

**The Effects of Virtual Manipulatives**

**Rylee M. Jones**

Western Governors University

Rachel Wedemeier, Ed.D.

September 30, 2021

### **Abstract**

This study is focused on the topic of distance education. In this study I focused on the effects of using virtual manipulatives when teaching place value to students. The research questions asked was, "What is the effect of using virtual manipulatives on my student's ability to do place value?" There were six total participants who participated in my study who had all completed second grade and were about to begin third grade. The students had previous experience doing place value, but they were students who had been identified as struggling with place value. I used a quantitative research design in order to specifically observe the data of the assessments. The data was compared through a comparison of the average pre-assessment score and average post-assessment score. The result of the pre-assessment was an average score of 75%, while the result of the post-assessment was an average score of 98%. The overall study showed that the students' knowledge of place value increased in a distance education setting while using virtual manipulatives.

## Table of Contents

<b>Chapter 1: Introduction of Topic</b> .....	4
Problem Statement.....	4
Research Question.....	5
Problem Discussion.....	5
<b>Chapter 2: Review of Literature</b> .....	6
Literature Review.....	6
<b>Chapter 3: Method</b> .....	14
Methodology.....	14
Conclusion .....	18
<b>Chapter 4: Results</b> .....	18
Summary of Results.....	18
Data Analysis Techniques.....	19
Visual Aids.....	20
Research Question Answer .....	21
<b>Chapter 5: Overview</b> .....	21
Problem Discussion.....	22
Strengths of Study .....	23
Weaknesses of Study .....	23
Factors That Potentially Skew the Data .....	23
Recommendations .....	24
<b>Appendix A</b> .....	25
<b>Appendix B</b> .....	37
<b>Appendix C</b> .....	38

## **Chapter 1**

### **Topic**

The topic of this research study is distance education. My degree program is Master of Arts Teaching Mathematics K-6, and I am currently a 6<sup>th</sup> grade teacher in my professional career.

This topic specifically relates to my current professional setting because, as a teacher in today's world, things are constantly changing and looking more towards distance education to help our students grow and learn instead of relying solely on teaching in a traditional classroom.

“By April, 2020, it became clear that the school year would end virtually. Teachers throughout the United States found themselves suddenly teaching remotely.” (Pryor et al., 2020) Because of this sudden change, online learning became a much higher priority and discussion in education.

“The sudden transformation to online learning demands educators and institutions to develop more innovative teaching methods in supporting students during this growing crisis.”

(Gawanmeh et al., 2021) This specific research topic is very important in our ever online transitioning educational world. Since distance education is a more pressing topic that we are constantly talking about in the education world. Parents and students both want to opt to online learning due to the flexibility that it brings. Unfortunately, like stated above, the level of effectiveness between online learning and distance education are very different. We, as educators, need to understand how to make this kind of distance/online learning as closely effective as traditional education.

### **Problem Statement**

Studies show that teaching mathematics virtually is not as effective as teaching mathematics in a traditional classroom setting, and I want to understand if using virtual manipulatives plays a role

in this as I am looking at the effect that virtual manipulatives have on learning mathematics. If students can't do place value they will specifically struggle to understand what each number actually represents in the different mathematics operations that they do. My students are struggling with place value in a distance education setting.

### **Research Question**

When researching the topic of distance education, I learned about different methods and ways to help have a successful online learning environment. I also learned that most data pointed in the direction that it was more effective to teach students in a traditional classroom verses an online environment. I want to present a distance teaching environment to my students and observe the effects of using virtual manipulatives to teach place value. Thus poses the reach question, "What is the effect of using virtual manipulatives on my student's ability to do place value?"

### **Problem Discussion**

It is stated in a study titled "Teaching Mathematics in a Context of Lockdown: A Study Focused on Teachers' Praxeologies," it states that one of the most difficult parts of teaching students in an online environment is "managing distance learning to support students' learning through specific methodologies." (Aldon et al., 2021) As I am helping students learn place value who specifically struggle with that, I am hoping to understand exactly what they need help with while mastering place value through the use of virtual manipulatives. A case study done on the opinions of parents during distance education stated that "parents think that face-to-face education cannot be replaced by distance education." (Hamaidi et al., 2021) This specific problem has a part to play in my professional career because distance education is becoming a more common way to earn an education. Especially since COVID-19 brought us new and uncharted territories in education, distance education has become one of the most important tools to help our students continue

their education. A reason that my students could be struggling specifically with place value in a distance education setting is that the students are having a difficult time understanding what each number truly represents and means. When students don't understand place value they will struggle with understanding the standard algorithm and long division. These are both needed for these specific students in third and fourth grade.

## **Chapter 2**

### **Literature Review**

#### **Introduction**

Over the last year, educators have realized just how important distance education needs to be – even if we don't necessarily use it in our day-to-day professional lives. During the coronavirus pandemic, teachers were asked to teach for the remainder of the school year online, with little to no preparation. Most teachers did not have very much experience in the field of teaching virtually, giving the education system an abrupt understanding that we need to do more to educate our teachers to also be prepared to teach online successfully. (Lemov, 2020) After personally experiencing the student perspective of transitioning to the “new normal” of online school and researching this topic, I began to think about how distance education is a problem that teachers in the past have not faced like teachers do today. This is something that I have personally felt frustrated by, interested in and, ultimately, scared to be placed under the pressure of understanding which methods work in online learning and which do not. As first year teacher during the 2020-2021 school year, I learned that my technological abilities that I had previously

felt confident in, only got me so far in keeping my students engaged and successfully creating an asynchronous learning environment.

### **Strengths of Online Learning**

There are so many positive possibilities that have become available through online learning, and it has become a very popular form of education over the last few years. (Clark et al., 2007) Each of these positives are strengths that online learning has, give educators a great foundation for creating successful and meaningful learning experiences, like an in-person environment. Some of these advantages are mentioned in a book titled, *Virtual Environments for Teaching and Learning*. In this textbook, e-learning “can be defined as technology-enabled distance learning, where the learners are no longer classroom-bound. The personal computer is the main tool, and the Internet is the main channel used to deliver interactive learning experiences.” (Ichalkaranje et al., 2002, p. 75) Because this kind of learning can be accessed by a vast majority of the population, higher education has become a priority for many more people than there would have been before the rise of technology in education. (Ichalkaranje et al., 2002, p. 79) This technology makes it possible for me to continue my education without needing to uproot my family or my career. This technology has so many advantages in the world of education. This same technology made teaching during the COVID-19 pandemic possible, even if looking back now, we realize it could have been better.

After the transition of the classroom to distance learning in 2020, a study was completed about students in middle to lower income school districts. The study showed that students who were completing new material at half the pace that they were before school transitioned to the “new normal.” (Lemov, 2020) This is obviously due, in part, to the lack of time available to teachers being able to prepare, but I also believe it is the feeling and environment that is created by the

teacher in a physical classroom. Lemov states, “We need to get remote learning as close to that as possible.” (Lemov, 2020) In a regular classroom, students can actively watch the teacher and be engaged in the lesson with little distractions that are controlled by the teacher. However, in a remote environment, the teacher can only control what distractions happen in his or her own home. Because there are so many extenuating factors that play into online learning and distance education, we need to figure out the best way to combat this and work to make this “new normal” that so many of us have been experiencing a successful learning environment for everyone. (Lemov, 2020)

### **Negatives of Online Learning**

Along with each of these strengths, there are also some negatives that can be part of distance education as well. Journell discusses many different challenges that teachers can face when teaching online. He discusses the debate for attendance issues and how much work a student needs to complete each week in order to be considered present vs. absent. The teacher must decide what that looks like for their own classroom based on their district policies. (Journell, 2014, p. 48) This book also talks about the challenge of having to communicate with your students in a professional aspect and what kinds of requirements this side of online learning can entail. Through teaching online, there is a whole new door that is opened in the communication aspect that is not as likely to be present in the traditional classroom setting. Journell discusses the issues that some teachers have had in the past when it comes to communicating professionally with students and what kinds of rules and regulations teachers must follow today because of those poor choices. (Journell, 2014, p. 40) Online teachers can have a difficult time when differentiating the work for students who are learning virtually because they are not able to see potentially exactly what that students knows how to do themselves. (Allsopp et. al, 2018) Parents



and/or siblings can help a student with their homework and assignments without the knowledge of the teacher. This can make it difficult for teachers to really understand the data and placement of each specific student. There is also a constant push for more parent involvement in a traditional school setting, which is very easily possible for a lot of traditional school. However, the lack of parent involvement in an online setting is something that would drastically effect student performance and parent-teacher communication issues. (Journell, 2014, p. 50) “Recent research suggests that may be even more important for online students than those in face-to-face classrooms because of the large amount of the large amount of time students spend learning at home.” (Journell, 2014, p. 50) As we look to understand how to create an online classroom that cannot only be accessible by all, but also be as effective as a traditional classroom setting, we, as educators, need to consider the different aspects of what negatives are associated with distance education to create a more effective system.

