15397.514			
Total	51130525.898	110				
Corrected Total	1693871.111	109				

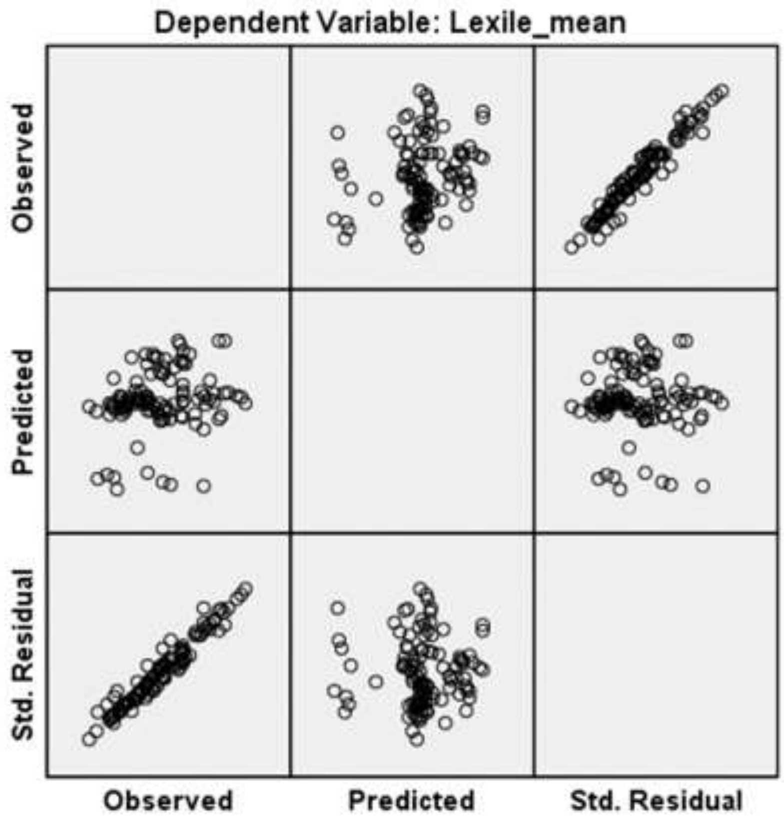
a. R Squared = .055 (Adjusted R Squared = .009)

Parameter Estimates

Dependent Variable: Lexile_mean

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Partial Eta Squared
Intercept	637.648	62.955	10.129	.000	512.805	762.490	.497
StartUp_mean	-.620	.748	-.828	.409	-2.103	.864	.007
[Knowledge=.00]	58.839	65.676	.896	.372	-71.400	189.078	.008
[Knowledge=1.00]	0[a]						
[Belief=.00]	27.008	34.272	.788	.432	-40.955	94.971	.006
[Belief=1.00]	0[a]						
[Action=.00]	63.351	47.800	1.325	.188	-31.439	158.141	.017
[Action=1.00]	0[a]						
[Knowledge=.00] * [Belief=.00]	0[a]						
[Knowledge=.00] * [Belief=1.00]	0[a]						
[Knowledge=1.00] * [Belief=1.00]	0[a]						
[Knowledge=.00] * [Action=.00]	-39.073	72.169	-.541	.589	-182.187	104.042	.003
[Knowledge=.00] * [Action=1.00]	0[a]						
[Knowledge=1.00] * [Action=.00]	0[a]						
[Knowledge=1.00] * [Action=1.00]	0[a]						
[Belief=.00] * [Action=.00]	0[a]						
[Belief=1.00] * [Action=.00]	0[a]						
[Belief=1.00] * [Action=1.00]	0[a]						
[Knowledge=.00] * [Belief=.00] * [Action=.00]	0[a]						
[Knowledge=.00] * [Belief=1.00] * [Action=.00]	0[a]						
[Knowledge=.00] * [Belief=1.00] * [Action=1.00]	0[a]						
[Knowledge=1.00] * [Belief=1.00] * [Action=.00]	0[a]						
[Knowledge=1.00] * [Belief=1.00] * [Action=1.00]	0[a]						

a. This parameter is set to zero because it is redundant.



