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Enhancing 3rd Grade Learning of Multiplication and Division with Differentiated Instructional Strategies

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University Honors Capstone

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Senior Honors Project/Thesis

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Abstract

This capstone project reports the differentiated instructional strategies and assessment methods implemented throughout a math unit in a third-grade classroom. The capstone will report the effectiveness of two instructional strategies and three assessment methods that were integrated into a math unit that focused on students' understanding of multiplication and division. The math unit had 10 lessons taught over two weeks between the pre-test and the final checkpoint. Based on student data, students' understanding, and performance increased throughout this unit by using a variety of differentiated instructional strategies and assessment methods. In this capstone, I will outline the instructional strategies and assessment methods utilized and their impact on student learning. I collected and analyzed the pre-and post-assessment data, concluding that cooperative learning, manipulatives, continuous observation, written response, and technology are effective instructional strategies and assessment methods to increase student learning.

Keywords: instructional strategies, assessment methods, cooperative learning, manipulatives, multiplication, division

Background

For my clinical practice placement, I was placed at Bennington Elementary in a third-grade classroom in Nebraska's Bennington Public School District. Bennington Elementary is composed of 493 students and 20 teachers. The student-to-teacher ratio is 24:1. The third-grade class I was placed in was composed of 16 students. My capstone project was supervised by my cooperating teacher who has been teaching in this district for five years. In collaboration with my cooperating teacher, it was determined I would plan, implement, and assess a math unit for the students in the class.

Introduction

The goal of this project was for students to successfully solve multiplication and division problems and write story problems. Students were assessed on their knowledge in the following areas: fact fluency, fact families, solving story problems, and writing story problems. The first goal of this unit was that students would be able to connect multiplication and division as inverse operations of one another. The second goal of this unit was that students would be able to solve and write story problems to connect multiplication and division to their everyday experiences. I created three objectives to guide my project. The first objective was to determine the effectiveness of cooperative learning on academic achievement growth from a pre-test to a post-test for students. The second objective was to reflect on how incorporating cooperative learning into lessons impacts student achievement and engagement. The third objective was to explore various ways to incorporate cooperative learning structures into the classroom as well as different ways to assess student learning from these activities.

The guiding question of my capstone project was, "*How do differentiated instructional and assessment strategies (i.e., cooperative learning, manipulatives, continuous observation,*

written response, and technology) impact student performance when solving problems involving multiplication and division?" For this project, students completed a pre-test prior to instruction. The pre-test assessed fact fluency, fact families, solving story problems, and writing story problems. Half-way through the unit, students completed a checkpoint as a post-test for two of the four areas being assessed (fact fluency and writing story problems). At the end of the unit, students completed a different checkpoint as a post-test for the two remaining areas that were assessed (fact families and solving story problems). The checkpoints mirrored the structure and assessment areas of the pre-test. The pre-test had 7 problems, totaling 32 points across all areas. The multiplication and division checkpoint also had 7 problems, worth 30 points in total, while the division checkpoint had 2 problems, totaling, 16 points. While teaching the unit, I implemented two differentiated instructional strategies and three assessment methods to determine if they would have a positive effect on student learning. The instructional strategies included cooperative learning and the use of manipulatives, while the assessment methods included continuous observation, written response, and technology integration.

Understanding of Instructional Methods

Cooperative Learning

Effective teachers use research-based instructional strategies to teach students and guide their instruction. One instructional strategy that was implemented in this unit was cooperative learning. Cooperative learning is an instructional strategy where students collaborate to accomplish a shared task or activity. Examples of cooperative learning include structures such as Think-Pair-Share, Turn and Talk, Stump Your Partner, and Roundtable. There are multiple studies supporting that cooperative learning has many benefits for students including increased academic performance.

Research supports that cooperative learning leads to students internalizing higher mental functions such as reasoning, critical thinking, and reflection that originate in social interactions (Genç, 2016). Cooperative learning enables the students to socialize and leads them to take an active part in the learning process rather than a teacher-led class structure where students take a more passive role in their learning (Genç, 2016). According to Silva et al. (2022), cooperative learning is described as "an efficient pedagogic methodology for the promotion of critical thinking skills," encompassing observation, interpretation, and analysis. Additionally, they note that cooperative learning has led to improvements for both low-achieving and high-achieving students (p. 16). This research supports that cooperative learning is a highly effective strategy to increase academic performance for all learners. Additionally, it enhances social and critical thinking skills which serve students well beyond. By actively engaging with the content, students move beyond passive learning.