### **Technology and Human Interaction**

To understand how we can teach using technology successfully, we need to look at the positives between technology and human interaction. As a human race, technology has increased our creativity and development to a level that has created a new way to learn and become educated. (Lee et al., 2016) This has made learning possible for people who might not have had access to it otherwise. The goal of online learning is to make it resemble in-person learning as closely as possible which, as a result, would create a similar outcome to learning and test scores. Logically, we can apply this same thinking to teachers. If they can teach effectively in a regular classroom setting, then they should be able to do the same online. (Lee et al., 2016) However, this is not the case. Even though technology has positively impacted our lives so much, it has also drastically changed the education world. With that change, we, as educators, must adapt our way of

practicing and teaching to a model that will fit the mold of the distance education. (Lee et al.,2016) We need to be able to hold students accountable for their work while also letting them be creative in the space that they are given. In order to do this, teachers need to be using best online teaching practices to help their students be successful.

### **Student Attitude Toward Online Learning**

A study outlined in the research article titled "*An Empirical Study of Student Attitudes Toward Acceptance of Online Instruction and Distance Learning*," suggests that there are 3 main themes when researching distance education. They are: "narrative accounts of instructors' experiences and their best practices; empirical studies of student perceptions, attitudes, and behaviors toward online courses; and comparative studies of online versus traditional classes." (Nguyen & Zhang, 2011, p. 24) This specific article discusses how students feel about distance education, the learning process, and outcomes. Students also needed to report their demographics to understand what other factors might be having an impact on their attitudes and performance. The researcher took the responses and transferred them to a 5-point Likert scale rating to quantitize the data. (Nguyen & Zhang, 2011) Overall, students enjoyed learning in an online setting, but also missed the face-to-face interaction. The students did also wish that they could know where they were sitting in the class compared to the other students or understand if they were succeeding in the class comparatively. (Nguyen & Zhang, 2011, p. 29)

Veletsianos, the author of *Learning Online: The Student Experience*, discusses his experience interviewing a man named Peter. He talks about Peter's current job and unpredictable schedule as a police officer. (Veletsianos, 2020, p. 21) Peter hoping to get a promotion for his job, but his work schedule does not allow for a traditional classroom experience. (Veletsianos, 2020, p. 21) Velestianos goes on to talking about Peter's perspective of online courses and how they have

made it possible, due to their flexibility and opportunity to work on them remotely, for Peter to achieve a higher position and provide a better life for his family.

Beaudoin discusses in his book, *“Online Learner Competencies: Knowledge, Skills, and Attitudes for Successful Learning in Online Settings,”* that online learning should be improved and continuously developed based off student feedback. (Beaudoin, 2013, p. 2) He states that this growth should be specific from the data and analysis gathered from this feedback. (Beaudoin, 2013, p. 2) Beaudoin specifically feels that this feedback leading to improvement will be what ultimately brings more people to the world of distance education. (Beaudoin, 2013, p. 2)

### **A Guide for Students to be Better Online Learners**

In the book *Getting the Most from Online Learning*, the author discusses a study that he had previously completed where he asked different questions to online learners about their experiences with distance education. (Piskurich, 2004) Piskurich stated that the online learners said that transitioning to online learning is not an easy process. One learner from the study stated, “It’s hard at first, but stay with it.” (Piskurich, 2004) This online learner understands that distance education is very different from a traditional classroom in many ways. Some of these ways include learning the various software and programs used by many different schools. We are also noticing that students have a difficult time understanding that they need to be responsible for their own learning now. Most online learners have a difficult time keeping the pace that they need to and understanding the material on their own. (Piskurich, 2004) However, Salmons, the author of *Learning to Collaborate, Collaborating to Learn: Engaging Students in the Classroom and Online*, states that “it is fair to say that without communication no collaboration can be successful—on- or offline.” (Salmons, 2019, p. 47) This being said, teachers and students need

to take on that responsibility of communicating in order to have a successful learning experience and environment.

### **A Guide for Teachers to be Better Online Educators**

When beginning the online course, educators need to be aware of the culture that they are teaching to. (Jung, 2014) If teachers can be aware of who they are teaching to and what each culture has access to in their learning, then the learning process will be much smoother for the students and teachers. In a physical classroom, this is not necessarily something that each teacher needs to think about often because it is common knowledge for the area in which they live, and the teacher can plan their instruction accordingly. However, when a teacher is teaching an online class, their students could be almost anywhere in the world. The teacher must first, consider what the students have access to, in order to plan their teaching based upon that information. (Jung, 2014)

There have been many studies completed on new “new” virtual classroom and what teachers can do to help make their students’ distance education experiences successful. Just like a traditional classroom, teachers must set up classroom norms while focusing on building relationships with the students. (Greathouse & Eisenbach, 2019, p. 54) The teachers in an online setting need to set a specific and professional form of communication between themselves and their students. (Greathouse & Eisenbach, 2019, p. 54) Teachers also need to specifically design the course for virtual delivery. (Christopher, 2015) Teacher need to continuously be trying to engage their learners and expect them to be active listeners. Even though these are all similar tips to a traditional classroom experience, these all need to be modified to fit an online learning course. Each of these tips will help make a successful online learning experience for teachers and students.

## **Connecting Research to Teaching Mathematics**

As a mathematics student and researcher, I am very data driven and want to know which of these guidelines set out work best when teaching mathematics online. I want to know if this can be comparable to teaching mathematics in a traditional classroom. Watson states that the key ideas in mathematics are the following:

- Having high potential or developing conceptual knowledge
- Having high relevance for building knowledge about mathematics as a science
- Supporting communication and mathematics-related arguments
- Encouraging reflection processes of teachers (Watson, 2013, p. 5)

When planning my research project, I will be taking each of these key ideas and creating online instruction that focuses on the elements from each of the guides and incorporating them into mathematics education.

## **Conclusion**

The purpose of my research is to evaluate the relationship between teaching the standard algorithm in a traditional classroom setting using physical manipulatives and teaching the standard algorithm in a distance education setting using virtual manipulatives.

- What is the relationship between teaching the standard algorithm in a traditional classroom setting using physical manipulatives and teaching the standard algorithm online using virtual manipulatives?
- Which setting is more beneficial to the students/produced better results in retention and understanding?

I will be using a quantitative research approach in order to observe which teaching method, if any, brings better results/retention of the standard algorithm. I will be focused solely on the data and numbers that I gather from my research to determine which method is more effective.

### **Conclusion**

My students are struggling with place value in a distance education setting. This specific literature review applies to the problem that's being researched because of the effects that distance education has on each student's learning. The literature review discusses many different strategies of how to make online learning as effective as traditional learning. In my study, I am researching to discover the effects that virtual manipulatives have on my students' learning.

## **Chapter 3**

### **Methodology**

My project adheres directly to the action research model. I first decided on a specific focus/topic that I wanted to research, which is distance education. I began clarifying theories that I had about distance education during my literature review. This also helped me to decide which theories I want to test and identify which research question(s) to ask. Following these steps I have collected the data, analyzed the data, and will be reporting my findings. Once my findings are reported, I will be implementing the use of virtual manipulatives or not in my students' distance education experiences.

The research question that I am looking to answer in my project is: “What is the effect of using virtual manipulatives on my student’s ability to do place value?”

There will be 6 research participants in my study. They will each be going into 3<sup>rd</sup> grade in the fall of 2021. The students were each recommended for a summer-school tutoring program because they need help with understanding place value. The study does not have random assignment because the students were already pre-selected for this study, however, it does have random sampling because my principal randomly assigned these specific 6 students to be part of my study. There were many 3<sup>rd</sup> grade students who struggled with place value, but only 6 of them were randomly assigned to my research project.

I will answer the research question by first be presenting my students with a pre-assessment to gather information about what they already know about place value and what specific information needs to be taught to them. I will use a website called I will use a website (<https://www.didax.com/math/virtual-manipulatives.html>) to provide the students with virtual manipulatives to help them see place value. This way the students will be able to understand place value while helping me understand if using virtual manipulatives makes a difference in their educational experience. The students will finally be given a post-assessment in order to see their growth and understanding of place value..

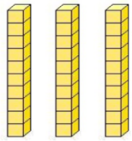
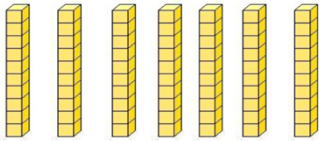
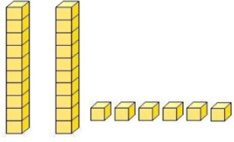
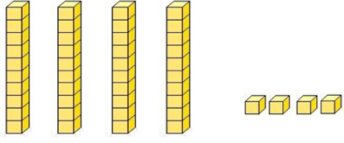
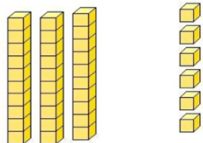
I will be using quantitative methods to collect the data. I will use a pre-assessment and post-assessment to help me understand the level of growth and knowledge of each of my students. I will begin my research by giving the students a pre-assessment to find what their current knowledge is on place value. The following worksheets are the pre-assessment/post-assessment:

## Place Value Assessment

## Pre-test/Post-test

Name: \_\_\_\_\_

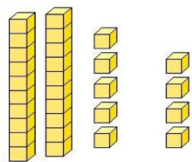
Directions: Count the groups then write the number.