Model: Intercept + StartUp_mean + Knowledge + Belief + Action + Knowledge * Belief + Knowledge * Action + Belief * Action + Knowledge * Belief * Action

Means

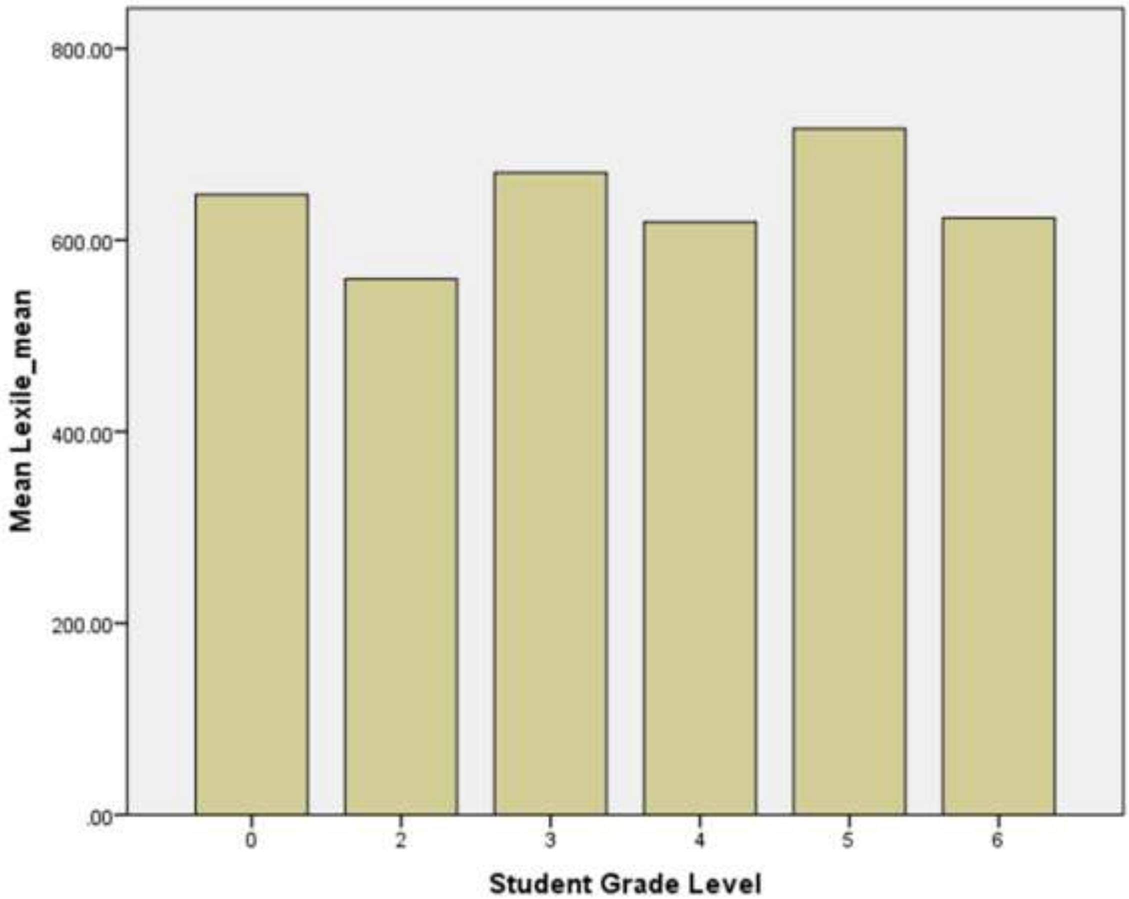
Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Lexile_mean * Student Grade Level	112	100.0%	0	0.0%	112	100.0%
StartUp_mean * Student Grade Level	110	98.2%	2	1.8%	112	100.0%