Use of Manipulatives

Manipulatives were also used during instruction. Manipulatives are concrete objects that allow students a hands-on experience while engaging with the content or curriculum. Examples of manipulatives that may be used in a classroom include snap cubes, tiles, and tokens. Math is an abstract concept for students that often requires a physical representation to help them conceptualize the idea.

Research supports the use of manipulatives as students who use mathematical manipulatives increase their mathematical achievement scores, as well as provides them with additional methods or strategies that are critical to building problem solving skills (Liggett, 2017). Liggett noted that "students who used mathematical manipulatives performed better on the post-test than those who did not use manipulatives" (p. 95). However, it is also important to

be considerate of which manipulatives are used as well as how they are used to teach mathematical concepts. Lafay et al. (2023) found that "at-risk students struggled to conceptualize larger number as groups of tens and ones and instead viewed them as all ones which made some manipulatives more difficult to use" (p. 103). Manipulatives can be highly effective in teaching abstract mathematical concepts when used appropriately and with scaffolding from the teacher. They provide students with a hands-on experience, allowing them to engage directly with the content.

Understanding of Assessment Methods

Continuous Observation

Assessments are given to students during lessons and throughout a unit so teachers can assess student understanding and adjust instruction accordingly. Effective teachers use research-based assessment methods to evaluate students' performance. Assessment is a crucial part of teaching as it allows students to show the depth of their knowledge as well as guides future instruction to meet students where they are. One assessment method that was implemented in this unit was continuous observation. Throughout a lesson, students are frequently asked to participate through speaking, hand signals, or showing their work as a form of continuous assessment. Examples of continuous assessment include utilizing a thumbs up or thumbs down, showing numbers on fingers, spoken responses, or writing down work to solve a problem or discuss an idea.

Research has found that the performance of both high and low achieving students increased as a result of using continuous observation to assess student learning and adjust instruction as a result (Iqbal et al., 2017). Continuous observation can take many forms as long as students are asked to display their thinking. For instance, Banes et al., (2020) noted that these

forms may include "various hand signals (holding up an answer, agreeing or disagreeing), using whiteboards to show their answers and work, or verbally sharing" (p. 1392). Beyond guiding teachers in their instruction, continuous observation also benefits students as it promotes better understanding of the content and develops confidence and self-evaluation attributes for students (Iqbal et al., 2017). Following instruction of the unit, I found that engaging in math discussions that embraced multiple approaches to problem-solving and providing students with frequent opportunities for students to speak, had a positive impact on their written achievement.

Written Response

The second assessment strategy I implemented in this unit was written responses. For this strategy, students' approach and solve problems in various ways and then explain their thinking through a written response. According to Harlan, (2019) "writing in mathematics has been found to not only increase students' understanding of mathematics concepts but also increase students' mathematical achievement" (p. 108). Harlan (2019) also noted that writing in math "gives students the opportunity to reflect on their personal understanding of mathematics concepts as well as communicate their understanding to others" and enables students to have the ability to communicate their understandings of those concepts to others (p. 108).

Throughout the unit the students were asked to write responses to given math prompts. I found the writing led students to be reflective as they learned to internalize the information before they communicated it within a written response. The students' written responses were especially insightful when they were prompted to explain the reasoning behind their work and answers, rather than solely focusing on producing correct numbers and computations.

Technology

The last assessment strategy that was implemented in the unit involved the use of technology to collect formative assessment. The effectiveness of using technology as an assessment tool relies heavily on the affordances of the digital tool and the way in which this is used by the teacher as an educational tool. Many existing pedagogies can be harnessed and used effectively when using technology in a classroom situation (Dalby & Swan, 2019). Beyond serving functions of rapid assessment, timely feedback, and tracking of student learning, technology also gives summaries of student responses for teachers from which they can quickly identify common misconceptions (Dalby & Swan, 2019).