<p>1.</p>  <p>___ tens ___ ones = ___</p>	<p>2.</p>  <p>___ tens ___ ones = ___</p>
<p>3.</p>  <p>___ tens ___ ones = ___</p>	<p>4.</p>  <p>___ tens ___ ones = ___</p>
<p>Write the numbers.</p> <p>5. 63 = ___ tens and ___ ones</p> <p>6. 87 = ___ tens and ___ ones</p> <p>7. 25 = ___ tens and ___ ones</p> <p>8. 49 = ___ tens and ___ ones</p>	
<p>Write the number in different ways.</p> <p>9.</p>  <p>___ tens ___ ones</p> <p>_____</p>	



Write the number in different ways.

10.

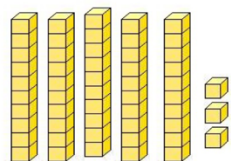


\_\_\_ tens \_\_\_ ones

\_\_\_\_\_

Write the number in different ways.

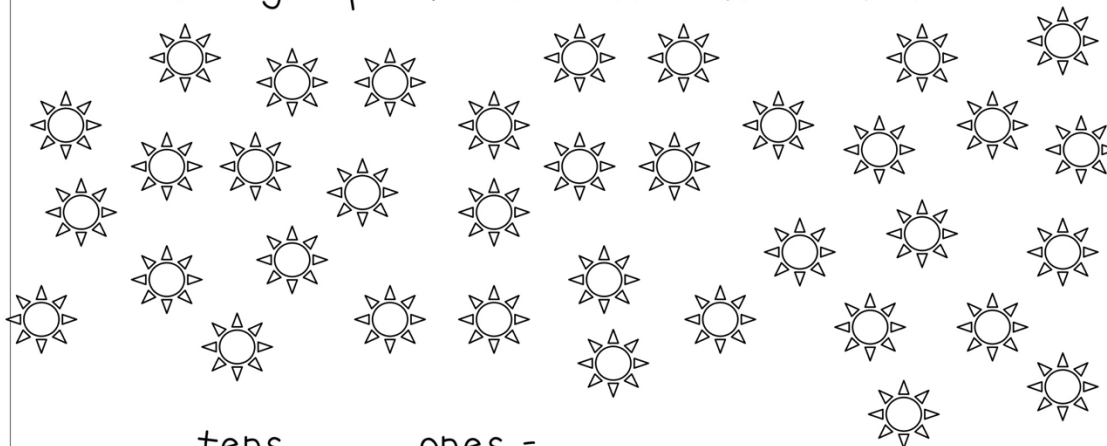
11.



\_\_\_ tens \_\_\_ ones

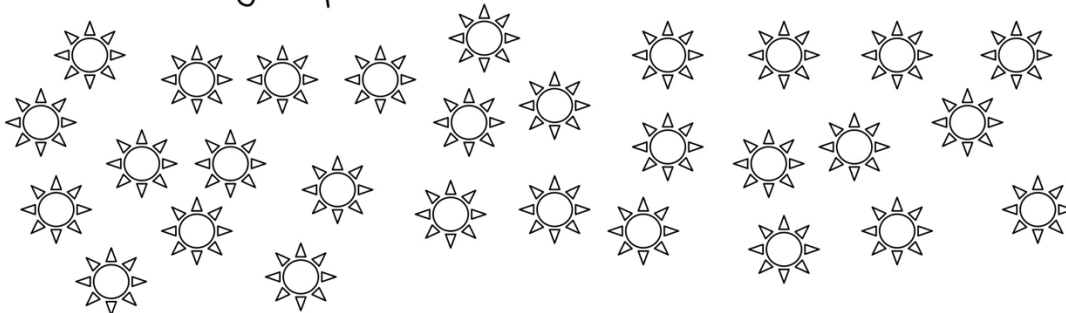
\_\_\_\_\_

12. Circle groups of ten. Write the number.



\_\_\_ tens \_\_\_ ones = \_\_\_\_\_

13. Circle groups of ten. Write the number.



\_\_\_ tens \_\_\_ ones = \_\_\_\_\_

Each participant's data will be kept private and confidential. The data will be collected through my professional Wasatch Peak Academy email and deleted on September 30<sup>th</sup>, 2021. The data that I will be using in the study will only be seen by myself, the researcher, and any raw data with personal identifiers like individual student names will not be used in any reported findings.

### **Conclusion**

My research project adheres directly to the action research model. There will be 6 3<sup>rd</sup> grade aged students in my study who struggle with place value. I will be comparing data from a pre-assessment and post-assessment on place value to observe student growth. Through the use of quantitative data, I will be able to see what the effects of using virtual manipulatives have on my students' abilities to learn place value. Any data that I gather from students will be kept confidential and private.