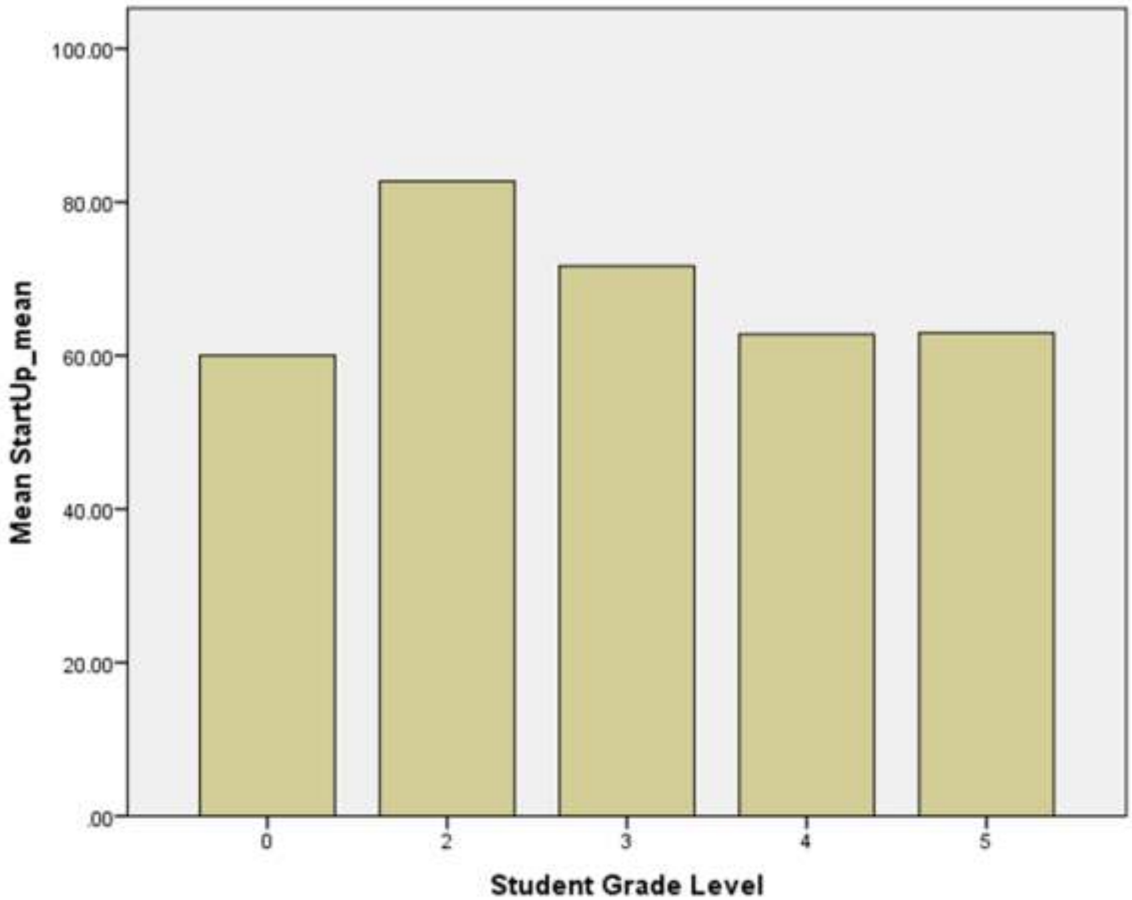
Report

Student Grade Level		Lexile_mean	StartUp_mean
0	Mean	647.5000	60.0000
	N	1	1
	Std. Deviation		
2	Mean	559.3558	82.7143
	N	7	7
	Std. Deviation	69.08538	10.91962
3	Mean	670.3775	71.6667
	N	57	57
	Std. Deviation	145.82234	13.46866
4	Mean	618.8856	62.7692
	N	13	13
	Std. Deviation	84.33089	29.00619
5	Mean	716.3435	62.9688
	N	32	32
	Std. Deviation	80.36543	16.88955
6	Mean	623.0000	
	N	2	
	Std. Deviation	86.26703	
Total	Mean	669.5448	68.6818
	N	112	110
	Std. Deviation	123.96326	17.47183

Graph


800.00
600.00
400.00
200.00
.00
Mean Lexile_mean
0
2
3
4
5
6
Student Grade Level

Graph



100.00
80.00
60.00
40.00
20.00
.00
Mean StartUp_mean
0
2
3
4
5
Student Grade Level

```
USE ALL.
COMPUTE
filter_$=(Student
GradeLevel_first
=3).
VARIABLE LABELS
filter_$
'StudentGradeLeve
l_first =3
(FILTER)'.
VALUE LABELS
filter_$ 0 'Not
Selected' 1
'Selected'.
FORMATS filter_$
(f1.0).
FILTER BY
filter_$.
EXECUTE.
UNIANOVA
Lexile_mean BY
Knowledge Action
WITH StartUp_mean

/METHOD=SSTYPE(3)

/INTERCEPT=INCLUD
E

/PRINT=PARAMETER
ETASQ HOMOGENEITY
DESCRIPTIVE
  /PLOT=RESIDUALS

/CRITERIA=ALPHA(.
05)

/DESIGN=StartUp_m
ean Knowledge
Action
Knowledge*Action.
```