The various apps that were implemented throughout the unit included Google Slides, Blooket, IXL, and XtraMath. I found that by integrating technology into the unit it assisted me in gathering useful information quickly. Van der Kleii et al. (2017) noted that technology can also be used to give feedback and allow students an opportunity for self-reflection. I found that the apps provided rapid assessment results, created timely feedback, and assisted me in tracking student learning. The technology apps also allowed the students to use an additional tool to demonstrate their knowledge of the math content.

Participants

The participants in this study were 16 third-grade students at Bennington Elementary. The class was composed of six girls and ten boys. Of these students, 12.5% qualified for special education services and had Individualized Education Plans (IEPs). Both students who received special education services had goals in math. These students received math services every day. Of the 16 students in the class, 12.5% also qualified for Higher Ability Learning (HAL) in math. These students were pulled once a week to complete extension activities in math.

Methods and Materials

This math unit connected to two Nebraska state standards for third-grade students.

- 3.A.1.f Use drawings, words, arrays, symbols, repeated addition, equal groups, and number lines to interpret and explain the meaning of multiplication and division and their relationship.
- 3.A.1.d Interpret and solve two-step authentic problems involving whole numbers and the four operations.

Based on these standards and the assessments that would be used throughout this unit, I created two primary objectives for students to meet: (1) students would be able to connect multiplication and division as inverse operations of one another, and (2) students would be able to solve and write story problems to connect multiplication and division to their everyday experiences. This unit centered on multiplication and division fact fluency, creating fact families, solving story problems, and writing story problems.

The Bennington Public Schools District uses the following grading scale: 93-100% (A), 86-92% (B), 77-85% (C), 70-76% (D), 69% and lower (F). For this project, I assessed students using the grading scale with these corresponding titles: meeting standard (A), approaching standard (B), strategic (C), and intensive (D). The target for students was to be approaching standard or above, as this would indicate that they had showed mastery of most to all of the topics addressed. This unit was taught over 17 days (approximately 3 and a half school weeks). A ten-question pre-test (Appendix A) worth 32 points was administered the first day of the unit. The pre-test directly mirrored the post-assessment that the students took at the end of the unit. The checkpoints each assessed part of the skills that were included in the pre- and post-assessments.

The pre-assessment was administered to provide a baseline of their understanding of their knowledge before beginning the unit. I read each question of the pre-assessment aloud as the students completed the test. I encouraged students to try their best on the pre-assessment even if they were unsure of the correct responses. After examining the pre-assessments, I used the data to plan instruction to best meet the needs of students.

Using the pre-test data, I created leveled small groups of students based on their knowledge of skills and content for the unit. There was a high group, middle group, and low group. Each day, the lesson started with a fifteen-minute whole group lesson that targeted the foundation of knowledge the students needed to learn throughout this unit. I integrated a variety of instructional strategies to include gradual release, explicit modeling, think alouds, math talks, and discussion.

I began each lesson teaching to the whole group. Following whole group instruction, the students rotated through three small group stations, one of which always included a lesson at the back table with me. The small group lessons allowed me to target skills specific to each group of students. The other rotations varied each day but included two of the following: (a) worksheet to complete with a partner or independently, (b) IXL and Xtra Math skills to complete on their chrome books, or (c) content-based games from the curriculum to play with a partner.

The multiplication checkpoint was administered after 13 instructional days (approximately 2 and a half weeks) and the division checkpoint was given 5 instructional days (approximately one week) later. These assessments were used to check the students' understanding of skills covered up to that point in the unit. Following analysis of the checkpoints I would adjust my instruction as needed.

In addition to the instructional strategies noted above, I also implemented two research-based instructional strategies. My goal was to determine if the strategies would have a positive effect on student learning and achievement throughout the unit. The first instructional strategy that I implemented in this unit was the use of cooperative learning. Cooperative learning supported the engagement and instruction of content in this unit. This instructional strategy required students to work with peers toward a common goal while taking ownership of their own learning. Some of the cooperative learning structures included stump your partner vocabulary review, small group "trashketball" review, turn and talks, group story problems, and gallery walks (Appendix B). Students were expected to engage with the content through discussion and activities with their peers. I found that the students' active participation in the cooperative learning structures supported their understanding of the content, which led to an increased achievement on the assessments.