## **Chapter 4**

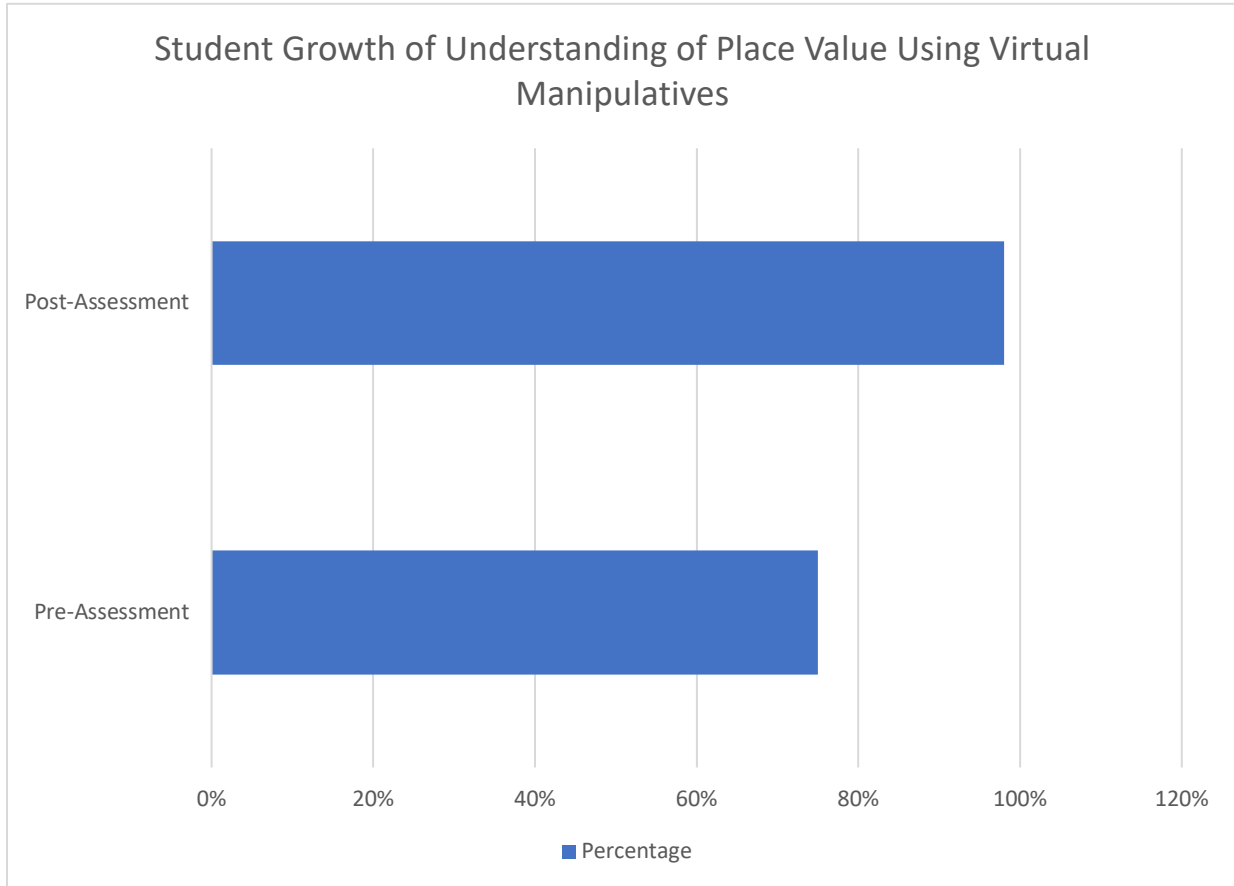
### **Summary of Results**

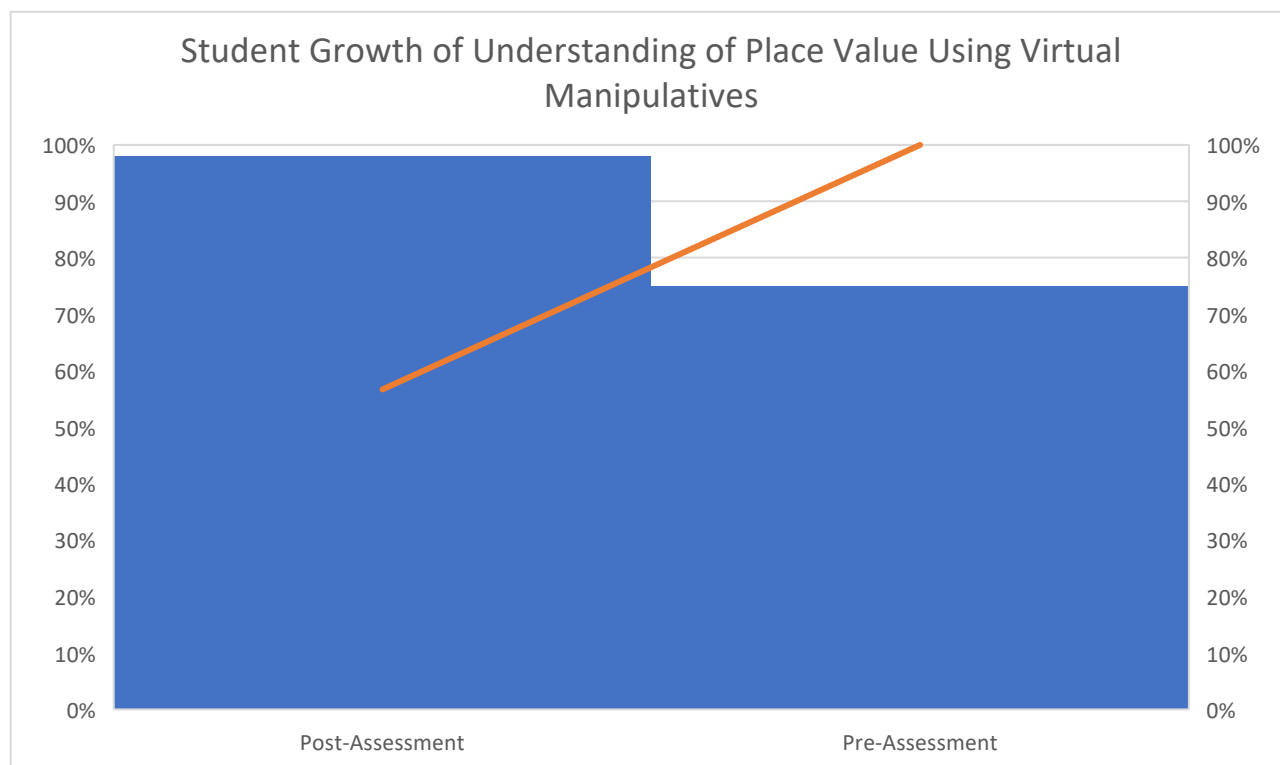
The students began my study in between their second and third grade year. They had previous experience with place value. The students took a pre-assessment and the average score of it was a 75%. The students had experience, but they still needed clarification on place value. Once I completed the teaching experience, the students took a post-assessment. The average score amongst the students of this test was a 98%. The students were able to grow during the distance instruction and use of virtual manipulatives. Though the literature review discussed the effects of

distance education and how it normally negatively impacts students' learning, I discovered that the students were positively effected with in their learning though we used virtual manipulatives to teach the students about place value.

### **Data Analysis Techniques**

Because my research question was, "What is the effect of using virtual manipulatives on my student's ability to do place value?" I looked specifically at using quantitative data analysis techniques to observe the students' growth and knowledge of place value. I looked at the data from the pre-test and post-test to observe student growth and understanding of place value. I observed the students' knowledge of place value and how it increased even after the use of virtual manipulatives. Since there were 13 questions in the pre/post test, I compared the mean of the test scores of the pre-test to the mean of the scores of the post-test. This showed me how effective using virtual manipulatives was during my study and what the growth of the students' knowledge was. This is how I specifically analyzed the statistical data from the quantitative research. Because I used a distance learning environment (teaching in-person, using virtual manipulatives) I specifically assessed the effectiveness of teaching place value while using virtual manipulatives instead of physical base ten blocks and place value mats. The results of the study addressed the effectiveness of using virtual manipulatives while teaching place value.

**Visual Aids**



### **Research Question Answer**

“What is the effect of using virtual manipulatives on my students’ abilities to do place value?”

The virtual manipulatives had a positive effect on my students’ abilities to do place value in a distance education setting. The students were able to improve their ability to do and understand place value while using the virtual manipulatives.

## **Chapter 5**

### **Overview**

The research shows that even in a distance education setting, the use of virtual manipulatives has a positive effect on student learning of place value. The students were still able to grow in and understand the concept of place value even though they were doing so in a distance environment.

The students showed great interest in wanting to learn about and use the virtual manipulatives. They were motivated in learning from them and letting them guide their understanding of place value. As the use of the virtual manipulatives increased so did the students' knowledge of place value. The students responded well to the use of the manipulatives during the lessons and it seemed as though they were a driving motivational source for the students in wanting to learn more. They continuously asked if they could show their work using the virtual manipulatives and their work on how they solved the problems. The students were very interested in working with the virtual manipulatives and became very comfortable using them in their studies.

### **Problem Discussion**

Studies show that teaching mathematics virtually is not as effective as teaching mathematics in a traditional classroom setting, and I wanted to understand if using virtual manipulatives played a role in this as I looked at the effect that virtual manipulatives had on learning mathematics. The students specifically were not able to do place value meaning that they specifically struggled to understand what each number actually represented in the different mathematics operations that they did. My students were struggling with place value in a distance education setting.

My study solved my research problem by showing that even though the students were learning through a distance setting, they were still able to show improvement and understanding while using the virtual manipulatives. The problem of students not getting the same quality of education when learning place value, in my study experience, was solved with the use of virtual manipulatives. The students were able to learn place value using the virtual manipulatives with ease.

### **Strengths of the Study**

Some strengths of my study were the virtual manipulatives that I used. The students were able to understand and use the Didax program with ease. The students also showed a lot of interest in using virtual manipulatives instead of physical ones, which really appealed to a young group of students who enjoy using virtual tools in their learning and personal lives. The students responded very well to the program.

### **Weaknesses of the Study**

A weakness of the study is that the students had already had experiences with place value, and this was a review for them. The students could have potentially understood place value pretty well beforehand and just tested poorly when taking the pre-assessment. Even though the students were all incoming third grade students, they still came with different levels of experience of doing place value. The students could have been absent for a specific period of time during the regular school year when previously learning place value. The students potentially could have not struggled with place value initially if they had been at school during those learning days. This could have created different starting points for each of the students in their place value educational experience.

### **Factors that Potentially Skew the Data**

A factor that could potentially skew the findings of my data are that not every student was able to meet and do the learning activity with us each day. Some students were absent causing them to miss out on some of the learning experiences. This could potentially effect the scores of the test. The students could have also had an “off-day” in their learning and not have performed to the point that they could have. Students also could have also performed exceptionally well or understood the material very well one day.

**Recommendations**

I would recommend a further investigation on the comparisons between different virtual manipulative websites. I only used Didax virtual manipulatives. I questioned multiple times if I had used a different resources, if my results would have been different. I would suggest finding which virtual manipulatives work best for distance education.

