2020

Effects of Blended Learning Using the Rotation Model on Fourth and Fifth Grade Students' Mathematics Scores

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Walden University
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Abstract

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by

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MA, University of Indianapolis, 2013

MA, Florida Atlantic University, 2003

BS, University of Southern Indiana, 2000

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Curriculum, Instruction, and Assessment

Walden University

November 2020

Abstract

The problem addressed in this quantitative study was that school administrators are allocating funds for implementing blended learning using the rotation model into mathematics classrooms without knowing if it is effective in improving student achievement in mathematics. The purpose of this study was to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics. Mayer's cognitive theory of multimedia learning guided this study. In this quantitative quasi-experimental comparative study, data from $N = 591$ fourth and fifth grade students and $N = 3$ principals from three selected central Indiana elementary schools were collected using a descriptive survey. Subsequently, an independent sample *t* test was used to determine if there were differences in terms of Northwest Evaluation Association (NWEA) Map Growth Mathematics assessment scores. The *t* test results indicated that there were no statistically significant differences in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated in blended learning using the rotation model and students who were in the traditional classroom. Educator awareness of the effect of blended learning using the rotation model may help support positive social change for classroom teachers by allowing school leaders to make informed decisions on how to increase students' capacity for learning. Positive social change may result for fourth and fifth grade mathematics students as the 29 selected central Indiana teachers use a blended learning approach during mathematics instruction. These decisions may help increase selected central Indiana fourth and fifth grade students' achievement in mathematics.

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Dedication

This dissertation is dedicated to my family. Words cannot even begin to express how much I appreciate all your support throughout this journey. To my amazing husband Greg, thank you for your love, encouragement, and support! You have been my anchor during this process, and I could have never gotten through this without you. To my parents, thank you for always encouraging and supporting me through anything! I am truly blessed by your unwavering support! Finally, thank you to my amazing daughters, Bry and Addy. The two of you inspire me to always be better. You are both beautiful and smart and have supported me to help me find the strength to complete this dissertation.

Acknowledgments

I would like to acknowledge Dr. Julie Frese for her support! I truly appreciate the timely feedback and our weekly phone calls to help support and guide me throughout this process. Thank you as well to Dr. Markus Berndt for providing specific feedback and suggestions that helped me strengthen my study. I would also like to thank the URR, Dr. Nistor, for reviewing my study and for providing feedback to help me complete this dissertation. Finally, I would like to thank my mentor, Dr. Tim Long, for his continued support and guidance throughout this entire dissertation process. I appreciate the time, encouragement, and support that he has offered to me.

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Chapter 1: Introduction to the Study

Introduction

Since 2016, school principals have started to focus on the impact of blended learning on selected central Indiana fourth and fifth grade student mathematics achievement (Dziuban, Picciano, Graham, & Moskal, 2016). Banyen, Viriyavejakul, and Ratanaolarn (2016) defined blended learning as an instructional practice that mixes face-to-face and online educational delivery of instruction. Prescott, Bundschuh, Kazakoff, and Macaruso (2018) described blended learning as an instructional practice where students have some control over the pace and location of their learning. As educators are being challenged with meeting the various learning needs of students in their classrooms, blended learning has gained momentum, and schools are continuing to transform classrooms by moving away from traditional whole class teaching (Lin, Tseng, & Chiang, 2017).

The problem addressed in this quantitative study is that selected central Indiana school administrators are allocating funds for implementing blended learning using the rotation model into the mathematics classroom without knowing if it is effective in improving student achievement in mathematics. Blended learning using the rotation model has students rotate on a fixed schedule or at the teacher's discretion between learning modalities, and at least one rotation involves online learning. In the traditional teaching model, teachers provide instruction in a whole group setting for introducing grade level mathematics standards and objectives for learning, instruction, and practice. In this study, the current research indicates that the gap in the literature tends to focus on

the secondary level grades six through twelve, and different models of blended learning like flipped classroom. Prescott et al. (2018) stated that there is a lack of research on the effect of blended learning at the elementary age level. This study was conducted to examine the effect of blended learning using the rotation model on 29 classrooms of selected central Indiana fourth and fifth grade students' achievement in mathematics. In this study, I identified implications for positive social change for selected central Indiana fourth and fifth grade teachers. Educator awareness of the effect of blended learning on selected central Indiana fourth and fifth grade student mathematics achievement may help support positive social change for selected central Indiana fourth and fifth grade classroom teachers by allowing the three selected central Indiana school principals to make informed decisions about instructional methods. These decisions may help increase selected central Indiana fourth and fifth grade students' achievement in mathematics.

Chapter 1 includes the background, problem statement, purpose, research question, hypotheses, theoretical framework, nature of the study, definitions, assumptions, scope, limitations, and significance of the study. In the background section, I focus on current research regarding blended learning and address the gap in literature to identify why additional research is beneficial. In the problem section, I address that selected central Indiana schools are allocating educational funds into implementing blended learning into selected central Indiana fourth and fifth grade mathematics classroom without knowing if it is an effective instructional practice in terms of improving student achievement in mathematics. Next, the purpose section of this quantitative study examines the effect of blended learning using the rotation model on

selected central Indiana fourth and fifth grade students' achievement in mathematics. In the theoretical framework section, I describe how the cognitive theory of multimedia learning can support why blended learning using the rotation model should impact selected central Indiana fourth and fifth grade student learning. In the nature of the study section, I identify the approach used to address the research question. This section also includes the methodology and design of the study. In the scope and delimitations section, I discuss the boundaries and generalizability of the research, followed by the limitations section. Finally, in the significance section, I address implications for how this study's findings will add to current research, support professional practice, and lead to positive social change.

Background

Teachers in selected central Indiana are beginning to transition from the traditional classroom model to using a blended learning model according to the school district's Fall 2016-2017 newsletter. Three selected central Indiana schools began implementing blended learning using station rotation in 2016. Blended learning has gained momentum in K-12 classrooms. Selected central Indiana elementary educators are working to meet the learning needs of their students and are being required by administrators to move away from the traditional model of teaching (Lin, Tseng, & Chiang, 2017).

Although there are instructors using blended learning, there is a lack of research on blended learning using the rotation model at the fourth and fifth grade level to determine if this is an effective practice. In 2010, there was a meta-analysis of research

regarding blended learning conducted by the United States Department of Education (Means et al., 2010). The results in this meta-analysis revealed that blended learning was being implemented more in the classrooms; however, data on the effectiveness of blended learning are limited. Harris, Al-Bataineh, and Al-Bataineh (2016) analyzed if blended learning using one-to-one technology had an impact on student achievement and motivation. Harris et al. included fourth grade participants from two different classrooms in a Title 1 elementary school in their study. Data were gathered through the Pearson enVision Math series with Topic Tests, Discovery Education Assessment results, and attendance records. The Pearson envision Math series was the mathematics curriculum that the teachers used to support instruction. This curriculum included different types of assessments to measure student achievement. These assessments included the topic tests, and discovery education assessments. The authors used student assessment data from these tests to analyze the results of their study. One-to-one technology, one laptop for each student, may be a factor in increasing student academic achievement and motivation to learn (Harris et al. 2016). Minicozzi (2018) said that pre-service teachers have a need for embedded technology integration throughout teacher preparation coursework to better prepare K-2 teachers. By including the integration of technology in the teacher preparation courses, teachers may be able to effectively integrate blended learning with the use of iPads into lessons which may benefit student learning.

Lin et al. (2017) examined the effects of blended learning on junior high students' learning achievement and students' attitudes toward mathematics. The authors included

54 seventh grade students for 8 months in the study; one group was a control group that received traditional teaching methods of whole class teaching, while one group was the experimental group that received instruction using the blended learning model with the use of videos, guided questions, and the use of Moodle. The authors used a pre- and posttest to measure student achievement. The post-hoc comparison showed that the experimental group had significantly higher posttest scores, M = 64.30, compared to the control group's posttest scores, M = 54.70. Lin et al. found that the experimental group that used blended learning in the mathematics classrooms showed statistically higher achievement scores on the mathematics posttest. The results supported the first hypothesis that there was a significant difference in academic achievement of students that participated in blended learning during mathematics.

Agosto, Copeland, and Zach (2014) investigated the use of student blogs to test the benefits of using a blended learning format. Twenty-eight Library and Information Science (LIS) students were enrolled and participated in the student blog throughout this course and the authors randomly selected 10 student blogs and utilized thematic analysis. Agosto et al. developed three categories to analyze the data: keys to success, educational benefits, and drawbacks. The authors reported that results indicated that the LIS students showed improvement in keys to success, participation, and personalization, and educational benefits such as increased student achievement. Since selected Central Indiana elementary principals are requiring teachers to transform their classrooms into a blended learning environment, the results are relevant to inform educators of how students are being instructed, assessed, and evaluated using technology.

The gap in research regarding the effect of blended learning using the rotation model on elementary student achievement demonstrates the need for further investigation for principals and teachers for the transition of the model of instruction, blended learning using the rotation model, in the mathematics classroom. Yaghmour (2016) recommended doing further research on the use of blended learning specifically in the mathematics classroom. Prescott et al. (2018) stated that there is a lack of research on the effect of blended learning at the elementary level. Since there are multiple methods of blended learning, it is unclear which type of methods are most effective for student learning. Clayton Christensen Institute (2019) recognized four methods of blended learning: (a) rotation, (b) flex, (c) a la carte, and (d) enriched virtual model and these different methods of blended learning will be discussed further in Chapter 2. The purpose of this quantitative study was to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics.

Problem Statement

Selected central Indiana schools are requiring teachers to transform their classrooms into a blended learning environment, according to the school district's Fall 2016-2017 newsletter. The problem addressed in this quantitative study is that school administrators at selected central Indiana schools are allocating educational funds for implementing blended learning using the rotation model into the mathematics classroom without knowing if it is effective in improving student achievement in mathematics. Eyyam and Yaratan (2014) discussed the importance of preparing students by providing

blended instruction that integrates technology into the classrooms so that students can develop higher order thinking skills and experience differentiated learning opportunities.

Since mathematics requires higher order thinking skills, blended learning using the rotation model may be a valid model for instruction in mathematics, but research is lacking in this area. Current research tends to focus on high school level students, or the subject area of reading (Prescott et al., 2018). Dziuban et al. (2016) wrote that one of the major hurdles for educators is the lack of solid research at the elementary level. Working (2018) suggested that further research on the effects of blended learning using technology in the mathematics classroom may provide further data on the effect on student achievement. Yudt and Columba (2017) stated that college students in the elementary education program showed improvement, as measured by a mathematics achievement pre and posttest, when using blended learning; however, further research should be conducted to determine the effect of blended learning on students' mathematics achievement.