The second instructional strategy that was implemented in this unit was the use of manipulatives. Students used manipulatives such as tiles, snap cubes, and whiteboards to engage in the content of this unit. The tiles were used to create arrays that were used in the creation of fact families and the snap cubes were used as hands-on models of multiplication and division. Additionally, students used whiteboards to respond to a variety of prompts and show their thinking. Examples of using whiteboards included students being tasked with writing and solving story problems, generating their own fact families, and demonstrating their problem-solving process when solving multiplication and division problems. While reviewing their responses, I would ask questions to explain their work to me, and sometimes to the whole group. This fostered classroom discussion and provided me with insight into the depth of understanding across the class.

Throughout this unit, I also implemented three research-based assessment methods to identify if these assessment methods would have a positive impact on student learning and achievement. The first assessment method that was implemented in this unit was continuous observation. Continuous observation occurred through various means including monitoring students' use of manipulatives, reading their written work on whiteboards and exit tickets, as well as actively listening to discussion and prompting students with questions. I incorporated the think aloud assessment strategy into my teaching approach. During whole group activities, I frequently prompted students to engage in peer discussion, listening to their conversations. This provided me with more personalized conversations with students during small group work.

The second assessment method that was implemented was written responses. I administered multiple written response prompts throughout the unit. Students were asked to respond on their whiteboards or on an exit ticket. For example, students were asked to write their own story problems (Appendix C) and justify if another person's strategy for solving was reasonable or not and explain why.

The third assessment method that was implemented was the use of technology. Technology was used to assess students in a variety of ways throughout the unit. Students were assigned skills on IXL and practiced fact fluency on Xtra Math, both of which sent continuous updates to the teacher. Students were also asked to write their own story problems on a class slideshow so their peers could practice solving problems. Students were able to complete the technology assessments, providing valuable insights into each student's understanding. Additionally, these assessments helped reveal class-wide misconceptions that needed to be addressed in the whole group setting.

Before taking each checkpoint, students reviewed the content that would be assessed with a partner. After each checkpoint, I immediately assessed the students' work to determine the students' growth and proficiency. I used the data that was collected to determine if the instructional strategies and assessment methods implemented throughout this unit positively impacted student learning and achievement.