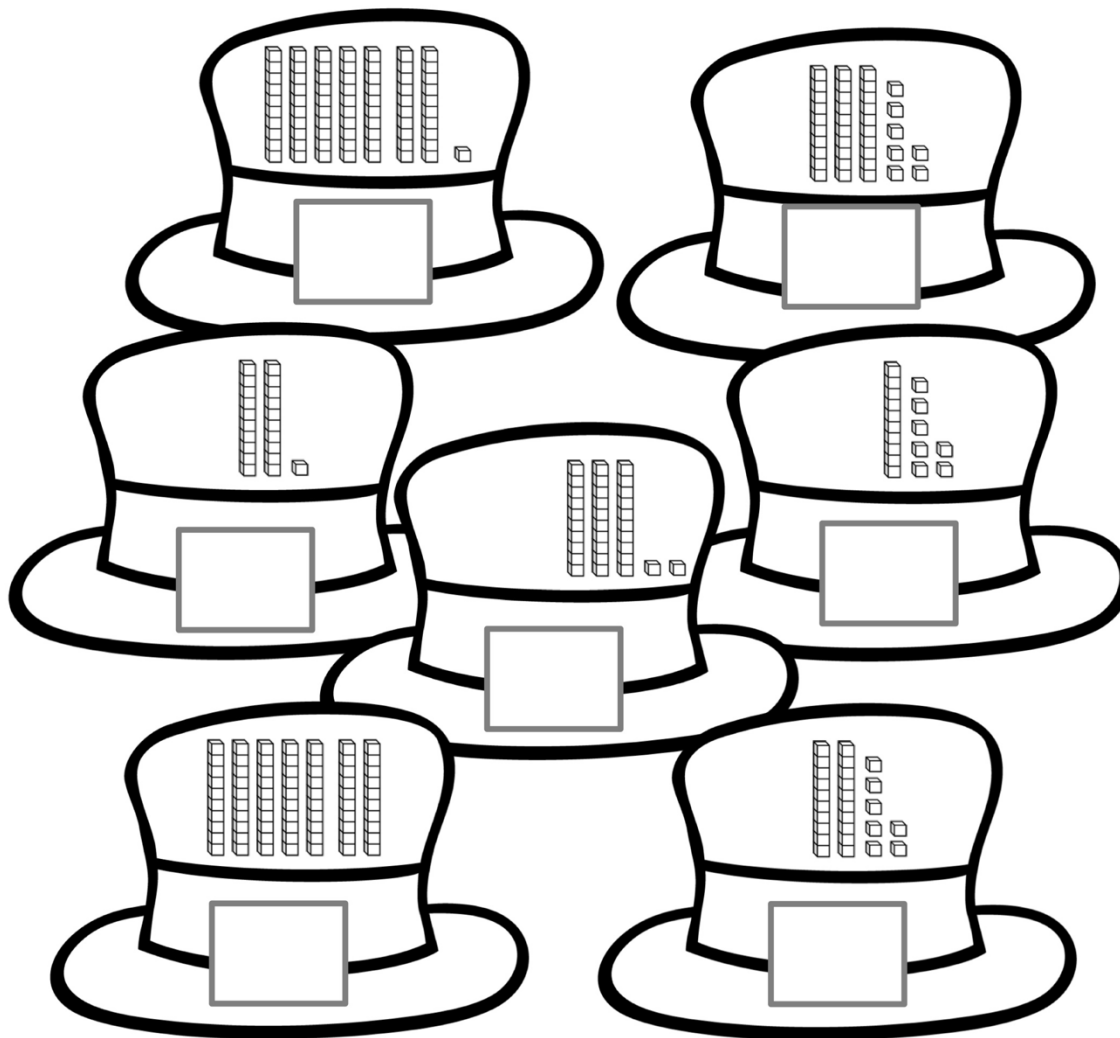


## Appendix A

## Curriculum Unit

# Seven Hats Base Ten

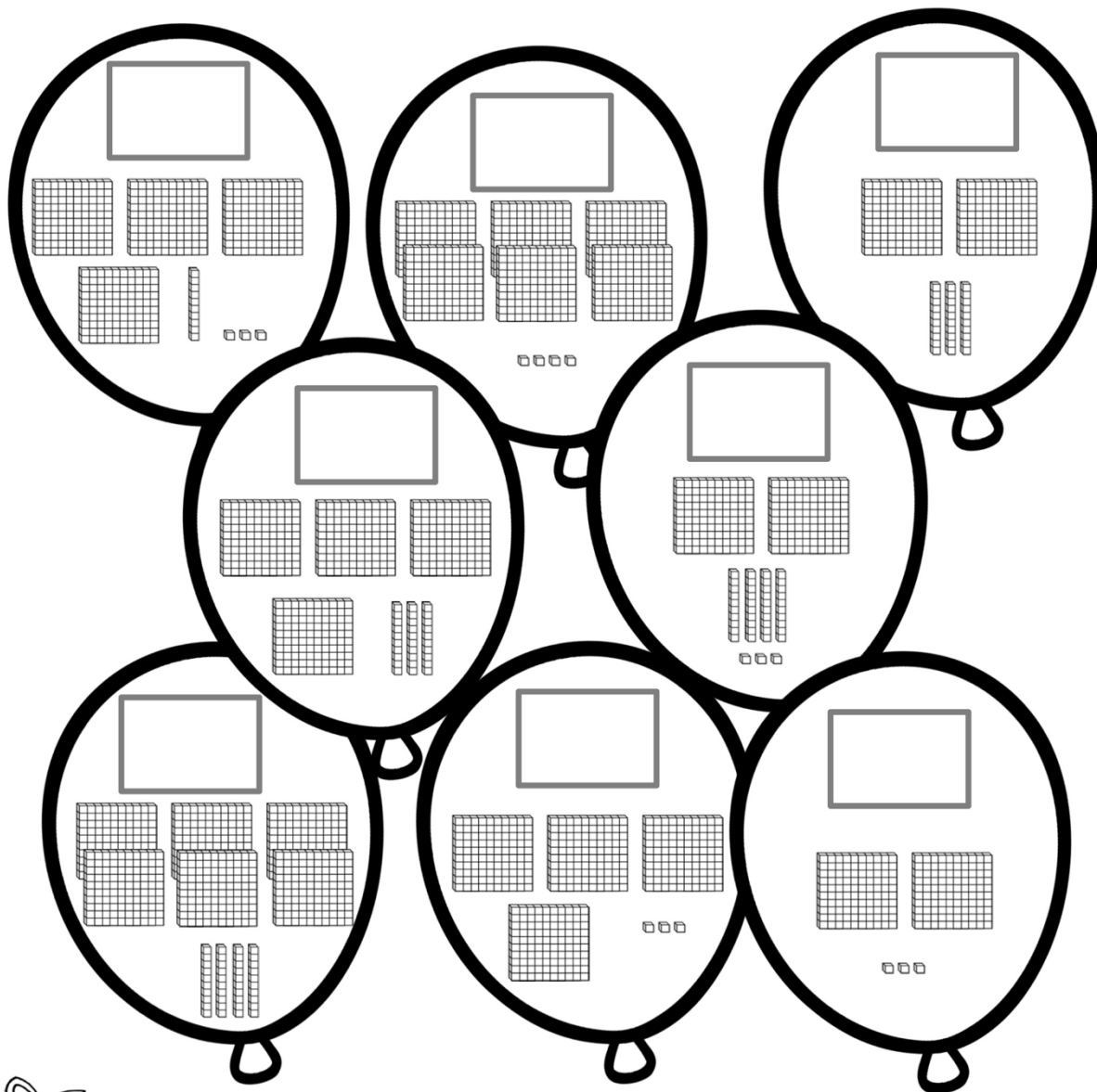
Cut along the dotted lines and glue each one in the correct hat.



37	70	32	71
27	17	21	

# Eight Balloons Place Value - Base Ten

Cut along the dotted lines and glue each one in the correct balloon.

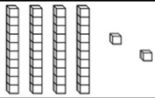


230	403	604	413
430	203	640	243

# Four Ways to Write a Number

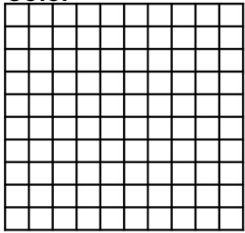
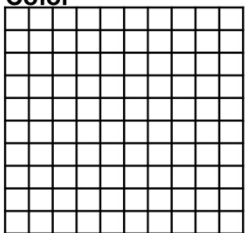
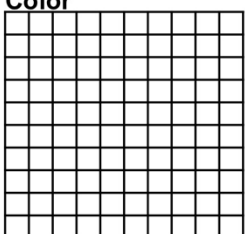
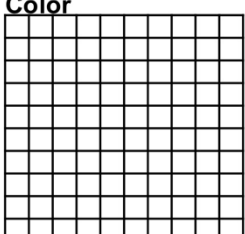
Tens and Ones Name \_\_\_\_\_

# 42

Number e.g. 42	Word e.g. forty-two	Tens and Ones e.g. 4 tens 2 ones	Draw e.g. 
		_____ tens _____ ones	
		_____ tens _____ ones	
		_____ tens _____ ones	
		_____ tens _____ ones	
		_____ tens _____ ones	
		_____ tens _____ ones	

# Ways to Write a Number and More and Less

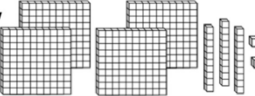
Tens and Ones Name \_\_\_\_\_

Number	Color 	Word	
		Tens and Ones _____ tens _____ ones	
+ 1	- 1	+ 10	- 10
Number	Color 	Word	
		Tens and Ones _____ tens _____ ones	
+ 1	- 1	+ 10	- 10
Number	Color 	Word	
		Tens and Ones _____ tens _____ ones	
+ 1	- 1	+ 10	- 10
Number	Color 	Word	
		Tens and Ones _____ tens _____ ones	
+ 1	- 1	+ 10	- 10

# Four Ways to Write a Number

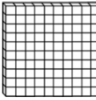
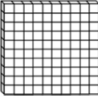
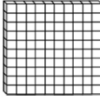
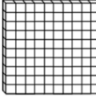
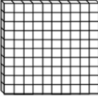
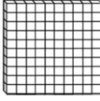
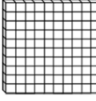
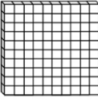
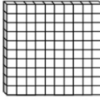
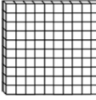
Hundreds, Tens and Ones Name \_\_\_\_\_