With the shift to blended learning using the rotation model, selected central Indiana elementary students are now experiencing a combination of face-to-face and online instruction to learn and apply mathematical skills. Horn and Staker (2014) stated that this model of blended learning has students rotate through different types of learning during a course or subject, to include kinesthetic, visual, auditory, and tactile activities. Since blended learning incorporates both face-to-face and online learning, the use of technology plays an important role in this instructional practice. Sargent and Miles (2016) discussed the importance of utilizing technology in blended learning for a

meaningful purpose and stated that more research should be conducted to examine the effect on student achievement when transforming instruction by integrating technology. Yen-Ting Lin (2016) investigated the importance of integrating technology into the traditional classroom in order to promote higher order thinking skills and problem-solving skills and suggested further research be conducted in order to evaluate the effect of blended learning on student achievement. Agosto, Copeland, and Zach (2013) examined the effect of blended learning of on-line LIS student's achievement and suggested that further research should be done to develop an understanding of the effects of blended learning, that is delivered in person, on student achievement.

Purpose

The purpose of this quantitative study was to determine the effect of blended learning using the rotation model on three selected central Indiana fourth and fifth grade students' achievement in mathematics. In this study, I observed 29 classes of fourth and fifth grade students because I wanted to add to the research at the elementary level, specifically fourth and fifth grade since these grade levels participate in the NWEA Map Growth Mathematics assessment. The NWEA Map Growth Mathematics assessment is an adaptive assessment that continues to adjust as students answer questions. This assessment is used to accurately measure a student's performance. The NWEA was developed in 1980 to measure growth and proficiency of student learning so that teachers can develop instruction to meet the learning needs of each student. The NWEA (2019) reported that this instrument is used in more than 9,500 school districts in the United States, as well as education agencies in 145 countries. In this study, I used the NWEA

Map Growth Mathematics pre and posttest scores to compare the growth scores of students who participated in a blended learning using the rotation model in the mathematics classroom to the scores of peers who do not. I also addressed the extent of the teacher use of blended learning in selected central Indiana elementary schools and how blended learning using the rotation model has affected fourth and fifth grade students' NWEA Map Growth Mathematics assessment scores. In this study, I had selected central Indiana school principals identify if teachers are using blended learning using the rotation model during mathematics instruction. Yudt and Columba (2017) investigated the use of blended learning with 57 students that were enrolled in an elementary teaching program to investigate if the use of blended learning in their mathematics course showed significant improvement in the student's mathematics performance. The authors reported that there was not a significant difference in the student's mathematics performance as measured by a mathematics achievement test. The authors stated that due to the lack of quantitative research regarding blended learning, given the current trend of utilizing blended learning in the classrooms, there is a need for further research regarding the effect of blended learning on students' mathematics achievement.

Research Question and Hypotheses

This research was conducted to examine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics. McCusker and Gunaydin (2019) explained that the researcher uses quantitative data to attempt to explain what is observed. Data analysis indicated if there were differences in

terms of NWEA Map Growth Mathematics assessment scores for fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and students who did not. The following research question was used to guide my study:

RQ: Is there a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom?

H_0: There is no statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

H_a: There is a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

Theoretical Framework for the Study

The cognitive theory of multimedia learning was used to guide my study in analyzing the effects of blended learning on fourth and fifth grade students' mathematics scores. Mayer (2009, 2014) stated that the cognitive theory of multimedia learning may address the issue of how to provide effective instructional strategies that help support learning. The cognitive theory of multimedia learning was used in my study to help establish if the teacher's use of blended learning through the rotation model is an effective instructional practice for selected central Indiana fourth and fifth grade students.

Mayer (2009, 2014) stated that learning is an active process involving using prior knowledge for new learning through selection, filtering, organizing, and integrating new information. Prescott et al. (2018) said that a major component of blended learning is that students have some control over the pace and location of their learning. Blended learning using the rotation model can allow students to receive differentiated instruction using technology. Prescott et al. explained that the use of technology allows students to work at their own pace and at their level of learning to master the content.

Blended learning using the rotation model can support the concept of limited capacity by allowing students the ability to control how much information is processed. Mayer (2009, 2014) explained there is a limit to how much cognitive information a student can process. Horn et al. (2014) stated that the rotation model allows students and teachers to control the amount of time spent on a specific learning task. The cognitive theory of multimedia learning demonstrates why students who receive instruction through the format of blended learning using the rotation model can learn more content than students who are exposed to a more traditional classroom. Horn et al. (2014) explained that the rotation model allows students to learn mathematics content while using different learning modalities during a class session. The cognitive theory of multimedia learning was used to guide my study in analyzing the effects of blended learning using the rotation model on fourth and fifth grade mathematics student achievement in selected Indiana schools.

Nature of the Study

The nature of this study was quantitative. In this research, I used growth data from the NWEA Map Growth Mathematics assessment gathered from 29 classrooms of fourth and fifth grade student mathematics assessment scores from selected central Indiana elementary schools. A total of 300 students were included in this study. Using a quasi-experimental approach, an independent sample *t* test to analyze data from nonequivalent groups was conducted. I investigated the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics.

I analyzed differences in terms of NWEA Map Growth Mathematics assessment scores of selected central Indiana fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model as well as students who stayed in the traditional classroom. The principals answered survey questions about instructors. The quasi-experimental research design was used because my study lacked random assignment (White & Sabarwal, 2014). Differences between the two groups involved learning ability, attendance, and behavior of students. The quasi-experimental design aligns with my study because I did not randomly assign students who participated in blended learning using the rotation model or those who participated in the traditional classroom. Since this study involved data that is not randomly assigned, this quasi-experimental research design was appropriate (Trochim, 2016).

I used a descriptive survey that was completed by three selected central Indiana school principals to gather data on what type of instruction, blended learning using the rotation model, or traditional model, was being used in the mathematics classroom. The

three selected central Indiana schools each had one principal. Principals were asked to complete a descriptive survey that provided information about each selected fourth and fifth grade teacher. Since principals in these selected central Indiana schools evaluate the fourth and fifth grade teachers, they may be able to provide this information using the information that is included in the survey directions. A benefit of conducting this type of survey is that it provides empirical data which reports real-world observations (Kelley, Clark, Brown, & Sitzia, 2003). The descriptive survey helped to identify information for which type of instruction, blended learning using the rotation model, or traditional, that each fourth and fifth grade classroom teacher was using during mathematics instruction. This survey allowed me to gather information on teachers without manipulating the survey data that was reported from each elementary principal. The survey data were important to provide information on the type of instruction, blended learning using the rotation model, or the traditional model, each fourth and fifth grade teacher uses during mathematics. The three selected central Indiana principals identified the type instruction, blended learning using the rotation model, or traditional teaching model, that each fourth and fifth grade teacher used during mathematics.

Definitions

Blended Learning: A type of instruction that includes part of a lesson delivered through direct instruction provided by a teacher and part of the lesson is delivered using online learning. During the online learning part of instruction, students have some control over time, place, and pace (Clayton Christensen Institute, 2012).

NWEA Map Growth Mathematics Assessment: Northwest Evaluation Association (NWEA) measures a student's academic progress throughout the year. This assessment is adaptive and continues to adjust as students answer questions. This assessment is used to accurately measure performance. Reports from this assessment help teachers identify instructional needs of each individual student (NWEA, 2019).

Rotation model of blended learning: Students rotate on a fixed schedule or at the teacher's discretion between learning modalities, and at least one rotation involves online learning. Student learning activities may include small-group activities or full-class instruction, group projects, individual tutoring, and pencil-and-paper assignments. (Clayton Christensen Institute, 2012, para. 2).

Traditional teaching method: Teachers provide instruction in a whole group setting for introducing grade level mathematics standards and objectives for learning, instruction, and practice. Instruction is delivered face to face by a teacher in a brick and mortar setting (Bonk & Graham, 2013).

Assumptions

There were two assumptions made for this study. First, I assumed that both models of instruction, blended learning using the rotation model and traditional, are aligned with the NWEA Map Growth Mathematics assessment and that data gathered from the school district is the same for all three schools. The second assumption in this study was that daily mathematics instructional time was followed by the teachers as intended by the Indiana Department of Education. Each selected central Indiana school developed a daily student schedule that met state requirements of providing sixty minutes

of mathematics instruction each day. There are many factors that can impede instructional time by causing a disruption in instruction, such as safety drills, student behavior, and teacher absence. Instructional time can influence student learning; however, it is assumed that both groups received equal amounts of instructional time (Yeşil Dağlı, 2019).

Scope and Delimitations

Participants in this research were from 29 selected central Indiana fourth and fifth grade classrooms in a suburban district. The results of this study limited generalization to other grade levels and other populations. Second, in this study I focused only on the rotation model of blended learning. Given that this study was specifically focused on the rotation model of blended learning, the research was limited to this model and limits generalization to other models of blended learning.

Limitations

Two limitations have been identified in this study. First, the quality of the information that was gathered is limited by how accurately the three selected central Indiana principals responded to the descriptive survey. The principals were asked to identify which type of instruction each fourth and fifth grade teacher used during mathematics. The survey data that was gathered is limited to the principal's response. A follow-up phone call was conducted for participants who provided sparse answers or failed to respond to the initial survey. Second, since teachers worked in a school corporation where professional development was provided weekly and there was a priority placed on technology integration into the classroom, the results may not be

applicable to surrounding school corporations that have limited technology and less focused professional development opportunities.

Significance

This study provided insight into how blended learning using the rotation model affects 29 selected central Indiana fourth and fifth grade students' mathematics assessment scores. I worked to provide original research and empirical data so that Indiana elementary administrators can determine if allocating funds and professional development resources into implementing blended learning using the rotation model into the elementary classroom is a meaningful practice. Positive social change may result for fourth and fifth grade mathematics students as the 29 selected central Indiana teachers use a blended learning approach in the mathematics classroom by increasing student engagement and academic achievement in mathematics (Dziuban, Graham, Moskal, Norberg, Sicilia, 2018). Educator awareness of the effect of blended learning on student mathematics achievement may help support positive social change by allowing school leaders to make informed decisions on how to increase the selected central Indiana fourth and fifth grade students' capacity for learning. The results of this study will be shared with the three selected principals so they may use the findings to determine if the use of blended learning is an effective model of instruction during mathematics instruction. The findings of this study can be used by these three selected principals as a data resource to monitor the effect of blended learning on students' mathematics assessment scores. If these three selected principals continue to have teachers that use blended learning with the rotation model, the results from this study can be the starting data and then the

principals and teachers can continue to review the data from additional NWEA Map Growth Mathematics assessment scores over time.

Summary

This study includes research on the effectiveness of blended learning using the rotation model. Using the framework of the theory of multimedia learning, I sought to determine if the incorporation of blended learning using the rotation model affects selected central Indiana fourth and fifth grade students' achievement in mathematics. In Chapter 2, I will provide a review of the literature regarding the effects of blended learning and theory of multimedia learning.

Chapter 2: Literature Review

Introduction

As technology is added into K-12 classrooms, educators are working to meet various learning needs of their students. The effect of blended learning using the rotation model on academic achievement at the elementary level has not been addressed adequately in research, even though blended learning is being implemented rapidly in elementary classrooms. This study will add to the research on the effect of blended learning using the rotation model at the fourth and fifth grade level in mathematics. To measure academic achievement, I used data from the NWEA Map Growth Mathematics assessment from selected central Indiana schools.