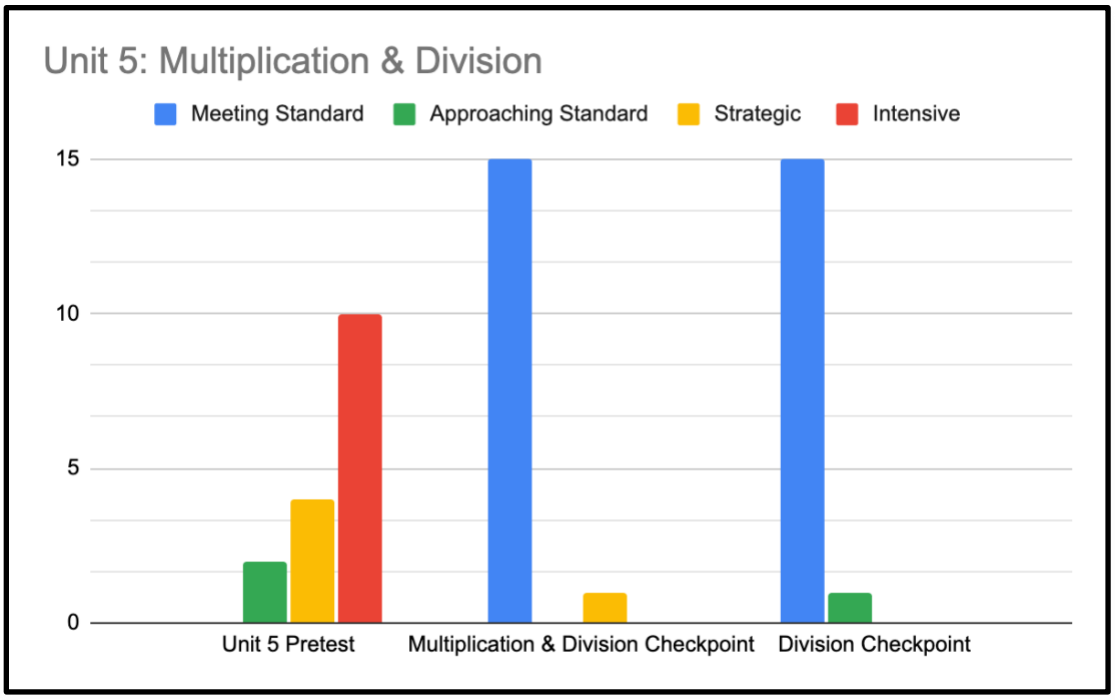
Results/Data Analysis

Appendix A includes the questions on the pre-assessment. Appendix D includes the questions on the Multiplication & Division Checkpoint and Appendix E includes the questions on the Division Checkpoint. These two checkpoints were utilized as a post-assessment for the unit as they covered all the skills on the pre-test when combined. Figure 1 displays the students' grades across pre-test and checkpoints in the unit. All 16 students completed all three of the assessments.

Figure 1 displays the student data across the three graded assignments or marking categories across the unit. Based on the students' scores, they were placed into one of four categories that followed the school's grading system. The categories included the following: meeting standard – A, approaching standard – B, strategic – C, intensive – D or lower. The categories also corresponded with a color to organize the data further (meeting standard – blue, approaching standard – green, strategic – yellow, intensive – red). Scores from these assessments were used in the planning and implementation of instruction throughout this unit.

Figure 1

Grading Standards



Note. Figure 1 shows student scores on the pre-test and checkpoints (used as post-assessment) in accordance with the grading system (meeting standard – A, approaching standard – B, strategic – C, intensive – D or lower).

Figure 2 reports each student's scores across the pre-test, multiplication & division checkpoint, and the division checkpoint. The two checkpoints were combined and utilized as the post-assessment for this unit. The color of each score is based on the student's grade in relation to the school's grading system. Red indicates a D or lower, yellow indicates a C, green indicates a B, and blue indicates an A. Figure 2 was utilized to create small groups of students with similar knowledge of the content and skills of the unit.

Figure 2

Student Scores

Unit 5	Pages 1-3 Pretest	Multiplication & Division Checkpoint	Division Checkpoint
Student 1	13	28	15
Student 2	27	29	16
Student 3	19	28	14
Student 4	30	25	16
Student 5	10	29	16
Student 6	17	28	16
Student 7	29	30	16
Student 8	22	30	16
Student 9	28	29	16
Student 10	29	29	16
Student 11	28	30	16
Student 12	21	28	16
Student 13	27	28	16
Student 14	11	28	16
Student 15	30	29	16
Student 16	27	28	16

Note. Figure 2 reports student scores across the three assessments used in the unit.

Discussion and Conclusions

The data collected throughout this unit provided valuable information about the level of understanding for each student which aided the planning of instruction for both whole and small groups. Based on the pre-test data shown in Table 1 and Graph 1, I knew that I had students performing at all levels. From this information, I created differentiated small groups so that the students were receiving instruction at their instructional level, and small group and whole group instructional time would be used efficiently and effectively. There was one high group, one middle group, and one low group, and their small group lessons were tailored to each group, yet all connected to the content being taught to the whole group.

Students 4, 7, 9, 10, 11, and 15 were in the high group as they scored between 28 and 30 points out of 32 on the pre-test. These students showed understanding of most of the concepts covered in this unit, but still needed direct instruction and discussion to clear up some misconceptions. When working with the teacher, this group focused on extending their learning. They worked on solving complex word problems with additional unnecessary information. They also were asked to write story problems independently for their peers to practice solving. The high performing group utilized efficient strategies to solve and then were asked to explain how they chose that strategy and explain why that strategy worked when solving the problems. In the small group, there were opportunities to solve problems with a partner and many opportunities to practice independently. The high performing group also worked on grade-level materials or extension activities at all stations to support their learning. Also, two of the students in this group qualified for High Ability Learning (HAL) in mathematics, so they were pulled to complete math-related extension activities once a week.

Students 2, 8, 12, 13, and 16 were in the middle group as they scored between 21 and 27 points out of 32 on the pre-test. These students showed the knowledge of some skills but made a few errors when solving and indicated that they needed instruction on the content of this unit as well as multiple opportunities to practice with feedback. When working with the teacher in small group, these students received direct instruction that focused on building their skills to a proficient level that would be approaching or meeting standard. The middle group had many opportunities to practice skills with a partner and then some opportunities to practice independently. The middle group also worked on grade-level materials at all stations to support their learning.