Univariate Analysis of Variance

(3rd grade only)

Between-Subjects Factors

		Value Label	N
Knowledge	.00	Low	35
	1.00	High	22
Action	.00	Low	45
	1.00	High	12

Descriptive Statistics

Dependent Variable: Lexile_mean

Knowledge		Mean	Std. Deviation	N
Low	Low	704.3396	150.70922	29
	High	652.1869	120.56699	6
	Total	695.3991	145.74104	35
High	Low	643.9440	141.54242	16
	High	594.9074	142.01166	6
	Total	630.5704	140.04135	22
Total	Low	682.8656	148.79031	45
	High	623.5471	129.10931	12
	Total	670.3775	145.82234	57

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Lexile_mean

F	df1	df2	Sig.
.811	3	53	.493

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + StartUp_mean + Knowledge + Action + Knowledge * Action

Tests of Between-Subjects Effects

Dependent Variable: Lexile_mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	88756.642[a]	4	22189.160	1.047	.392	.075
Intercept	372744.071	1	372744.071	17.588	.000	.253
StartUp_mean	7967.858	1	7967.858	.376	.542	.007
Knowledge (High K/Low K)	13853.189	1	13853.189	.654	.422	.012
Action (High Action/Low Action	22798.749	1	22798.749	1.076	.304	.020
Knowledge * Action (Diagonal comparison)	423.638	1	423.638	.020	.888	.000
Error	1102036.079	52	21193.002			
Total	26806934.374	57				
Corrected Total	1190792.721	56				

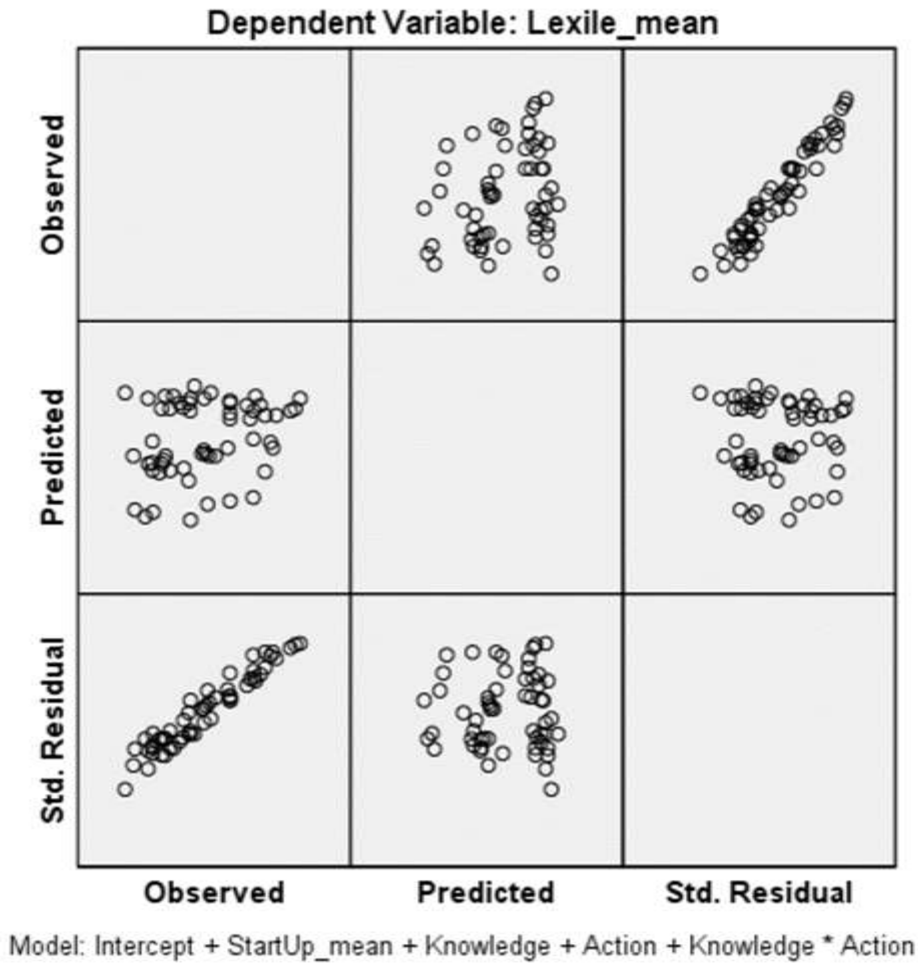
a. R Squared = .075 (Adjusted R Squared = .003)