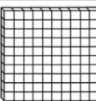
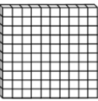
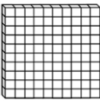
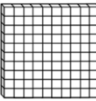
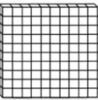
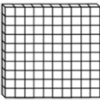
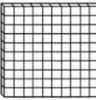
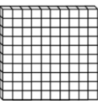
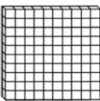
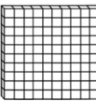
# 432

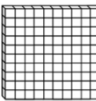
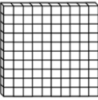
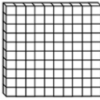
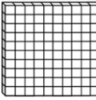
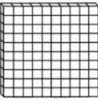
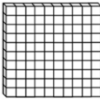
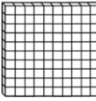
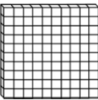
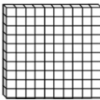
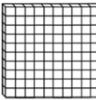
Number e.g. 432	Word e.g. four hundred, thirty-two	hundreds, tens, ones e.g. 4 hundreds, 3 tens, 2 ones	Draw e.g. 
		_____ hundreds _____ tens _____ ones	
		_____ hundreds _____ tens _____ ones	
		_____ hundreds _____ tens _____ ones	
		_____ hundreds _____ tens _____ ones	
		_____ hundreds _____ tens _____ ones	
		_____ hundreds _____ tens _____ ones	

# Ways to Write a Number and More and Less

Hundreds, Tens and Ones Name \_\_\_\_\_

<b>Number</b>	<b>Hundreds, Tens and Ones</b> ____ hundreds ____ tens ____ ones	<b>Color</b>		
<b>Word</b>				
<b>Expand e.g. 300+60+5</b>	_____ + _____ + _____			
<b>+1 _____ -1 _____ +10 _____ -10 _____ +100 _____ -100 _____</b>				

<b>Number</b>	<b>Hundreds, Tens and Ones</b> ____ hundreds ____ tens ____ ones	<b>Color</b>		
<b>Word</b>				
<b>Expand e.g. 300+60+5</b>	_____ + _____ + _____			
<b>+1 _____ -1 _____ +10 _____ -10 _____ +100 _____ -100 _____</b>				

<b>Number</b>	<b>Hundreds, Tens and Ones</b> ____ hundreds ____ tens ____ ones	<b>Color</b>		
<b>Word</b>				
<b>Expand e.g. 300+60+5</b>	_____ + _____ + _____			
<b>+1 _____ -1 _____ +10 _____ -10 _____ +100 _____ -100 _____</b>				

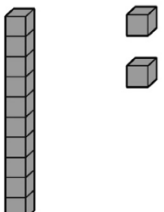

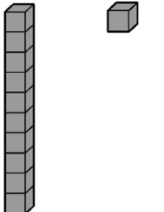

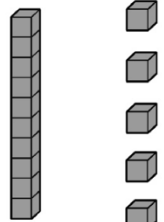

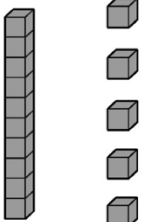

## Place Value: Teen Numbers

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write to tell how many tens and ones.

1. 17 is \_\_\_ ten and \_\_\_ ones.
2. 14 is \_\_\_ ten and \_\_\_ ones.
3. 12 is \_\_\_ ten and \_\_\_ ones.
4. 18 is \_\_\_ ten and \_\_\_ ones.
5. 13 is \_\_\_ ten and \_\_\_ ones.
6. 19 is \_\_\_ ten and \_\_\_ ones.

**Directions:** Write the number the blocks show.

<p>7.</p>  	<p>8.</p>  
<p>9.</p>  	<p>10.</p>  

## Place Value: Teen Numbers

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write the number.

1. One ten and **four** ones is \_\_\_\_\_.
2. One ten and **three** ones is \_\_\_\_\_.
3. One ten and **eight** ones is \_\_\_\_\_.
4. One ten and **two** ones is \_\_\_\_\_.
5. One ten and **one** one is \_\_\_\_\_.
6. One ten and **six** ones is \_\_\_\_\_.

**Directions:** Draw the number with base ten blocks.

**13**

**18**

**17**

**15**



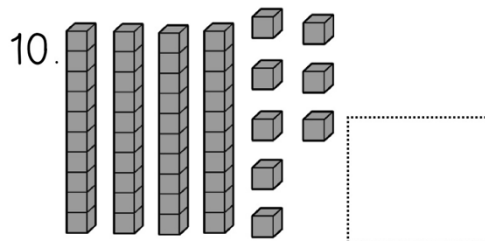
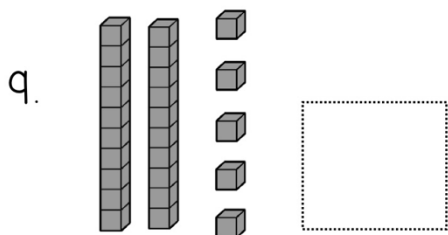
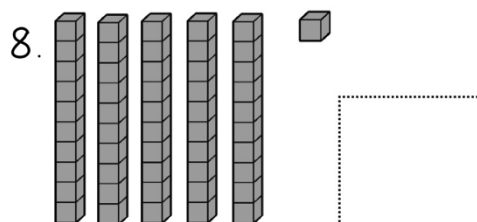
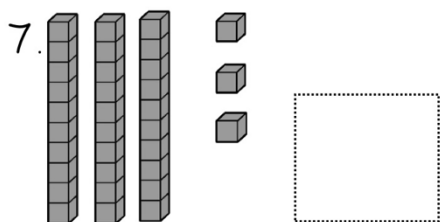
## Place Value: Tens & Ones

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write to tell how many tens and ones.

1. 28 is \_\_\_ tens and \_\_\_ ones.
2. 34 is \_\_\_ tens and \_\_\_ ones.
3. 72 is \_\_\_ tens and \_\_\_ ones.
4. 48 is \_\_\_ tens and \_\_\_ ones.
5. 33 is \_\_\_ tens and \_\_\_ ones.
6. 67 is \_\_\_ tens and \_\_\_ ones.

**Directions:** Write the number the blocks show.



## Place Value: Tens & Ones

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write the number.

1. **Two** tens and **four** ones is \_\_\_\_\_.
2. **Three** tens and **three** ones is \_\_\_\_\_.
3. **Six** tens and **eight** ones is \_\_\_\_\_.
4. **Five** tens and **two** ones is \_\_\_\_\_.
5. **Seven** tens and **one** one is \_\_\_\_\_.
6. **Four** tens and **six** ones is \_\_\_\_\_.

**Directions:** Draw the number with base ten blocks.

73

58

27

45

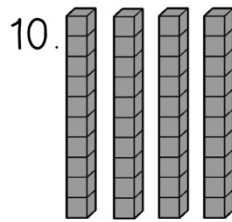
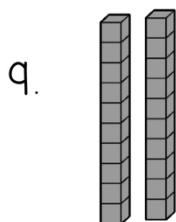
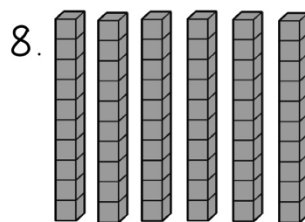
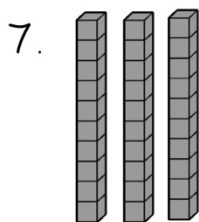
## Place Value: Multiples of Ten

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write to tell how many tens.

1. 20 is \_\_\_ tens.
2. 40 is \_\_\_ tens.
3. 70 is \_\_\_ tens.
4. 50 is \_\_\_ tens.
5. 30 is \_\_\_ tens.
6. 60 is \_\_\_ tens.

**Directions:** Write the number the blocks show.



## Place Value: Tens & Ones

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Directions:** Write the number.

1. Five tens is \_\_\_\_\_.
2. Four tens is \_\_\_\_\_.
3. Six tens is \_\_\_\_\_.
4. Eight tens is \_\_\_\_\_.
5. Seven tens is \_\_\_\_\_.
6. Two tens is \_\_\_\_\_.

**Directions:** Draw the number with base ten blocks.

30

50

90

40

## Appendix B

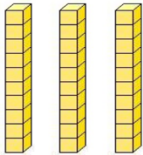
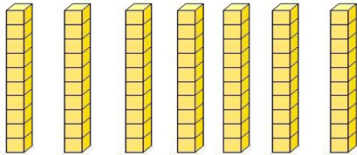
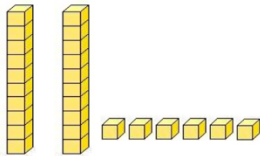
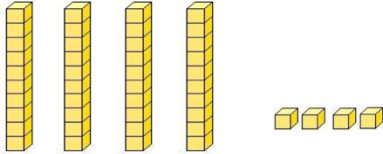
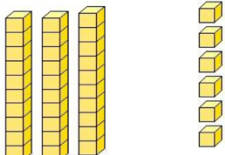
### Data Gathering Instruments

Place Value Assessment

Pre-test/Post-test

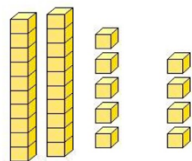
Name: \_\_\_\_\_

Directions: Count the groups then write the number.