Students 1, 3, 5, 6, and 14 were in the low group as they scored between 10 and 19 points out of 32 on the pre-test. These students showed little understanding of the concepts in this unit which indicated that they needed explicit and direct instruction, discussion, multiple exposures to the content and strategies being taught, and various opportunities to practice with feedback. When working with the teacher in small group, these students focused on using manipulatives and practicing strategies to solve while discussing how those strategies work. The lower-performing group typically collaborated in group activities during the small group lesson, with opportunities for partner work or independent work toward the end of the session. The students were exposed to grade-level activities at other rotations with supports in place. For example, stations may have included adult assistance or immediate feedback on incorrect responses when working on IXL or Xtra Math. Additionally, two of the students in this group qualified for math special education services, so they received additional support from the resource teacher each day on the content of this unit as well as the content of their Individualized Education Program (IEP) goals.

After analyzing the data from the two checkpoints, I concluded that the instructional strategies and assessment methods implemented throughout this unit had a positive impact on student learning and achievement. After students received differentiated small group instruction, 15 out of 16 students increased their scores and 15 out of 16 students met standard on both checkpoints.

I found cooperative learning to be an effective instructional strategy as the learning became student-centered. Students were taking ownership of their learning and engaging with both the content and their peers which led to great discussions to deepen their understanding of the content. By using cooperative learning, students were able to ask their peers questions or

watch their solve problems which helped them see things from another person's perspective while also analyzing their own understanding so they could communicate their own thoughts and strategies for solving various problems. When students were asked to participate in cooperative learning, students were more engaged which led to more questions and discussion for the entire class. Students utilized critical thinking in discussions that facilitated whole group discussions to clear up misconceptions or extend understanding at the end of each activity. After reviewing the data from the two checkpoints, I concluded that using cooperative learning structures positively impacted student learning and achievement.

The use of manipulatives was also an impactful instructional strategy. I found that the students gained a greater understanding of multiplication, division, and inverse operations when they could see and manipulate a hands-on object. Students were able to extend their knowledge from their hands-on experiences into creating written equations to solve. Using manipulatives also aided in the approach to solving story problems that become complex by representing the objects in the problem with physical objects. After reviewing the checkpoint scores, I concluded that using manipulatives positively affected student learning and achievement.

Using continuous observation as an assessment method was highly effective and insightful. I found that continuously collecting data from students, whether written or through conversation, allowed me to understand the depth of their understanding. This approach provided me with the opportunity to adjust my instruction in real-time and to be more intentional in my future planning. For example, I overheard students discussing various strategies for solving division problems and debating which approach to use. In response, I led a class discussion where we explored each strategy and its connection to others, highlighting how each approach led to the correct answer. I was also able to walk around the room and make note of which

students were solving problems quickly or using multiple strategies and which students were struggling to start solving the problem which was helpful in guiding future instruction and intervention. Continuous observation provided me with information about my students' level and depth of understanding throughout the unit.

Using written responses as an assessment method was also an effective assessment strategy. I found that using written responses to assess the level and depth of understanding of students provided insightful information that I used to adjust my instruction. Students were tasked with writing their own story problems and justifying whether the proposed strategy was reasonable, along with explaining their reasoning. For example, when examining the story problems written by students, I noticed that many students were writing the answer within the problem. I addressed the mistake with the entire class, employing a gradual release approach with explicit modeling. I guided students through the process of writing story problems without including the answer using a think aloud to illustrate the process. After this discussion, most students were no longer writing the answer within the story problem. Written responses allowed me to gain more information on the level and depth of the students' understanding.

In addition, using technology as an assessment method was impactful. I utilized applications such as Google Classroom, Google Slides, IXL, and Xtra Math to assign skills and practice opportunities, enabling quick assessment of student understanding. These applications allowed me to see individual student responses and class-wide trends in a timely manner which helped drive my instruction each day. Also, each of these applications assessed students in a different way which allowed students with different learning preferences to have various opportunities to practice problems and show what they know. Technology can be adapted to the

content being taught and gave timely results that provided valuable information to drive future instruction.