The following literature review provides information on research that has information regarding how blended learning has been implemented in the classroom. In the first section of the literature review, I describe search strategies I used to collect data for the study. In the second section, I discuss the theoretical framework used in this study. I discuss blended learning and the traditional classroom in the third section of this chapter. The next section of the literature review includes a discussion of how the selected central Indiana schools are currently using blended learning in some classrooms.

Search Strategies

I conducted this search through Walden University Library's education databases. These databases included ERIC, SAGE, ProQuest, and Academic Search Complete. The first general search resulted in 17,527 sources. To narrow the search, I looked at peer-reviewed articles in full text published between 2014 and 2019. With these additional

search refinements, search results listed 7,502 sources. I used the following key terms: *blended learning, hybrid learning, rotation model, K-12, education, effectiveness, elementary,* and *mathematics*. To continue to narrow the search, additional key terms were added: *fourth and fifth grade*. This search result listed 19 sources.

Additional research was also conducted using Google and Google Scholar. When using these search engines, the same key terms that I used to search the Walden University Library database were used. The results from this search included additional articles, as well as government documents that discussed blended learning in the classroom. I did not find specific results that discussed the effect of blended learning using the rotation model on student mathematics achievement in Indiana using NWEA Map Growth Mathematics Assessment results.

Theoretical Framework

For this study, I used the cognitive theory of multimedia learning as the theoretical framework to investigate blended learning using the rotation model. The cognitive theory of multimedia learning was used in my study to explain whether the use of blended learning through the rotation model by selected central Indiana teachers is an effective instructional practice to use in classrooms. This theory will be discussed in detail in the following section.

Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning that I used to frame the research entails that the "human information-processing system includes dual channels for visual/pictorial and auditory/verbal processing, each channel has limited capacity for

processing, and active learning entails carrying out appropriate cognitive processing during learning" (Mayer, 2009, p. 57). I used this theory to frame my research because blended learning using the rotation model includes the use of multimedia for the online part of instruction. Blended learning using the rotation model may assist in providing dual processing, aid with limited capacity, and provide opportunity for active processing.

Dual processing is described as how the brain processes information from both visual images and verbal stimuli. When a student can process information using both types of instruction, learned information is more likely to be processed into their long-term memory. Visual stimuli are first processed through the eyes and can be presented as images or printed words. Auditory stimuli are received from someone else presenting information. Learning is enhanced when the student is offered both visual and auditory stimuli that complement each other (Mayer, 2009).

Two main principles of the cognitive theory of multimedia learning include pretraining, and lesson segmentation. During pretraining, the teacher presents scaffolded information for the students to understand instruction before the lesson is presented. When a teacher segments a lesson, they break the instruction into smaller sections where students can control the pace of the learning. These two ideologies, pretraining, and lesson segmentation, shelter the student from cognitive overload (Mayer, 2009). The modality principle is defined as how students can retain more information "from pictures and spoken words than from pictures and printed words" (Mayer, 2009, p. 200).

Schuler, Scheiter, and van Genuchten (2011) said that using the multimedia learning theory for educational research is fitting if researchers explain why this theory is

of interest. Blended learning was examined in the included research studies and is reinforced by Mayer's theory of multimedia learning (2009). Additionally, Kennedy, Thomas, Meyer, Alves, and Lloyd (2014) said that general and special education high school social studies students who participated in content acquisition podcast (CAPs) lessons significantly outperformed the students who received instruction through text-based lessons on the weekly checks and on the posttest.

The cognitive theory of multimedia learning was used to frame my study because it may support the concept of blended learning using the rotation model. The rotation model of blended learning that was implemented during mathematics by selected central Indiana teachers has students rotate on a fixed schedule or at the teacher's discretion between learning modalities, and at least one rotation involves online learning. The online portion of student mathematics instruction allows for dual processing of information, limited capacity, and active processing. Students are given the opportunity to be active participants in their learning by completing online instruction at their own pace. They can take part in dual processing using interactive videos, visual text, read aloud text, and interactive curriculum. They can also personalize the pace of lessons by controlling information during assigned online time. Students can do this by having the choice to redo lessons or move forward to the next lesson at a personalized pace once they have demonstrated mastery. In addition, students can be active participants in their learning by integrating information as they complete online lessons and thus are able to gain knowledge regarding learned lessons so there are no gaps in their learning. The cognitive theory of multimedia learning also supports segmentation of lessons. When a

teacher segments a lesson, they break the entire lesson into small sections of instruction where the students can control the pace. Classrooms from selected central Indiana schools that are using blended learning and rotation model are segmenting lessons throughout mathematics instructional time.

Literature Review Related to Key Variables

Defining Blended Learning

Generally, blended learning is a combination of face-to-face learning and online learning. Banyen et al. (2016) defined blended learning as an instructional practice that combines face-to-face and online educational delivery of instruction. Prescott et al. (2018) described blended learning as a practice where students can control the pace and location of their learning. Means, Bakia, and Murphy (2014) stated that blended learning generally provides at least 30% of online instruction and at least 21% of face-to-face instruction. Mahalli, Nurkamto, Mujiyanto, and Yuliasri (2019) said that blended learning allows students to learn individually at their own pace.

There are a variety of blended learning models. The Clayton Christensen Institute (2019) recognized four categories of blended learning: (a) rotation, (b) flex, (c) a la carte, and (d) enriched virtual model. The rotation model focuses on students rotating between learning modalities that include at least one online learning activity. In the flex model, online learning is where most of the student learning occurs. Students work at their own pace through the curriculum and teachers provide support when needed. For the a la carte model, students take a course entirely online combined with receiving instruction in other courses a brick-and-mortar setting. Finally, the enriched virtual model allows

students to work online at their own pace, with scheduled face-to-face meetings with their instructor.

In this study I focused on blended learning using the rotation model. The students who participate in the blended learning using the rotation model environment are provided with self-paced instruction that includes online activities. During the face-to-face instruction, the students are grouped according to data collected from the NWEA Map Growth Mathematics assessment. These data allow the teacher to provide students with direct instruction that targets the students' learning needs.

Research on Blended Learning

Effectiveness. Blended learning may have the potential to improve student achievement in mathematics (Angelone, 2019). Several researchers found evidence that students who use blended learning in the classroom have shown an increase in learning achievement (Baranova, Khalyapina, Kobicheva, & Tokareva, 2019; Boninger, Molnar, & University of Colorado at Boulder, 2019; D'addato & Miller, 2016; Fazal & Bryant, 2019; Harris et al., 2016; Minicozzi, 2018; Misfeldt & Zacho, 2016; Seage & Türegün, 2020; Shechtman, Roschelle, Feng, & Singleton, 2019). Although researchers have studied the effect of blended learning, there still is a lack of research on its effectiveness (Dziuban et al., 2016; Shechtman, Roschelle, Feng, & Singleton, 2019).

In designing this study, I used research that has been conducted in various blended learning environments. After reviewing this literature, I was able to develop the problem and purpose statements for my study. Misfeldt and Zacho (2016) stated that selected Denmark third grade teachers that included technology into their mathematics

classroom self-reported an increased competence of using this assessment, and students reported that they were able to increase their understanding of mathematics. This resource provided information for this study on the effects of blended learning and how incorporating technology can improve the learning experience for students.

Minicozzi (2018) provided participating teachers with iPads and digital curriculum to assist them in better meeting the needs of K-2 students. Minicozzi used a case study approach using two surveys to better understand by quantitative methods how teachers have been trained to use technology in the classroom. In the qualitative portion of the study, Minicozzi et al. used focus group interviews to explore how teachers used the iPad to better meet the learning needs of K-2 students. Minicozzi found that there is a need for embedded technology integration throughout teacher preparation coursework to better prepare K-2 teachers and that with appropriate training, teachers can effectively integrate iPads into lessons which benefit student learning. Similarly, Harris, Al-Bataineh, and Al-Bataineh (2016) analyzed whether one-to-one technology had an impact on student achievement and motivation. Harris et al. included fourth-grade participants from two different classrooms in a Title 1 elementary school. Harris et al. gathered data through the Pearson enVision Math series with topic tests, Discovery Education assessment results, and attendance records. They found that one-to-one technology could be a factor in student academic achievement and motivation to learn. Their findings are important because many schools are using the instructional practice of blended learning.

Lin, Tseng, and Chiang (2017) examined the effects of blended learning on junior high students' learning achievement and students' attitude toward mathematics. The

authors included 54 seventh-grade students for 8 months; one group was a control group that received traditional teaching methods of whole class teaching, while one group was the experimental group that was exposed to blended learning with the use of videos, guided questions, and the use of Moodle. The authors used a pre and posttest to measure student achievement. The results were measured by ANCOVA and MANCOVA analyses demonstrated that the experimental group showed statistically higher achievement scores on the mathematics posttest. The authors found that the results supported that the use of blended learning in the mathematics classrooms showed a significant positive effect on student academic achievement.

Teacher perceptions. The effectiveness of blended learning may be impacted by teacher perceptions and attitudes. Anderson, Boaler, and Dieckmann (2018) discussed how making educational reforms may be difficult because many teachers continue to use previous teaching methods even after participating in professional development regarding new methods. The level of comfort a teacher has with blended learning using the rotation model may influence how this instructional practice is integrated into the classroom (Bicer & Capraro, 2017; Yaghmour, 2016). Anderson et al. (2018) examined how teacher beliefs on new instructional practices can impact the effectiveness of implementation. The authors conducted a mixed-methods study using 40 teachers from eight different school districts. Anderson et al. used observations of lessons, teacher reflections, interviews, and student increase in achievement to provide data for the study. Anderson et al. found that a change in teacher mindset regarding new instructional techniques was important for the selected mathematics teachers to make a change in

instruction. To make educational reforms successful, teachers need to be willing to make instructional changes in their mathematics classrooms. This can directly impact student achievement (Anderson et al. 2018).

Generalizability. Blended learning research has largely been focused on the postsecondary education level where blended learning has been accepted more quickly to accommodate the need for flexibility in time and location of instruction (McGee & Reis, 2012). Because there is a lack of standardized definitions for blended learning, it remains unclear how many students are participating in blended learning at any level (Dziuban, Picciano, Graham, & Moskal, 2016). Thus, the generalizability of the reviewed research studies is uncertain because most data that have been collected are from postsecondary education. There are limited data that examine the effect of blended learning at the K-12 level. Most researchers who have examined blended learning specifically related to K-12 students, indicate that blended learning may be an effective practice in increasing academic achievement (Agosto et al., 2013; Brown, 2015; Chee, L., Jalil, H., Ma'rof, A. & Saad, W. 2020; Dziuban et al., 2016; Eyyam et al., 2014; Lin et al., 2017). Many researchers that have studied blended learning state that there is a need for further research to examine the effectiveness of blended learning on student achievement (Anderson et al, 2018; Bicer & Capraro, 2017; Liachovitzky & Wolf, 2019; Lin, Tseng, & Chiang, 2017; Yaghmour, 2016).