<p>1.</p>  <p>___ tens ___ ones = _____</p>	<p>2.</p>  <p>___ tens ___ ones = _____</p>
<p>3.</p>  <p>___ tens ___ ones = _____</p>	<p>4.</p>  <p>___ tens ___ ones = _____</p>
<p>Write the numbers.</p> <p>5. <math>63 =</math> ___ tens and ___ ones</p> <p>6. <math>87 =</math> ___ tens and ___ ones</p> <p>7. <math>25 =</math> ___ tens and ___ ones</p> <p>8. <math>49 =</math> ___ tens and ___ ones</p>	
<p>Write the number in different ways.</p> <p>9.</p>  <p>___ tens ___ ones</p> <p>_____</p>	

Write the number in different ways.

10.

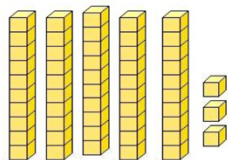


\_\_\_ tens \_\_\_ ones

\_\_\_\_\_

Write the number in different ways.

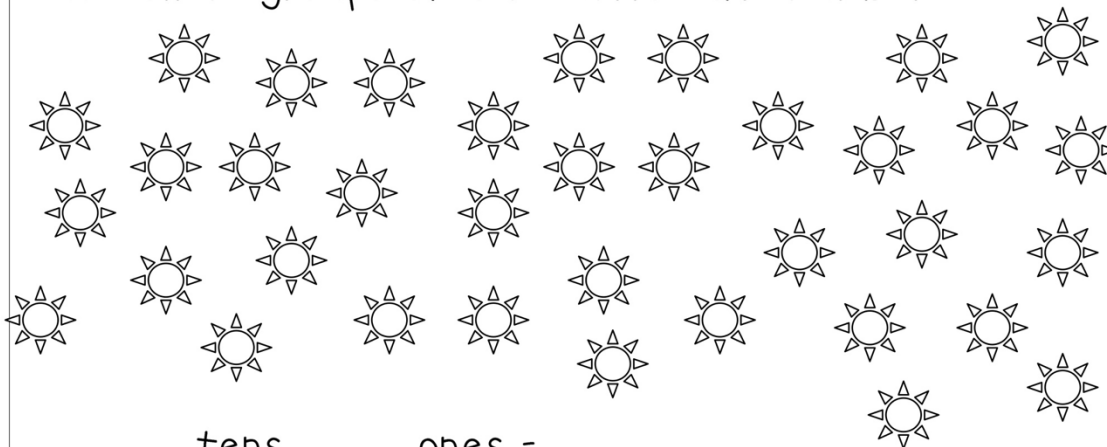
11.



\_\_\_ tens \_\_\_ ones

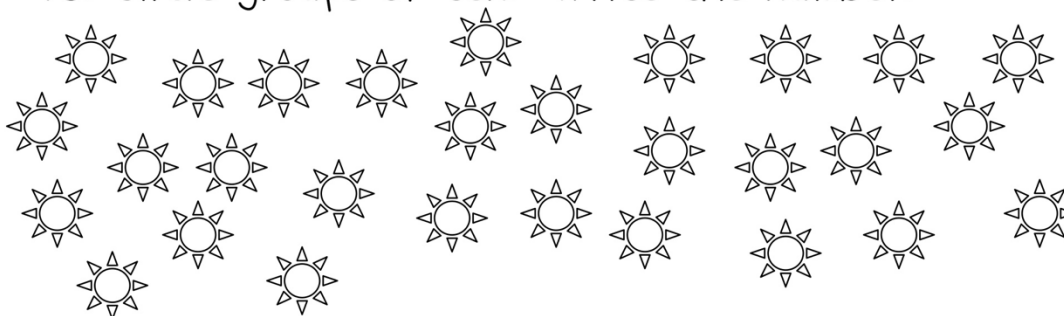
\_\_\_\_\_

12. Circle groups of ten. Write the number.



\_\_\_ tens \_\_\_ ones = \_\_\_\_\_

13. Circle groups of ten. Write the number.



\_\_\_ tens \_\_\_ ones = \_\_\_\_\_

## Appendix C

### Informed Consent Form

## Informed Consent

### Student (K–12) Classroom Research

*Western Governors University - Teachers College*

*[M.A. Teaching Mathematics K-6]*

*[Rylee Jones]*

*[The Effects of Virtual Manipulatives]*

### Introduction

Rylee Jones, a graduate student researcher in the Teacher's College at Western Governor's University, wishes to conduct a research study for the purpose of determining the effectiveness of using virtual manipulatives when teaching place value to a third grade class. Approval of the Wasatch Peak Academy Charter School principal to conduct this study was obtained prior to this announcement. By signing this consent form, parents or legal guardians agree to allow their child to participate in the study. Any data collected will be reported as part of a group; individual student names will not be used.

### Description of the Project

Describe the nature of the research and the data-gathering methods. Be specific; provide an accurate description of what the child participants will do, by doing *all* of the following:

- The purpose of this quantitative research study is to understand what effect teaching mathematics using virtual manipulatives has on students.
- The students will be participating in the learning of place value while using the intervention of virtual manipulatives.
- The research will take place during Wasatch Peak Academy summer school program. The dates will be on regular school days (Monday-Friday) August 16<sup>th</sup> - August 26<sup>th</sup>. Since this will take place in a distance setting, the students will be at the school, and I will be teaching at a distance setting.
- The research is expected to take 10 days and 7.5 hours total.
- All students are expected to participate fully in all routine classroom activities unless a child has been withdrawn from the study by a parent.
- The student will not miss any instructional time due to the study.
- If your child has been withdrawn from the study, they will participate in regular summer school activities in another classroom.

### Benefits and Risks of the Study

- A potential physical risk that the students could be exposed to would be getting tired during the lessons and distracted. The steps that I will take to minimize physical risks would be to take a break halfway through our lesson. The emotional risk that students could be exposed to would be getting frustrated with learning place value. The students have already previously struggled learning place value, and they could potentially get frustrated during the lesson. To minimize the emotional risk I will have the

students show me a thumbs up, sideways, or down on how they are feeling during each lesson. The psychological risk that students could be exposed to would be the chance that something has happened outside of summer school effecting how the students will learn and and understand. I will take into account the fact that a student could be having an “off-day” and this could affect their scores.

- This study may help us understand if the use of virtual manipulatives when teaching place value is effective when teaching place value in a distance education setting.

## **Confidentiality**

Each participant’s data will be kept private and confidential. The data will be collected through my professional Wasatch Peak Academy email and deleted on September 30<sup>th</sup>, 2021. The data that I will be using in the study will only be seen by myself, the researcher, and any raw data with personal identifiers like individual student names will not be used in any reported findings.

## **Voluntary Participation**

Participants are expected to participate in any regular classroom instruction but parents may choose to have their child withdraw from any form of data gathering that is specific to my research project. This would result in the child who has been withdrawn participating in regular summer school activists in a different class. Generally, since routine data gathering such as quizzes and exams are used to inform instruction or measure preassessment knowledge or postassessment knowledge gains, these are considered part of regular classroom instruction.

## **Withdrawal**

- Participants may withdraw at any time from nonregular classroom instruction and will not be penalized for nonparticipation.
- To withdraw from the study, parents or child participants must notify the researcher.
- Consent from parents or legal guardians as well as permission from school principals or district administrators must be granted in order for me to gather data for the purposes of my research project.
- Participants can request that their individual results be excluded from the final report.
- Grades/enrollment will not be impacted in any way as a result of participation or lack of participation in this study.

## **Questions, Rights, and Complaints**

- Participants and parents/legal guardians can contact me with any questions. My conact information is listed below.

Rylee Jones

Email: [rjon781@wgu.edu](mailto:rjon781@wgu.edu)


Phone: (801) 936-3066

- If you have questions about your rights, unresolved questions, or complaints pertaining to the study, contact the WGU IRB Chairperson by email: [irb@wgu.edu](mailto:irb@wgu.edu)
- Participants and their parents/legal guardians have a right to view the results of the study.

## **Consent Statement**



- By signing this document, the administrator grants permission for student data collection and reporting necessary for this study.
- By signing this document, the parent/legal guardian grants permission for their child to participate in the study and has the opportunity to have his or her questions answered.
- Student participants will be informed of the research purpose and activities and will be asked for their assent to participate upon parental approval.