The data collected from the pre-test revealed several areas of challenge for the students: (1) difficulty identifying multiplication and division as inverse operations within the same fact family, (2) inaccuracies in writing and solving multiplication and division story problems, and (3) struggles with multiplication and division fact fluency. On the pre-test, students earned 368 out of 512 possible points, which is an accuracy of 75%. On the checkpoints, students earned 709 out of 736 possible points, which is an accuracy of 96%. This data suggests a 21% increase in student achievement. The data from the pre-test and checkpoints suggests that the instructional and assessment strategies implemented throughout this unit had a positive impact on the learning and achievement of students.

All students are unique and have different learning preferences and needs. Implementing a variety of instructional strategies and assessment methods is a research-based teaching practice that enriched and improved my instruction. Following the outcomes of this capstone project, I plan to integrate differentiated instructional and assessment strategies into my future teaching. These strategies proved effective in enhancing student learning and achievement. I found that integrating a variety of instructional and assessment strategies created an environment that supported the diverse needs of every student in the classroom. In my opinion, this approach embodies the ideal way of teaching.

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Appendix

Appendix A: Pre-Assessment

Unit 5 Module 1 | Session 1 *class set, plus 1 copy for display*

NAME | DATE

Unit 5 Pre-Assessment page 1 of 4

1 Draw a line from each problem on the left to the matching equation on the right. Then write the correct answer.

a A T-shirt costs $10 at the mall. A jacket costs 4 times as much as a T-shirt. How much does a jacket cost?

$18 \div 6 =$ ____

b Jeff and his sister picked 18 flowers. They put 6 flowers in each vase. How many vases did they use?

$24 \div 4 =$ ____

c The third graders are setting up the room for Grandparents' Day. They set up 3 rows of chairs with 9 chairs in each row. How many chairs in all?

$3 \times 9 =$ ____

d There are 4 minivans to take 24 kids to the museum. How many kids will ride in each van if all the vans take the same number of kids?

$4 \times 10 =$ ____

2 Fill in the answer to both equations. Then write a story problem to match each one.

a $4 \times 5 =$ ____
My Story Problem:

b $14 \div 2 =$ ____
My Story Problem:

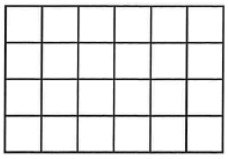
(continued on next page)

Unit 5 Module 1 | **Session 1** *class set, plus 1 copy for display*

NAME _____ | DATE _____

Unit 5 Pre-Assessment page 2 of 4

3 Write 2 multiplication and 2 division equations (a fact family) to describe this array.



_____ × _____ = _____ _____ ÷ _____ = _____

_____ × _____ = _____ _____ ÷ _____ = _____

4 Solve each story problem. Use numbers, labeled sketches, or words to show your thinking, and write the answer. Then write an equation to match the problem.

a The pet store just got 24 new turtles. Petra is putting the turtles into terrariums. She puts 6 turtles in each terrarium. How many terrariums does she use?

Work:

Petra uses _____ terrariums.

Equation: _____

b The pet store has 9 puppies. Each puppy drinks 6 cups of water each day. How many cups of water do all of the puppies, together, drink in one day?

Work:

The puppies drink _____ cups of water in one day.

Equation: _____

(continued on next page)

Unit 5 Module 1 | Session 1 *class set, plus 1 copy for display*

NAME | DATE

Unit 5 Pre-Assessment page 3 of 4

5 The pet store got 4 boxes of new dog collars. There were 6 dog collars in each box. Petra unpacked all the collars and hung them up in 3 equal rows on the wall. How many collars in each row?

a Choose the equation that could help you solve this problem.

- ○ $(4 + 6) \times 3 = c$
- ○ $(4 \times 6) \div 3 = c$
- ○ $4 + 6 + 3 = c$
- ○ $(4 \times 6) - 3 = c$

b Solve the problem. Show all your work.

Answer: There were _____ collars in each row.

6 Fill in the missing number to solve each equation.

$15 \div \_\_\_ = 5$ $24 = 4 \times \_\_\_$

$4 = \_\_\_ \div 5$ $\_\_\_ \times 3 = 21$

7 Jami has to solve this story problem:

There are 32 fourth graders in the gym. The gym teacher divides them into 4 equal groups. How many fourth graders in each group?