The gap in research reviewed suggests a need to know what specific types of blended learning are most effective. Most of the research on the effect of blended learning pertains to the postsecondary or secondary level and further research should be

conducted at the elementary level. I used a quasi-experimental design, and I conducted an independent sample *t* test to analyze the data from the nonequivalent groups. I investigated the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics.

Blended Learning Implementation at Study School Site

Blended learning using the rotation model as implemented by selected central Indiana schools allows students to personalize their learning through online and face-to-face instruction. Throughout the online portion of mathematics instruction, students participate in self-paced lessons that provide instructional videos, interactive practice, and assessment. This online instruction enables students to individually remediate, reinforce, or enrich their learning skills at their own pace, as supported by the cognitive theory of multimedia learning.

During the face-to-face portion of the rotation model of blended learning, the selected central Indiana schools used the assessment data gathered from the online portion to plan differentiated learning instruction for small groups. Students were grouped together using this data to develop lessons that met individual learning needs. During one rotation, these groups met with the teacher to receive face-to-face instruction that was targeted to their learning needs.

Table 1

Time Allotment for Instruction

Traditional Model of Mathematics	**Rotation Model of Mathematics**
45-minute whole group lesson	10-minute whole group mini lesson

(table continues)

introducing grade level mathematics standard and objective for learning	introducing grade level mathematics standard and objective for learning
10-minute whole group practice of grade level standard	45-minute rotation of stations where students participate in online learning, partner learning, and face-to-face instruction with the teacher
5-minute whole group review of objective and grade level standard	5-minute whole group review of objective and grade level standard

Summary

In this literature review I identified that there is a limited amount of published research on the effect of blended learning using the rotation model at the elementary level. I also revealed that many research studies on blended learning focus on defining this practice or focused on the secondary level. Due to the lack of consensus on the definition of blended learning, the research lacks generalizability and is less significant. In this chapter, I also included peer-reviewed articles where researchers defined blended learning and examined the effect of this practice on student achievement. In the literature review, I located research that did not provide evidence that the implementation of blended learning was effective, and authors suggested further research.

The cognitive theory of multimedia learning may provide evidence as to how using the rotation model may be an effective model of blended learning (Mayer, 2014). Blended learning using the rotation model as implemented by the three selected central Indiana teachers allows students to personalize their learning through online and face-to-face instruction. Throughout the online portion of mathematics instruction, students participate in self-paced lessons that provide instructional videos, interactive practice, and assessment. This theory supports that using the rotation model may assist in providing

dual processing, aid with limited capacity, and provide opportunities for active processing which can help improve student achievement.

In Chapter 3, I discuss the methods used to examine the effect of blended learning using the rotation model on fourth and fifth grade students' mathematics achievement. I identify the specific population that was included in my study and describe sampling procedures and data collection. This study was developed to examine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics and address the gap in literature pertaining to the effect of blended learning using the rotation model in fourth and fifth grade mathematics classrooms.

Chapter 3: Research Method

Introduction

The purpose of this study was to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics as measured by the NWEA Map Growth Mathematics assessment by comparing the scores of students who use a blended learning model in the classroom to the scores of their peers who do not. In this chapter, I include a discussion regarding the methodology of this study. I also discuss information regarding the specific population that was used in this study, sampling procedures, data collection, instrumentation and operationalization constructs, threats to validity, ethical procedures, and a summary.

Research Design and Rationale

The research design of this study is quantitative. In this study, I investigated the effect of blended learning using the rotation model on fourth and fifth grade students' achievements in mathematics. The independent variable in this study was the type of instruction, either blended learning using the rotation model or traditional learning. The dependent variable was NWEA Map Growth Mathematics assessment scores of selected fourth and fifth grade students.

I used a quasi-experimental approach and conducted an independent samples *t* test to analyze data from nonequivalent groups: students who are receiving instruction in mathematics through blended learning using the rotation model and students in the traditional setting. There are differences between the two groups. Some of these differences could involve learning ability, attendance, and behavior of students. Selected

central Indiana schools began implementing blended learning using station rotation in 2016. Selected central Indiana fourth and fifth grade teachers received professional development beginning in 2016, and this training has been ongoing for the past 4 years. The selected central Indiana fourth and fifth grade teachers use data from the NWEA Map Growth Mathematics assessment to make instructional decisions for students. Students are placed in classrooms based on assessment data, behaviors, and specific learning needs. School administrators create mathematics classes that are balanced so that teachers and principals can compare the NWEA Map Growth Mathematics assessment growth data between the two groups: blended learning using the rotation model, and traditional. This allows the school administrators and teachers to analyze the assessment growth scores of students who are participating in blended learning using the rotation model during mathematics compared with students who are participating in the traditional model during mathematics.

Methodology

In this section, I include information regarding the study population, sampling procedures, data collection, and instrumentation and operationalization of constructs. The study population was collected from three selected central Indiana elementary schools. The data retrieved was archival assessment growth data from the NWEA Map Growth Mathematics assessment pre and posttest scores. To gather this archival data, permission was requested from the three selected principals from the three different selected schools. Since this study used deidentified archival data, individual recruitment and permissions were not necessary.

Population

In this study, the population was fourth and fifth grade students from three selected central Indiana elementary schools. The current total population includes 282 fourth grade students and 301 fifth grade students. The demographic of the current population is 81.2% White, 6.4% Black, 5.8% multiracial, 5.2% Hispanic, 1.1% Asian, 0.2% American Indian, and 0.1% Native Hawaiian or other Pacific Islander.

Sampling and Sampling Procedures

For this study I used a total of 300 participants: 150 fourth graders and 150 fifth graders. The reason for selecting this number of participants was so that I could account for any students who moved out of the classroom, resulting in skewed results. According to G*Power software, the minimum number of participants for this quantitative study to be reliable was 176 students. By including 300 participants, I hoped to find reliable data that could add to research regarding blended learning at the elementary level. I examined if there were differences between student mathematics achievement scores depending on the type of instruction that the students participate in for 16 weeks. There was one independent variable with two identified groups (blended learning using the rotation model and traditional instruction). This study used one dependent variable (NWEA Map Growth Mathematics assessment scores). I conducted an independent sample *t* test to analyze data from nonequivalent groups.

G*Power software was used to identify the appropriate sample size for this study. This software was chosen because it helped identify the minimum required participants needed in this study to detect statistical differences between the two groups. G*Power

software was set to run an independent *t* test and a means statistical test that shows differences between the two independent groups. The effect size was set at 0.5, the error probability was set to 0.05, and power was set at .95. Power is a measurement to ensure that if I reject the null hypothesis, it is done correctly (see Appendix A).

Procedures for Recruitment, Participation, and Data Collection

Recruitment for this study was conducted through email. I sent emails to three principals at selected central Indiana schools. Emails were sent with a read receipt attached so I could monitor the process of correspondence. Emails included a request for schools to participate in my study. Principals were asked to provide information regarding the type of instruction that the fourth and fifth grade classroom teachers were using and the NWEA Map Growth Mathematics fourth and fifth grade students pre and posttest scores from the beginning (August 2019) to the middle (December 2019) of the school year. Principals were also asked to complete a survey that identified if teachers taught fourth or fifth grade, and what type of instruction was used during mathematics Principals were asked to respond to the initial email to provide informed consent that they were willing to provide archival data from the NWEA Map Growth Mathematics assessment and complete the survey. Once I received approval from Walden University to gather the data, a second email with a read receipt was sent to three selected central Indiana principals. These emails included the survey and a Microsoft Excel document to add student archival data from the NWEA Map Growth Mathematics assessment for the 2019-2020 school year. Principals were asked to complete this information and return it to me by a specific date. In this study, I used gathered archival student data to determine

the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics.

Once I received information from all three selected central Indiana schools, I analyzed data and survey responses. If I did not receive a response from all three principals, a follow-up call was completed to remind them to submit data to me. Once I completed the study and had an approved dissertation from Walden University, I offered a scheduled meeting with principals to review findings of my study. This meeting was optional and scheduled at a mutually agreed upon place and date.

Instrumentation and Operationalization of Constructs

For this study, I used deidentified student pre and posttest data from the NWEA Map Growth Mathematics assessment. The NWEA was developed in 1980 to measure growth and proficiency of student learning so that teachers can develop instruction to meet the learning needs of each student. The NWEA (2019) reported that this instrument is used in more than 9,500 school districts in the United States, as well as education agencies in 145 countries. Selected central Indiana schools have been using the NWEA Map Growth Mathematics assessment since 2014. This instrument was appropriate to use in my study since it measures mathematics skills. When looking at student growth from the beginning to the middle of the year, this report identifies student growth norms for each grade level. For fourth grade, the mean growth is 6.8 points with a standard deviation of 5.05. The mean growth for fifth grade is 5.8 points with a standard deviation of 5.22 (NWEA, 2019). Pre and post assessment data were used in the deidentified format. This data were used to analyze if students in the blended learning class are

showing more growth than students in the traditional setting. Because I used archival data, permission from the developer was not required for this study.

I also used a descriptive survey to collect demographic data regarding the fourth and fifth grade classroom teachers that were included in the study. An example of the information that was gathered included if the teacher was using blended learning with the rotation model during mathematics instruction. The three selected principals answered questions on this survey to indicate the number of years that the teachers have been teaching in the current setting. This survey was sent to the three selected central Indiana principals through email and a follow up call was made when necessary. Since I developed the survey, permission was not needed.

Data Analysis Plan

Deidentified archival student data was received from the selected central Indiana schools using Microsoft Excel. Once this data were gathered from selected Central Indiana schools, I used SPSS Version 25 to analyze deidentified student data To ensure the data gathered from the selected schools were valid, I screened the data for errors and duplications. I sent the selected central Indiana schools the same Excel spreadsheet for principals to add deidentified archival student data. The principals used this spreadsheet to identify the specific data they should include from the NWEA Map Growth Mathematics assessment reports. This ensured the collected data were identical from each school.

Research Question

RQ: Is there a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom?

H_0: There is no statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

H_a: There is a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

Testing of the Hypotheses

The hypotheses were tested by analyzing the *t* statistic and *p*-value from the data used to conduct the independent *t* test. I used the *t* statistic to determine if I would accept or reject the null hypothesis. The *p*-value identified the significance of the results of this study. I used the data to identify if there were significant differences in terms of NWEA Map Growth Mathematics assessment scores between fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and students who stayed in the traditional classroom.

Additional Exploratory Analyses and Supplemental Comparisons

The independent variable was the type of instruction used by the teacher, to include blended learning or traditional learning, and the dependent variable is the NWEA

Map Growth Mathematics assessment scores. Deidentified archival student data was received from selected central Indiana principals using Microsoft Excel. I used SPSS Version 25 to analyze variables and data. To test assumptions of homogeneity of variance, I used Levene's test of equality of variances in SPSS statistics when I ran the independent *t* test on the data from selected central Indiana schools. I used this test to determine if the population variances were equal (Warner, 2013). This test for homogeneity of variance delivered a significance value (*p*-value). If the result of this test is greater than 0.05, the group variances can be treated as equal. However, if the results of this test are less than 0.05, the group has unequal variances, and this violates the assumption of homogeneity of variances.