 _____ School Administrator Signature	_____ Parental/Legal Guardian Signature
<i>Principal</i> _____ Title of Administrator	_____ Typed/Printed Name
<i>Amy Pilkington</i> _____ Typed/Printed Name	_____ Date
<i>8/9/21</i> _____ Date	_____ Student Signature (Assent)
	_____ Typed/Printed Name
	_____ Date

2016-0616 3

## References

- Aldon, G., Cusi, A., Schacht, F., & Swidan, O. (2021). Teaching Mathematics in a Context of Lockdown: A Study Focused on Teachers' Praxeologies. *Education Sciences*, 11(2), 38. <https://doi.org/10.3390/educsci11020038>
- Allsopp, D. H., Lovin, L. A. H., & Ingen, V. S. (2018). *Teaching Mathematics Meaningfully: Solutions for Reaching Struggling Learners*. Paul H. Brookes Publishing Co. <https://eds.b.ebscohost.com/eds/detail/detail?vid=0&sid=fc95a294-0a82-4fa5-ba27-e9079b6ef6c0%40pdc-v-sessmgr01&bdata=JmF1dGh0eXBIPXNzbyZjdXN0aWQ9bnMwMTc1Nzgmc2l0ZT11ZH MtbGl2ZSZzY29wZT1zaXRl#AN=1716648&db=e000xna>.
- Beaudoin, M. F. (2013). *Online Learner Competencies: Knowledge, Skills, and Attitudes for Successful Learning in Online Settings*. IAP, Information Age Publishing Inc. <https://eds.b.ebscohost.com/eds/ebookviewer/ebook/ZTAwMHhuYV9fNjMxNjgwX19BTg2?sid=22882aac-d78e-4a00-ab8a-0fddecc64eef@pdc-v-sessmgr01&vid=0&format=EB&rid=1>.
- Christopher, D. (2015). *The Successful Virtual Classroom: How to Design and Facilitate Interactive and Engaging Live Online Learning*. American Management Association. [https://wgu-library.skillport.com/skillportfe/main.action?assetid=RW\\$29491: ss\\_book:73816#summary/BOOKS/RW\\$29491: ss\\_book:73816](https://wgu-library.skillport.com/skillportfe/main.action?assetid=RW$29491: ss_book:73816#summary/BOOKS/RW$29491: ss_book:73816).
- Clark, R. C., & Kwinn, A. (2007). *The New Virtual Classroom: Evidence-Based Guidelines for Synchronous E-Learning*. Pfeiffer. [https://wgu-library.skillport.com/skillportfe/main.action?assetid=27251#summary/BOOKS/RW\\$29993: ss\\_book:27251](https://wgu-library.skillport.com/skillportfe/main.action?assetid=27251#summary/BOOKS/RW$29993: ss_book:27251).
- Gawanmeh, A., Al-Karaki, J. N., Ababneh, N., & Hamid, Y. (2021). Evaluating the Effectiveness of Distance Learning in Higher Education during COVID-19 Global Crisis: UAE Educators' Perspectives. *Contemporary Educational Technology*, 13(3). <https://doi.org/10.30935/cedtech/10945>
- Greathouse, P., & Eisenbach, B. (2019). *The Online Classroom: Resources for Effective Middle Level Virtual Education*. Information Age Publishing, Inc. <https://eds.b.ebscohost.com/eds/ebookviewer/ebook/ZTAwMHhuYV9fMTkzNzY4MV9fQU41?sid=f2b9203d-c3ba-435f-a6cb-df88574e8676@pdc-v-sessmgr03&vid=0&format=EB&rid=1>.
- Hamaidi, D. D., Arouri, D. Y., Noufal, R. K., & Aldrou, I. T. (2021). Parents' Perceptions of Their Children's Experiences With Distance Learning During the COVID-19

- Pandemic. *The International Review of Research in Open and Distributed Learning*, 22(2), 224–241. <https://doi.org/10.19173/irrodl.v22i2.5154>
- Ichalkaranje, N. S., Howlett, R. J., Tonfoni, G., & Jain, L. C. (2002). *Virtual Environments & Teaching and Learning*. World Scientific Publishing.  
<https://eds.a.ebscohost.com/eds/detail/detail?vid=0&sid=2d6de892-1e79-40a7-b6d4-4a2023e45f33%40sessionmgr4006&bdata=JmF1dGh0eXBIPXNzbyZjdXN0aWQ9bnMwMTc1Nzgmcm2l0ZT1lZHMtbGl2ZSZzY29wZT1zaXRl#AN=235728&db=e000xna>.
- Journell, W. (2014). *Online Learning: Strategies for K-12 Teachers*. Rowman & Littlefield Education. [https://web.b.ebscohost.com/ehost/ebookviewer/ebook?sid=3da6161f-d5de-42e5-a8a5-3e14c8b44291%40pdc-v-sessmgr02&ppid=pp\\_C1&vid=0&format=EB](https://web.b.ebscohost.com/ehost/ebookviewer/ebook?sid=3da6161f-d5de-42e5-a8a5-3e14c8b44291%40pdc-v-sessmgr02&ppid=pp_C1&vid=0&format=EB).
- Jung, I., Gunawardena, C. N., & Moore, M. G. (2014). *Culture and Online Learning: Global Perspectives and Research*. Stylus.  
<https://eds.b.ebscohost.com/eds/ebookviewer/ebook/ZTAwMHhuYV9fMTA3MDU3NV9fQU41?sid=5975d960-7f81-44be-8907-e6d2acbf7ebf@pdc-v-sessmgr01&vid=0&format=EB&rid=1>.
- Lee, M. J. W., Tynan, B., Dalgamo, B., & Gregory, S. (2016). *Learning in Virtual Worlds: Research and Applications*. AU Press.  
<https://eds.b.ebscohost.com/eds/ebookviewer/ebook/ZTAwMHhuYV9fMTIxNTQ5MI9fQU41?sid=be80ce2e-8fb8-4fab-bbba-be1b4fb884fc@sessionmgr102&vid=0&format=EB&rid=1>.
- Lemov, D. (2020). *Teaching in the Online Classroom: Surviving and Thriving in the New Normal*. Jossey-Bass, a Wiley brand. [https://wgu-library.skillport.com/skillportfe/main.action?assetid=153459#summary/BOOKS/RW\\$64741:ss\\_book:153459](https://wgu-library.skillport.com/skillportfe/main.action?assetid=153459#summary/BOOKS/RW$64741:ss_book:153459).
- Nguyen, D.-D., & Zhang, Y. J. (2011). *An Empirical Study of Student Attitudes Toward Acceptance of Online Instruction and Distance Learning*. *Contemporary Issues in Education Research (CIER)*, 4(11), 23. <https://doi.org/10.19030/cier.v4i11.6486>
- Piskurich, G. M. (2004). *Getting the Most from Online Learning*. Pfeiffer. [https://wgu-library.skillport.com/skillportfe/main.action?assetid=RW\\$29424:ss\\_book:12766#summary/BOOKS/RW\\$29424:ss\\_book:12766](https://wgu-library.skillport.com/skillportfe/main.action?assetid=RW$29424:ss_book:12766#summary/BOOKS/RW$29424:ss_book:12766).
- Pryor, J., Wilson, R., Chapman, M., & Bates, F. (n.d.). Elementary Educators' Experiences Teaching during COVID-19 School Closures: Understanding Resources in Impromptu Distance Education. *Online Journal of Distance Learning Administration*, 23(4).  
<https://eds.b.ebscohost.com/eds/detail/detail?vid=1&sid=d15e9f68-4a77-4c6c-86f3-00050fb0da1b%40pdc-v-sessmgr02&bdata=JkF1dGhUeXBIPXNzbyZzaXRlPWVkcylsaXZlJnNjb3BIPXNpdGU%3d#AN=148088841&db=eue>.

- Salmons, J., & Wilson, L. A. (2019). *Learning to Collaborate, Collaborating to Learn Engaging Students in the Classroom and Online*. Stylus.  
<https://eds.a.ebscohost.com/eds/detail/detail?vid=0&sid=0081f861-5649-4945-be0d-194c8041d7fc%40sdc-v-sessmgr03&bdata=JkF1dGhUeXBIPXNzbyZzaXRIPWVkey1saXZIJnNjb3BIPXNpdGU%3d#AN=2100223&db=e000xna>.
- Veletsianos, G. (2020). *Learning Online: The Student Experience*. Johns Hopkins University Press. [https://web.b.ebscohost.com/ehost/ebookviewer/ebook?sid=0960087c-bf0b-42e0-b585-e419b6d8e48f%40pdc-v-sessmgr01&ppid=pp\\_15&vid=0&format=EB](https://web.b.ebscohost.com/ehost/ebookviewer/ebook?sid=0960087c-bf0b-42e0-b585-e419b6d8e48f%40pdc-v-sessmgr01&ppid=pp_15&vid=0&format=EB).
- Watson, A., Jones, K., & Pratt, D. (2013). *Key Ideas in Teaching Mathematics: Research-based we Guidance for Ages 9-19*. OUP Oxford.  
<https://eds.a.ebscohost.com/eds/detail/detail?vid=0&sid=97f70f65-675d-4e26-ac04-ba08f3819953%40sessionmgr4008&bdata=JmF1dGh0eXBIPXNzbyZjdXN0aWQ9bnMwMTc1Nzgmc2l0ZT1lZHMtbGl2ZSZzY29wZT1zaXRl#AN=531717&db=e000xna>.