Parameter Estimates

Dependent Variable: Lexile_mean

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	517.145	140.057	3.692	.001	236.101	798.190	.208
StartUp_mean	1.181	1.926	.613	.542	-2.684	5.047	.007
[Knowledge=.00]	50.586	84.756	.597	.553	-119.488	220.660	.007
[Knowledge=1.00]	0[a]						
[Action=.00]	56.591	70.771	.800	.428	-85.421	198.604	.012
[Action=1.00]	0[a]						
[Knowledge=.00] * [Action=.00]	-14.071	99.526	-.141	.888	-213.785	185.642	.000
[Knowledge=.00] * [Action=1.00]	0[a]						
[Knowledge=1.00] * [Action=.00]	0[a]						
[Knowledge=1.00] * [Action=1.00]	0[a]						

a. This parameter is set to zero because it is redundant.


Dependent Variable: Lexile_mean
Observed
Predicted
Std. Residual
Observed
Predicted
Std. Residual
Model: Intercept + StartUp_mean + Knowledge + Action + Knowledge * Action

Appendix G

SPSS ANOVA

SPSS ANOVA

Regression

[New]
C:\Users\near\Desktop\nearshare\Weldon
Clients\6. 2016 - Summer\Doom\Clean.sav

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Action, Belief, Knowledge[b]		Enter

a. Dependent Variable: Lexile_mean

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.198[a]	.039	.013	123.17613

a. Predictors: (Constant), Action, Belief, Knowledge

b. Dependent Variable: Lexile_mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	67110.049	3	22370.016	1.474	.226[b]
	Residual	1638614.670	108	15172.358		
	Total	1705724.720	111			

a. Dependent Variable: Lexile_mean

b. Predictors: (Constant), Action, Belief, Knowledge

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	701.634	25.684		27.318	.000
	Knowledge	-17.596	27.042	-.067	-.651	.517
	Belief	-25.576	31.017	-.084	-.825	.411
	Action	-45.623	35.454	-.126	-1.287	.201