Threats to Validity

When research is conducted, there are internal and external threats to validity. It is important to identify possible threats and attempt to decrease the threats while maintaining the feasibility of the study. I have identified two possible internal threats to this study. The first internal threat that is being considered is attrition. Attrition can occur when data is collected from different points of time (Miller & Hollist, 2007). Once the data from the selected central Indiana schools is received, there may not be identical data collected from the NWEA Map Growth Mathematics student scores from pre to posttest if participants drop out from either learning environment. To address this threat, I screened this data and equated the data from the pre and posttest. The second internal threat is selection. As the researcher, I did not randomly assign students who would participate in blended learning using the rotation model or students who would participate

in the traditional classroom. Therefore, participant selection may be a possible internal threat. To minimize these two internal threats, students' assessment data that does not have a pre and posttest score were not included in the analysis.

The external threat that was identified in this study is selection bias. Selection bias is a threat because I limited my study to one specific subject. In this study, I focused only on the subject area of mathematics. The purpose was to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics, thus prohibiting generalizability to other academic areas.

The dependent variable data were NWEA MAP Growth Mathematics assessment scores. NWEA has provided each school with reference charts that display normative data that shows the expected growth at each grade level. For fourth grade, the mean growth is 6.8 points with a standard deviation of 5.05. The mean growth for fifth grade is 5.8 points with a standard deviation of 5.22.

Ethical Procedures

Data Collection

This study used archival data gathered from the selected central Indiana schools. Having access to archival data that is SPSS ready was a key factor for this study. Permission to conduct the study was obtained from the Walden University Institutional Review Board (IRB) (06-12-20-0721472) and selected school administrators (see Appendix B). There was not a plan to conduct an exit procedure or have any additional follow-up with the participants because I used archival data. Since the data for this study were collected as archival data, there was no need to contact the participants.

Risks

Archival data was used in this study, so there were not any legal or psychological conflicts. I developed a letter of cooperation that was given to selected central Indiana schools prior to gathering data. This letter contained the purpose of the study and how data were used, with the intent of eliminating potential legal issues.

Role of the Researcher

This study involves data from selected central Indiana schools where I was previously employed. When the study was completed, I was no longer employed at these selected schools. My role in this study was to contact principals from three selected central Indiana schools, gather data for this study, and analyze these data to determine the effect of blended learning on fourth and fifth grade students' mathematics achievement.

Treatment of Data

In this study, the data used was deidentified. This data was received from the selected school's administrative staff. I have protected this data without any identifiers. The deidentified data will be securely stored for 5 years.

Summary

In this chapter, I have discussed the research design, methodology, instrumentation and operationalization of constructs, threats to validity, and ethical procedures. I have provided information regarding how this study will be designed to determine if there are significant differences in terms of NWEA Map Growth Mathematics assessment scores of students who use a blended learning using the rotation model in the classroom compared to their peers who do not use this model. For this study

I used a quasi-experimental approach and conducted an independent sample *t* test to analyze data from nonequivalent groups. In Chapter 4, I provide information on data collection as well as results from this study.

Chapter 4: Results

This study was developed to examine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics to fill the gap in research on this topic. In this quantitative study, I used data from the NWEA Map Growth Mathematics assessment collected from three selected central Indiana elementary school principals. I conducted this study to determine if there were statistical differences between NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and those in the traditional classroom. Mayer's cognitive theory of multimedia learning was used to guide this study.

The following research question and hypotheses guided this study:

RQ: Is there a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom?

H_0: There is no statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

H_a: There is a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

In this chapter, I provide information on data collection for this study, describe the recruitment process, outline the timeframe for collecting data, and present descriptive characteristics of the sample. Results from the study are discussed and tables that display resulting data are shared. Finally, the chapter is concluded with a summary that includes answers to the research question and an introduction to Chapter 5.

Data Collection

Timeframe and Recruitment

I received approval to collect data for this study from the Walden University IRB on June 12, 2020. The IRB approval number for this study is 06-12-20-0721472. Upon receiving approval from the IRB, invitation emails were sent to three selected central Indiana school principals along with a read receipt on June 13, 2020. This invitation email included an explanation of the purpose of the study, directions for completing the survey, and information for returning deidentified NWEA Map Growth Mathematics assessment data (see Appendix C). On June 15th, 2020, I received survey responses and deidentified student data from two of the three principals. A follow-up call was made on June 17, 2020 to the principal who had not returned data. This principal followed up on June 18, 2020 with the completed survey and deidentified student data. This study had a 100% response rate from the three selected principals.

Baseline Demographics

After collecting deidentified student data, I had a total of 590 deidentified student assessments. When planning for this study, I had stated that there would be 300

deidentified student assessments to analyze. I decided to use all 590 returned deidentified student assessment scores so that the statistical power for this study would increase.

The population for this study was fourth and fifth grade students from three selected central Indiana elementary schools. The current total population of students in these three schools was 313 fourth grade students and 277 fifth grade students. The demographic of this population was 81.2% White, 6.4% Black, 5.8% multiracial, 5.2% Hispanic, 1.1% Asian, 0.2% American Indian, and 0.1% Native Hawaiian or other Pacific Islander.

I used a purposive sampling strategy for this study. According to Amin, Utaya, Bachri, Sumarmi, and Susilo (2020), this type of sampling allows researchers to provide a sample that is representative of the population. All 590 deidentified assessment scores were included in this study to ensure the sample group was proportionate to the three selected central Indiana student population.

The deidentified sample of fourth graders consisted of 313 students. This included 225 students who participated in blended learning using station rotation and 88 students who stayed in a traditional setting. The survey results completed by the three selected principals (see Appendix D) identified that there was a total of 16 fourth grade teachers. Principals had to identify the type of instruction that each teacher used during mathematics instruction. The survey included definitions of blended learning using the rotation model and the traditional classroom. Blended learning using the rotation model was defined as: Students rotate on a fixed schedule or at the teacher's discretion between learning modalities, and at least one rotation involves online learning. The traditional

teaching model was defined as: Teachers provide instruction in a whole group setting for introducing grade level mathematics standards and objectives for learning, instruction, and practice. Blended learning using the rotation model was coded as 1, and the traditional teaching model was coded as 2. There was a total of 11 fourth grade teachers who were identified as using blended learning with the rotation model during mathematics instruction. The three selected principals stated that there was a total of 5 fourth grade teachers who provided instruction in the traditional setting. There were 10 students from the blended learning using the rotation model group and eight traditional model students who were missing assessment scores. To control for the internal threat of attrition, I did not include these students' assessment data in the analysis.

The deidentified sample of fifth graders consisted of 277 students. This included 200 students who participated in blended learning using station rotation and 77 students who stayed in a traditional setting. The three selected principals identified that there were 13 fifth grade teachers. There was a total of eight fifth grade teachers who were identified as using blended learning with the rotation model during mathematics instruction and five fifth grade teachers who provided instruction in the traditional setting. There were nine students using the rotation model group and seven traditional model students who were missing assessment scores. Once again, these students' assessment data were not included in the analysis to control for the internal threat of attrition.

Study Results

In this study, the data analysis plan included the use of an independent *t* test to test my hypothesis. Researchers use an independent *t* test to test statistical differences between means. I analyzed NWEA Map Growth Mathematics assessment scores from 590 participants to address the research question. Descriptive statistics in Table 2 show that 72% of the students used blended learning using the rotation model compared to 28% of the students that participated in the traditional model. There was a difference of 258 students between students that participated in blended learning using the rotation model, and students that participated in the traditional model. The discrepancy between the planned sample size of 300 students and the actual sample size of 590 students was the result of student growth at the selected central Indiana schools. I decided to use all 590 returned, de-identified student assessment scores so that the statistical power for this study would increase. The selected central Indiana principals provided the requested de-identified student data from the 2019–2020 school year for their current enrollment of fourth and fifth grade students. I completed the data collection plan that was presented in Chapter 3 without any other discrepancies.

Table 2

NWEA Growth Mathematics Scores Group Statistics

Groups	*N*	*M*	*SD*	*Standard Error Mean*
Traditional	166	6.30	6.712	.521
Blended learning	424	6.26	6.304	.306

In this study, I used an independent *t* test. To check the fulfillment of requirement for this analysis I had to examine the equality of variance and the normal distribution of variables. To examine the equality of variance, I used the Levene's test for equality of variances in the SPSS output. In the SPSS output, I was provided with an equal variance assumed, and an equal variance not assumed. The Levene test was used in this study to determine which data to report. The normal distribution of variables is important to review because to use an independent t test the dependent variable, NWEA Map Growth Mathematics assessment scores, should be normally distributed between both groups.

Using SPSS Version 25, I conducted an independent *t* test. The output from the Levene's test for equality of variances showed a *F* value of .139 and $p = .710$. These data were analyzed to determine if there were any variances within the samples. I assumed that the variances are approximately equal and that the mean scores between the group are not statistically significant. The *p* value of .710 is well above the conventional threshold of 0.05. This indicated there was no evidence to reject the null hypothesis of the Levene test. The results from the independent *t* test are presented in Table 3.

Table 3

Levene's Test of Equality

		Treatment Equal variances assumed
t test for equality of means	*T*	.067
	Df	588
	Sig. (2-tailed)	.947
	Mean difference	.039
	Std. error difference	.588

The NWEA Map Growth Mathematics assessment mean growth scores for the students in the blended learning using station rotation (M = 6.26, SD = 6.30 and the students in the traditional model (M = 6.30, SD = 6.71) conditions t (588) = .07, p = .947 displays data that supports the failure to reject the null hypothesis. In this study, N represents the total number of NWEA Map Growth Assessment scores for both groups (N = 588). There is no statistically significant difference in NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and students who were in the traditional classroom.

In this study, I reported that there was not a significant effect, so there is not a need to calculate the size of the effect. If I were to calculate the effect, I would have used an online statistics calculator. The effect size would have been found by dividing the mean difference by the standard deviation. To find the effect size, I entered both groups' means, standard deviations, and number of participants per group into this calculator. The Cohen's d = (6.26-6.3)/6.511197 = 0.006143, which is a very small effect size. Since the groups do not differ by at least 0.2 standard deviations, the difference is insignificant. When analyzing the confidence interval, the lower limit was -1.115 and the upper limit was 1.194. This data supported the failure to reject the null hypothesis.

Summary

The purpose of this quantitative study was to determine the effect of blended learning using the rotation model on fourth and fifth grade students' NWEA Map Growth Mathematics assessment scores. In this study, I used a quasi-experimental approach and

conducted an independent samples *t* test to analyze data from nonequivalent groups: 424 students that received instruction in mathematics through blended learning using the rotation model and 166 students in the traditional setting. Amin et al. (2020) stated that when the researcher cannot control all external variables, using a quasi-experimental approach is appropriate. The results from the independent *t* test (i.e., students in the blended learning using the rotation model [$M = 6.26$, $SD = 6.30$] and the students in the traditional model [$M = 6.30$, $SD = 6.71$] conditions $t\ (588) = .07$, $p = .947$) supported the failure to reject the null hypothesis. There is no statistically significant difference in NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and students who are in the traditional classroom.