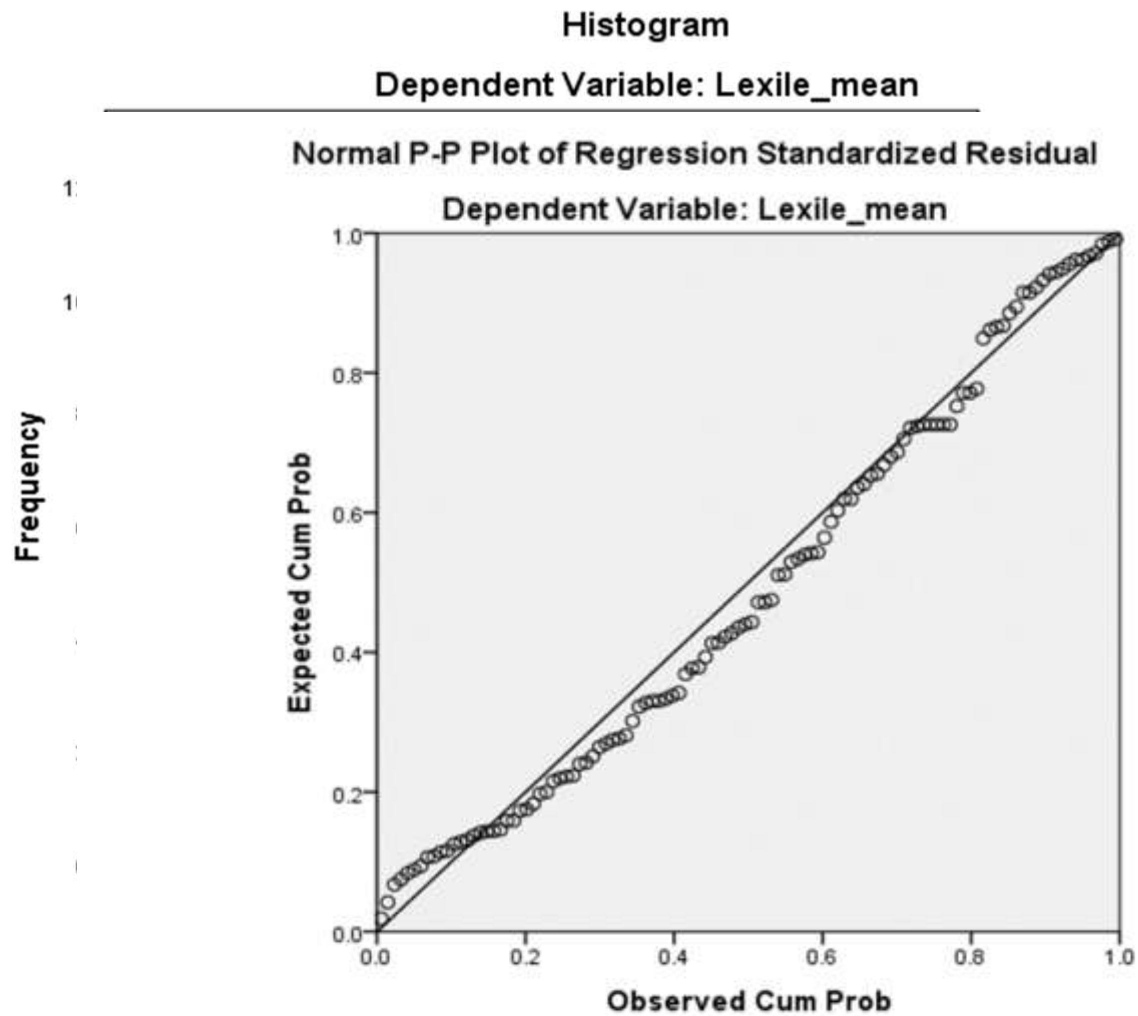
a. Dependent Variable: Lexile_mean

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	612.8400	701.6343	669.5448	24.58851	112
Residual	-256.05853	293.94147	.00000	121.50018	112
Std. Predicted Value	-2.306	1.305	.000	1.000	112
Std. Residual	-2.079	2.386	.000	.986	112

a. Dependent Variable: Lexile_mean

Charts


Histogram
Dependent Variable: Lexile_mean
Frequency
Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Lexile_mean
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Knowledge * Belief * Action	112	100.0%	0	0.0%	112	100.0%

Knowledge * Belief * Action Crosstabulation

Count

Action			Belief .00	Belief 1.00	Total
.00	Knowledge	.00	23	47	70
		1.00	0	27	27
	Total		23	74	97
1.00	Knowledge	.00		6	6
		1.00		9	9
	Total			15	15
Total	Knowledge	.00	23	53	76
		1.00	0	36	36
	Total		23	89	112

Frequencies

Notes

Output Created		21-JUN-2016 13:15:14
Comments		
Input	Data	C:\Users\near\Desktop\nearshare\Weldon Clients\6. 2016 - Summer\Doom\Clean.sav
	Active Dataset	New
	File Label	Aggregated File
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	112
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=District_first /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Statistics

District

N	Valid	112
	Missing	0

District

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	30	26.8	26.8	26.8
	B	36	32.1	32.1	58.9
	C	25	22.3	22.3	81.3
	D	6	5.4	5.4	86.6
	E	7	6.3	6.3	92.9
	F	2	1.8	1.8	94.6
	G	6	5.4	5.4	100.0
	Total	112	100.0	100.0	