The goal for this study was to provide data to address a gap in the literature on blended learning at the elementary level and help school administrators make decisions on allocating educational funds for implementing blended learning using the rotation model into the mathematics classroom. In Chapter 5, I will interpret the findings of the study, discuss the limitations, describe recommendations for further research, and identify implications for potential positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

This quantitative study involved determining the effect of blended learning using the rotation model on fourth and fifth grade students' NWEA Map Growth Mathematics Assessment scores. For this study, I used deidentified student data from the NWEA Map Growth Mathematics assessment. Hypotheses were tested by analyzing the *t* statistic and *p*-values from data used to conduct the independent *t* test. This quantitative study showed there were no statistically significant differences in terms of NWEA Map Growth Mathematics assessment scores between fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and those who participated in the traditional classroom.

This study provided insight into how blended learning using the rotation model affects selected central Indiana fourth and fifth grade students' mathematics scores. I worked to present original research and empirical data so that selected central Indiana elementary administrators can determine if allocating funds and professional development resources to implement blended learning using the rotation model into the elementary classroom is a meaningful practice. This chapter will include a summary of my study, interpretation of findings, limitation of the study, recommendations for further studies, and information regarding potential for positive social change.

Interpretation of Findings

The results of this quantitative study showed there were not statistically significant differences in terms of NWEA Map Growth Mathematics assessment scores between fourth and fifth grade students who participated for 16 weeks in blended

learning using the rotation model and those who were in the traditional classroom. These results did not align with part of the research discussed in Chapter 2. Several research studies reviewed in Chapter 2 supported that blended learning was an effective instructional practice for improving student achievement (Angelone, 2019; Baranova, Khalyapina, Kobicheva, & Tokareva, 2019; D'addato & Miller, 2016; Fazal & Bryant, 2019; Harris et al., 2016; Minicozzi, 2018; Misfeldt & Zacho, 2016; Seage & Türegün, 2020; Shechtman, Roschelle, Feng, & Singleton, 2019). The findings from my study showed there was not a significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and those in the traditional classroom. The findings from this study aligned with the research studies discussed in Chapter 2 that did not provide evidence that the implementation of blended learning was effective (Divayana, 2019; Shechtman, Roschelle, Feng, & Singleton, 2019; Ullman, 2017; Yaghmour, 2016). Also discussed in Chapter 2, there was a need for further research on the effect of blended learning on student achievement. According to the literature, researchers suggest that educators need to know what specific types of blended learning are the most effective (Dziuban et al., 2016; Shechtman, Roschelle, Feng, & Singleton, 2019). This study's results add to the research on the effect of blended learning using the rotation model at the elementary level. The results from this study can be used to help school administrators determine if blended learning using the rotation model should be used during mathematics instruction.

For this study, I used the cognitive theory of multimedia learning as the theoretical framework to investigate blended learning using the rotation model. Mayer (2009, 2014) explained that the cognitive theory of multimedia learning may support blended learning using the rotation model because it may assist teachers in providing dual processing, auditory and visual, allowing teachers to aid with limited capacity, and provide a student the opportunity for active processing. The cognitive theory of multimedia learning supported part of the literature in Chapter 2, whose results showed that blended learning was an effective instructional method in mathematics (Angelone, 2019; Fazal & Bryant, 2019; Minicozzi, 2018). In this study, I developed one research question and corresponding hypotheses and used an independent sample t test to analyze the data.

RQ: Is there a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom?

H_0: There is no statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

H_a: There is a statistically significant difference in terms of NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participate for 16 weeks in blended learning using the rotation model and those in the traditional classroom.

The three selected central Indiana principals identified the type of instruction each fourth and fifth grade teacher provided during mathematics: blended learning using the rotation model or traditional. I used Mayer's cognitive theory of multimedia learning to frame my research because it revealed that blended learning using the rotation model may assist in providing dual processing, aid with limited capacity, and provide students an opportunity for active processing. The cognitive theory of multimedia learning was also used to help define blended learning using the rotation model so the principals could have a clear understanding of this model when they were choosing the type of instruction that the selected fourth and fifth grade teachers use during mathematics instruction.

Analyzing the results from the independent *t* test, I was able to answer the research question. The results from the independent *t* test, students in the blended learning using rotation model [M = 6.26, SD = 6.30] and the students in the traditional model [M = 6.30, SD = 6.71] conditions t (588) = .07, p = .947, supported the failure to reject the null hypothesis. I concluded there were no statistically significant differences in terms of NWEA Map Growth Mathematics assessment scores between fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and those who were in the traditional classroom. Results from this study did not support the cognitive theory of multimedia learning because it did not support that there was a significant difference in fourth and fifth grade student's mathematics assessment scores who participated for 16 weeks in blended learning using the rotation model.

Limitations of the Study

In this study, I examined NWEA Map Growth Mathematics scores of fourth and fifth grade students in three suburban schools. This selection limited generalization to other grade levels. The results may only be representative of fourth and fifth grade students in a similar population. For this research study, I focused exclusively on the subject area of mathematics using the rotation model of blended learning. In this study, I identified two limitations. First, the quality of the information gathered may be influenced by how accurately the principals responded to the descriptive survey. Principals were asked to identify which type of instruction each fourth and fifth grade teacher used during mathematics instruction. The survey included definitions of blended learning using the rotation model and the traditional model to help principals accurately identify the type of instruction for each teacher so that this data is reliable. Follow up phone calls were conducted for participants who provided sparse answers or failed to respond to the initial survey. By following up with the participants, I was able to provide reliable data from the three selected principals to use in this study. Second, since the participants worked in a school corporation where professional development was provided weekly, and there was a priority placed on technology integration into the classroom, results may not apply to surrounding school corporations with limited technology and less focused professional development opportunities.

Recommendations

The findings of this study add to the research on the effect of blended learning using the rotation model on fourth and fifth grade students' mathematics achievement.

The results from this study showed that there was not a significant difference in NWEA Map Growth Mathematics assessment scores of fourth and fifth grade students who participated for 16 weeks in blended learning using the rotation model and students who are in the traditional classroom. The first recommendation for future studies would include conducting additional research on fourth and fifth grade students in different population areas. The results of this study are only representative of fourth and fifth grade students in a suburban population. Further research should be conducted to analyze the effect of blended learning using the rotation model on fourth and fifth grade students from different environments, including participants from urban, suburban, and rural areas. The results of this study were limited to the subject area of mathematics. Additional research that examines the use of blended learning at the elementary level that includes other subject areas will add to the literature on the effects of blended learning (Prescott et al., 2018).

This study was conducted to examine the effects of blended learning using the rotation model using a quantitative approach. Further research could be performed utilizing a mixed-methods approach. This type of study would allow a researcher to include quantitative data and qualitative data. A mixed-methods design would enable researchers to examine the effect on blended learning on student mathematics achievement scores and students' perception of learning in mathematics. Another recommendation for using a mixed-methods analysis would be to use quantitative data to examine the effect on blended learning on student mathematics achievement scores and use qualitative data to observe teacher instructional practices within the two instructional

model and compare teacher perceptions. A mixed-methods design may provide a broader and more encompassing study.

Implications

Since 2016, 79% of the fourth and fifth grade teachers from the three selected central Indiana schools have started to use blended learning during mathematics instruction to meet their students' various learning needs. The results of this study indicated there was no significant difference in growth scores for students who received mathematics instruction in blended learning using the rotation model. After examining the results from this study, I have identified potential implications for social change at the organizational and individual levels.

At the organizational level, school leaders can use data from this study, and from other research studies to support if blended learning using the rotation model effectively improves student achievement. As school leaders are making decisions on how to allocate funds to improve instruction, using the results from this study may help support instructional goals and aid in choosing effective instructional methods. Although this study showed that there was not a significant difference in achievement between blended learning using the rotation model, and the traditional model classes, there are additional studies that have shown that blended learning has been more effective. Knowledge of the effect of blended learning on student achievement may support positive social change by helping school district leaders make informed decisions regarding how to increase students' performance in mathematics. The results of this study will be shared with the three selected principals so they may use the findings to determine if the use of blended

learning is an effective model of instruction during mathematics instruction. The findings of this study can be used by these three selected principals as a data resource to monitor the effect of blended learning on students' mathematics assessment scores. If these three selected principals continue to have teachers that use blended learning with the rotation model, the results from this study can be the starting data and then they can continue to review the data from additional NWEA Map Growth Mathematics assessment scores over time.

A possible implication for positive social change at the individual level could be that if teachers understand why school administrators are making instructional changes, there may be more buy-in from teachers. Anderson et al. (2018) examined how teacher beliefs on new instructional practices can impact the effectiveness of implementation. If school administrators are reviewing research to make decisions on how to allocate funds and develop explicit purposes for implementing instructional models like blended learning using the rotation model, there may be buy-in from the teachers. This shift can create positive social change by empowering teachers to implement blended learning using the rotation model with fidelity to help meet the various learning needs of the selected fourth and fifth grade students. This can lead to improvements in student learning and ultimately to increased chances of academic success.

Blended learning using the rotation model may also help support positive social change by allowing teachers and students to develop appropriate relationships to build a positive classroom community. Blended learning using the rotation model enables teachers to interact with small groups of students instead of teaching to the whole group.

Also, the students can be active participants in their learning by integrating information as they complete online lessons. Thus, they can gain knowledge of the learned lessons so that there are no learning gaps in their education. The cognitive theory of multimedia learning allows students to use prior knowledge for new learning through selection, filtering, organizing, and integrating information.

Educators are inundated with different types of instructional methods that claim to improve student learning. A recommendation for practice for school leaders and teachers is to continuously review and analyze research studies on instructional methods so that informed decisions regarding instruction can be made. This is an on-going practice because additional research studies will continue to be conducted on instructional methods such as blended learning using the rotation model.

Conclusions

In this study, I examined the effect of blended learning using the rotation model on fourth and fifth grade students' NWEA Map Growth Mathematics assessment scores The results indicated there was not a significant difference in assessment growth scores for the fourth and fifth grade students that received mathematics instruction in blended learning using the rotation model. According to the literature reviewed in this study, there are mixed results on the effect of blended learning using the rotation model on student achievement. There are studies that show blended learning is effective at improving student achievement (D'addato & Miller, 2016; Fazal & Bryant, 2019; Harris et al., 2016), and there are studies that report that blended learning does not show a significant difference, (Angelone, 2019; Fazal & Bryant, 2019; Minicozzi, 2018). This

study provided evidence that there was not a significant difference in assessment growth scores for fourth and fifth grade students who received mathematics instruction in blended learning using the rotation model. The perpetual challenges for educators include meeting the various learning needs of students who are in their classrooms and being up to date on effective instructional models that best support student achievement. Since blended learning has continued to gain momentum and teachers are continuing to transform classrooms by moving away from traditional whole-class teaching, further research is needed on the effect of blended learning using the rotation model on student achievement in mathematics.