Univariate Analysis of Variance

Between-Subjects Factors

		N
Knowledge	.00	76
	1.00	36
Belief	.00	23
	1.00	89
Action	.00	97
	1.00	15

Descriptive Statistics

Dependent Variable: Lexile_mean

Knowledge			Mean	Std. Deviation	N
.00	.00	.00	701.6343	82.56122	23
		Total	701.6343	82.56122	23
	1.00	.00	673.2818	142.16899	47
		1.00	652.1869	120.56699	6
		Total	670.8937	139.00766	53
	Total	.00	682.5976	125.80908	70
		1.00	652.1869	120.56699	6
		Total	680.1968	124.89567	76
1.00	1.00	.00	663.2966	117.89592	27
		1.00	598.3391	122.01935	9
		Total	647.0572	120.59102	36
	Total	.00	663.2966	117.89592	27
		1.00	598.3391	122.01935	9
		Total	647.0572	120.59102	36
Total	.00	.00	701.6343	82.56122	23
		Total	701.6343	82.56122	23
	1.00	.00	669.6385	133.07988	74
		1.00	619.8782	120.18743	15
		Total	661.2520	131.68317	89
	Total	.00	677.2252	123.35463	97
		1.00	619.8782	120.18743	15
		Total	669.5448	123.96326	112

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Lexile_mean

F	df1	df2	Sig.
2.828	4	107	.028

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Knowledge + Belief + Action + Knowledge * Belief + Knowledge * Action + Belief * Action + Knowledge * Belief * Action

Tests of Between-Subjects Effects

Dependent Variable: Lexile_mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	72834.447[a]	4	18208.612	1.193	.318	.043
Intercept	23735213.399	1	23735213.399	1555.321	.000	.936
Knowledge	12123.628	1	12123.628	.794	.375	.007
Belief	12414.013	1	12414.013	.813	.369	.008
Action	22032.709	1	22032.709	1.444	.232	.013
Knowledge * Belief	0.000	0				0.000
Knowledge * Action	5724.397	1	5724.397	.375	.542	.003
Belief * Action	0.000	0				0.000
Knowledge * Belief * Action	0.000	0				0.000
Error	1632890.273	107	15260.657			
Total	51914225.898	112				
Corrected Total	1705724.720	111				

a. R Squared = .043 (Adjusted R Squared = .007)

Estimated Marginal Means

1. Knowledge

Dependent Variable: Lexile_mean

Knowledge	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
.00	675.701[a]	19.809	636.432	714.970
1.00	630.818[a]	23.774	583.688	677.947

a. Based on modified population marginal mean.

2. Belief

Dependent Variable: Lexile_mean

Belief	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
.00	701.634[a]	25.759	650.571	752.698
1.00	646.776	17.904	611.283	682.269

a. Based on modified population marginal mean.

3. Action

Dependent Variable: Lexile_mean

Action	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
.00	679.404[a]	13.138	653.360	705.448
1.00	625.263[a]	32.554	560.728	689.798

a. Based on modified population marginal mean.

4. Knowledge * Belief

Dependent Variable: Lexile_mean

Knowledge		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
.00	.00	701.634[a]	25.759	650.571	752.698
	1.00	662.734	26.777	609.651	715.818
1.00	.00	.[b]			
	1.00	630.818	23.774	583.688	677.947

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

5. Knowledge * Action

Dependent Variable: Lexile_mean

Knowledge		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
.00	.00	687.458	15.718	656.299	718.617
	1.00	652.187[a]	50.433	552.210	752.164
1.00	.00	663.297[a]	23.774	616.167	710.426
	1.00	598.339[a]	41.178	516.709	679.970

a. Based on modified population marginal mean.

6. Belief * Action

Dependent Variable: Lexile_mean

Belief		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
.00	.00	701.634[a]	25.759	650.571	752.698
	1.00	.[b]			
1.00	.00	668.289	14.916	638.721	697.858
	1.00	625.263	32.554	560.728	689.798

a. Based on modified population marginal mean.

b. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.

7. Knowledge * Belief * Action

Dependent Variable: Lexile_mean

Knowledge			Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
.00	.00	.00	701.634	25.759	650.571	752.698
		1.00	.[a]			
	1.00	.00	673.282	18.019	637.561	709.003
		1.00	652.187	50.433	552.210	752.164
1.00	.00	.00	.[a]			
		1.00	.[a]			
	1.00	.00	663.297	23.774	616.167	710.426
		1.00	598.339	41.178	516.709	679.970

a. This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.