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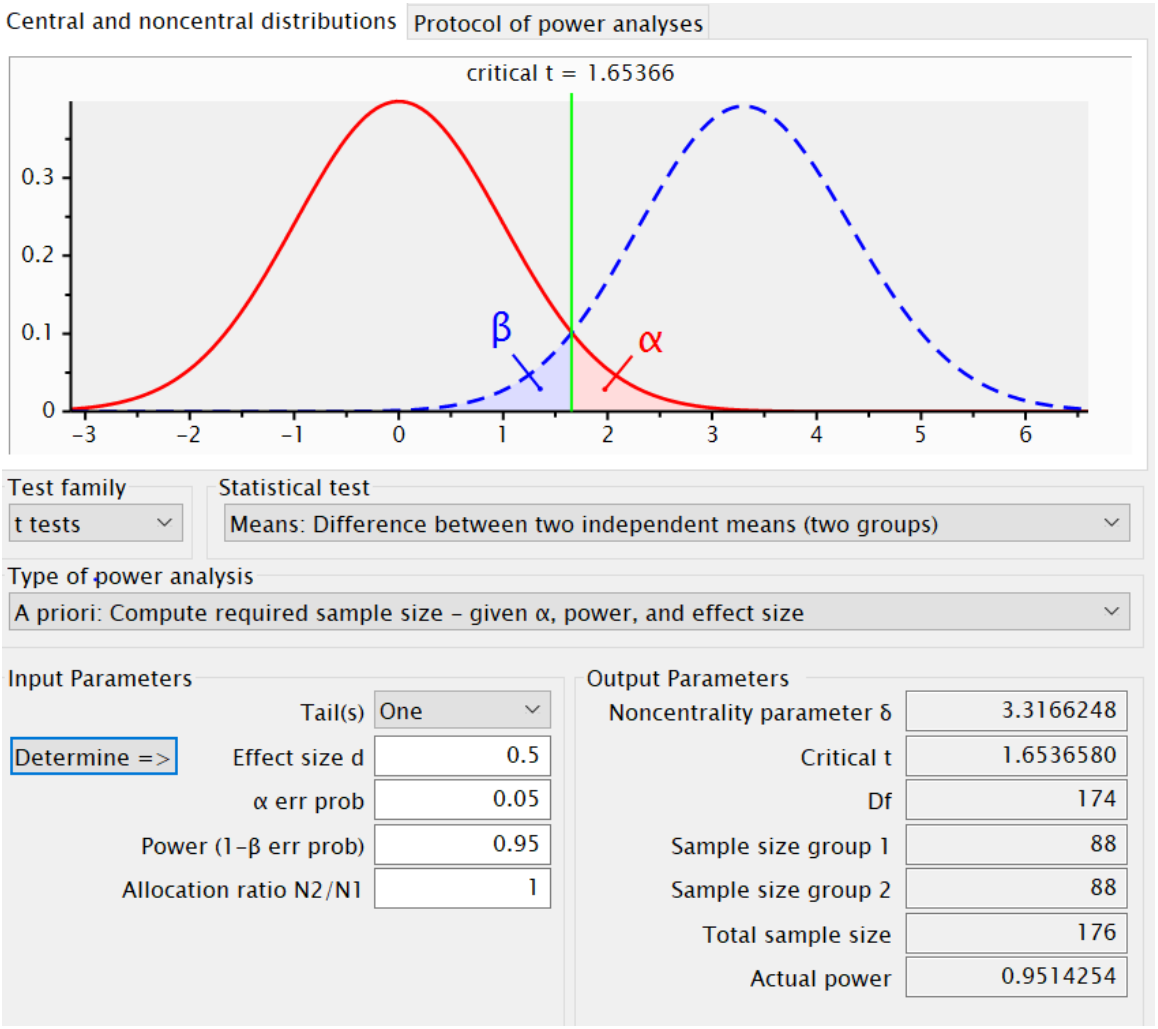
Appendix A: G*Power Results



Appendix B: Informed Consent

You are invited to take part in a research study about blended learning using the rotation model. The researcher is inviting selected Central Indiana elementary principals that work at a school that is identified as using 1-to-1 devices to be in the study. One-to-one devices can be defined in this study as 1 laptop or iPad for each student in the classroom. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Heather A. Roach, who is a doctoral student at Walden University. You may know me as a former employee, but this study is separate from that role.

Background Information:
The purpose of this study is to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics.

Procedures:
If you agree to be in this study, you will be asked to:

- Complete a short survey to provide information about the 4th and 5th grade teachers in your building. This survey will help identify the type of instruction that is happening in each classroom. This survey should take approximately 20-30 minutes to complete.

- Share de identified student data from the NWEA Map Growth Mathematics Assessment from the 2019-2020 school year. This data will be sent to the researcher in a spreadsheet. This data sharing should take approximately 15-20 minutes to complete.

    -Step 1: Download student data from 2019-2020 NWEA Map Growth Mathematics
    Assessment
    -Step 2: Transfer this data into the provided spreadsheet
    -Step 3: Email the spreadsheet that includes the deidentified student NWEA Map
    Growth Mathematics Assessment data to the researcher

Voluntary Nature of the Study:
This study is voluntary. You are free to accept or turn down the invitation. No one at Walden University will treat you differently if you decide not to be in the study. If you decide to be in the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as fatigue. Being in this study would not pose risk to your safety or wellbeing.

Knowledge of the effect of blended learning on student achievement may help school principals and teachers make informed decisions regarding instruction in mathematics.

Payment:
As a thank you for your time and participation in this study, you will be mailed a $10 Starbucks gift card.

Privacy:
Reports coming out of this study will not share the identities of individual participants. Details that might identify participants, such as the location of the study, also will not be shared. The researcher will not use your personal information for any purpose outside of this research project. Data will be kept secure by using de identified student data that will be stored with password protection. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via email at heather.roach@waldenu.edu or at 317-716-2039. If you want to talk privately about your rights as a participant, you can call the Research Participant Advocate at my university at 612-312-1210. Walden University's approval number for this study is 06-12-20-0721472 and it expires on June 11th, 2021.

Please print or save this consent form for your records.

Obtaining Your Consent
If you feel you understand the study well enough and you would like to participate in this study, the first page of the survey will provide an informed consent letter. Please read the informed consent letter and click continue to indicate your consent and complete the survey. If you read the consent letter and do not wish to participate in the survey do not click continue and close the survey window.

Appendix C: Sample Invitation Email to Participants

Dear [principal]

My name is Heather Roach. I am a doctoral student at Walden University. I am asking for your participation in a doctoral study that I am conducting titled: The Effects of Blended Learning Using the Rotation Model on Fourth and Fifth Grade Students' Mathematics Scores. The purpose of this quantitative study is to determine the effect of blended learning using the rotation model on fourth and fifth grade students' achievement in mathematics. In this study, I will use fourth and fifth grade de-identified student NWEA Map Growth Mathematics Assessment data so that I can add to the research on the effectiveness of blended learning using the rotation model.

You will be asked to complete a short survey to provide information about the 4th and 5th grade teachers in your building. This survey will help identify the type of instruction that is happening in each classroom. This survey should take approximately 20-30 minutes to complete. You will also be asked to share de identified student data from the NWEA Map Growth Mathematics Assessment from the 2019-2020 school year. This data will be emailed to the researcher in a spreadsheet. This data sharing should take approximately 15-20 minutes to complete.

If you would like to participate in this study, please click on the survey link below. The first page of the survey will provide an informed consent letter. Please read the informed consent letter and click continue to indicate your consent and complete the survey. If you read the consent letter and do not wish to participate in the survey do not click continue and close the survey window.

Survey link: https://forms.gle/fGuf4ZyRYNGPq4qK7

Thank you in advance for your time and participation. If you have any questions, please feel free to contact me at heather.roach@waldenu.edu or at 317-716-2039.

Sincerely,

Heather Roach

Doctoral Student

Walden University

Appendix D: Survey Results

Principal Survey

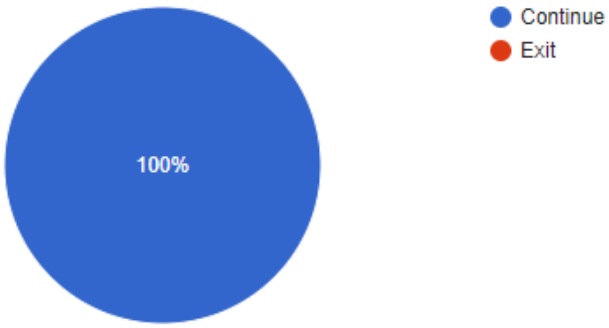
3 responses

Publish analytics

Informed Consent

If you feel you understand the study well enough to make a decision about it, please indicate your consent by replying to this in the first question of the survey that is sent. Please choose the answer, “continue.”

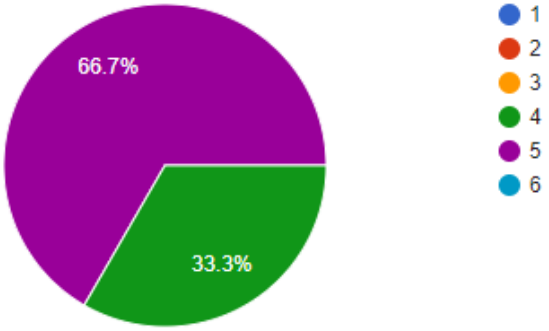
3 responses



Survey Questions

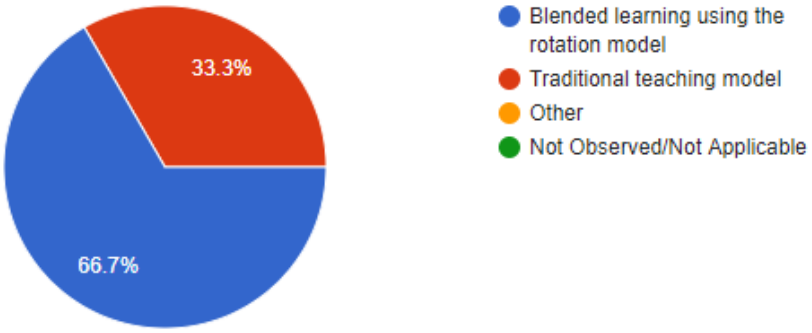
How many 4th grade classroom teachers are in your building?

3 responses



Thinking about your 4th grade teachers in alphabetical order, please identify the type of instruction the teacher uses during mathematics: Fourth grade teacher A mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



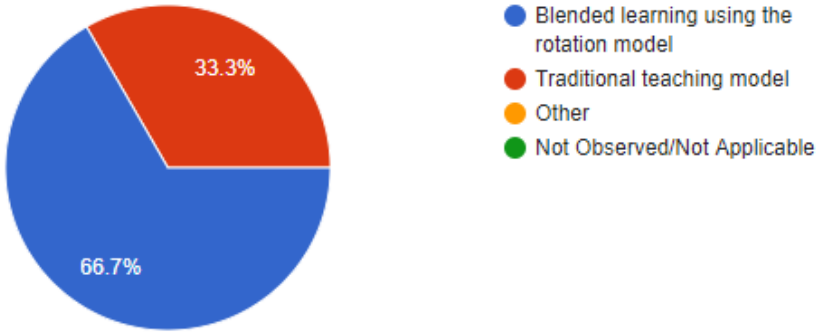
If you marked "Other", please explain.

1 response

N/A

Fourth grade teacher B mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



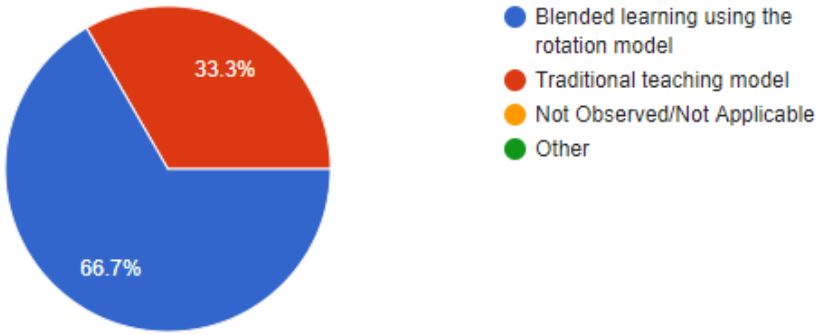
If you marked "Other", please explain.

0 responses

No responses yet for this question.

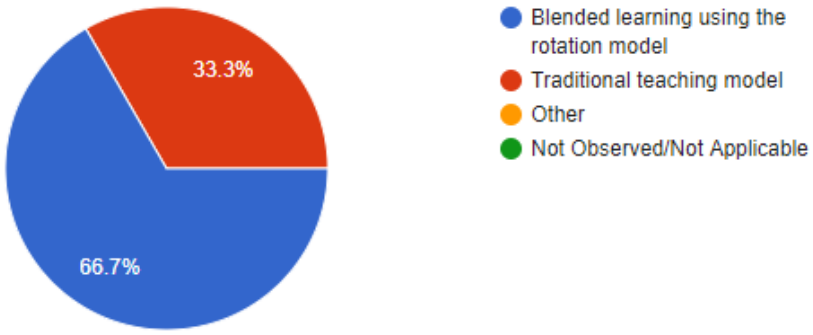
Fourth grade teacher C mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



Fourth grade teacher D mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



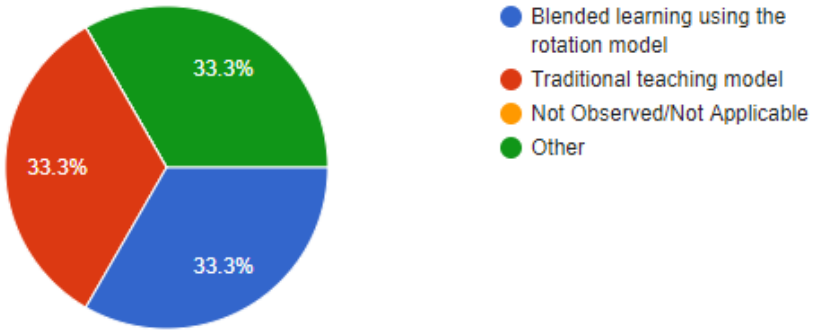
If you marked "Other", please explain.

0 responses

No responses yet for this question.

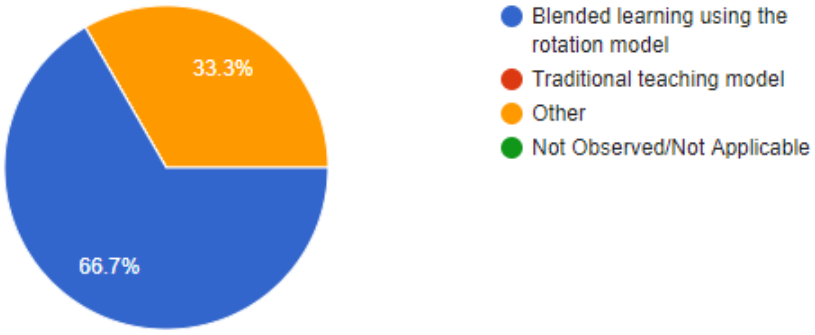
Fourth grade teacher E mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



Fourth grade teacher F mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



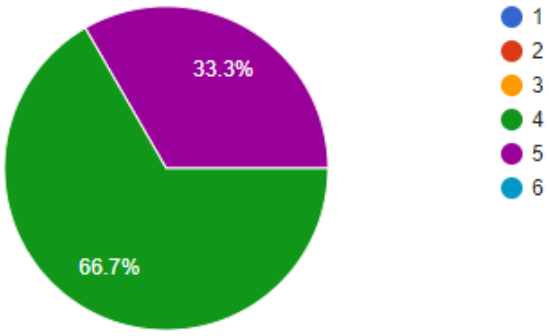
If you marked "Other", please explain.

1 response

N/A

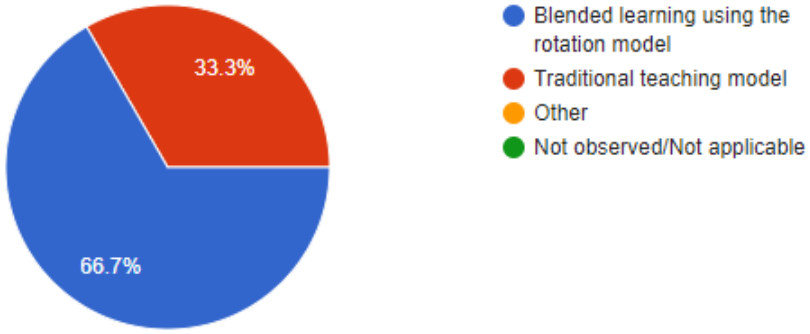
How many 5th grade classroom teachers are in your building?

3 responses



Thinking about the 5th grade teachers in alphabetical order, please identify the type of instruction the teacher uses during mathematics: Fifth grade teacher A mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



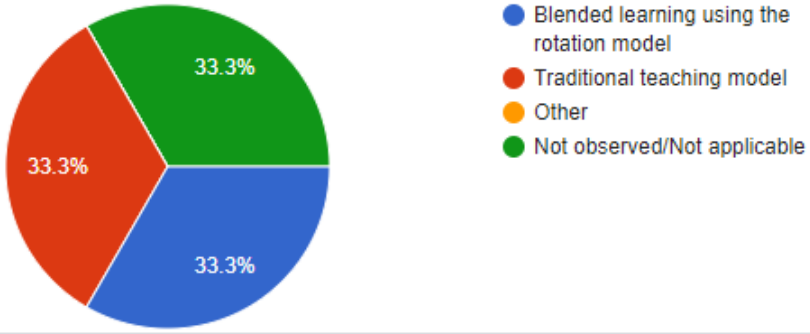
If you marked "Other", please explain.

0 responses

No responses yet for this question.

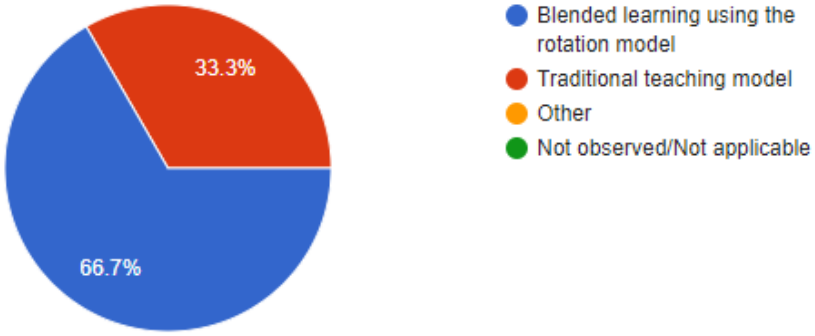
Fifth grade teacher B mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



Fifth grade teacher C mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



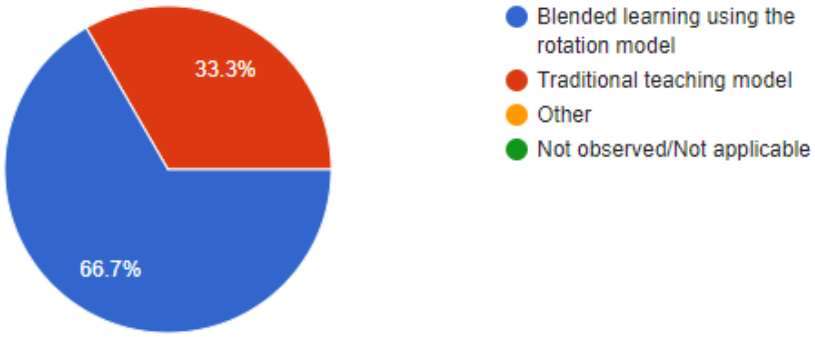
If you marked "Other", please explain.

0 responses

No responses yet for this question.

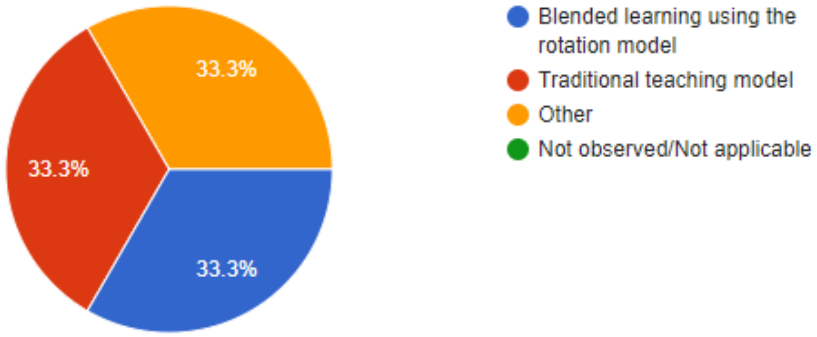
Fifth grade teacher D mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



Fifth grade teacher E mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



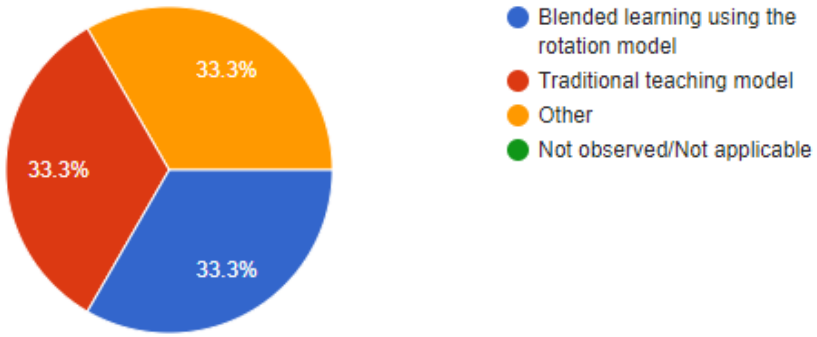
If you marked "Other", please explain.

1 response

N/A

Fifth grade teacher F mathematics instruction (please see the definition of instruction at the top of the survey.)

3 responses



If you marked "Other", please explain.

1 response

N/A