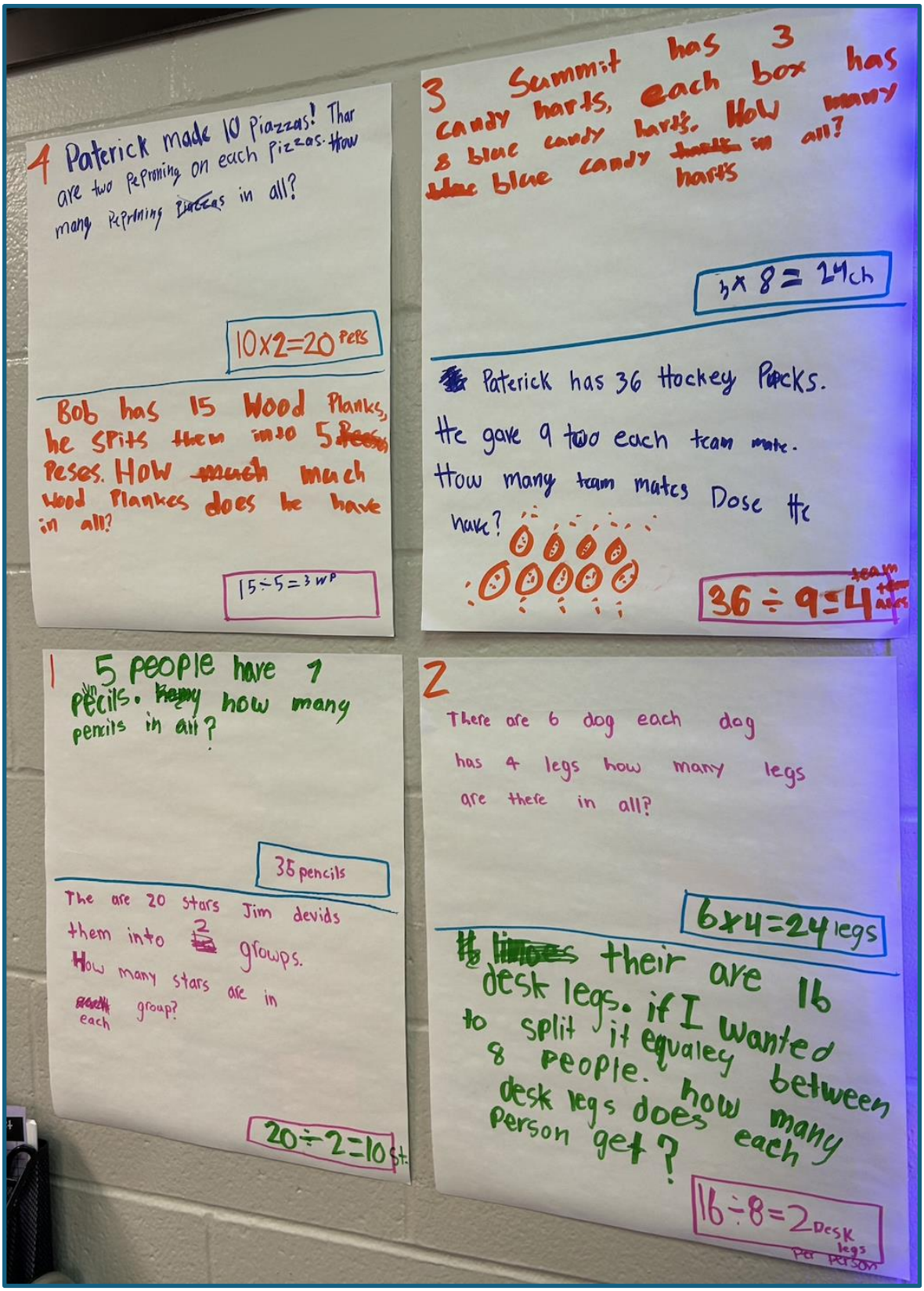
a Jami says she can solve the problem by thinking, "4 times *what number* equals 32?" Do you agree with Jami? Why or why not?

b Write and solve a division equation to match Jami's problem.

(continued on next page)

Appendix A: Pre-test given to students to assess their understanding before the unit.

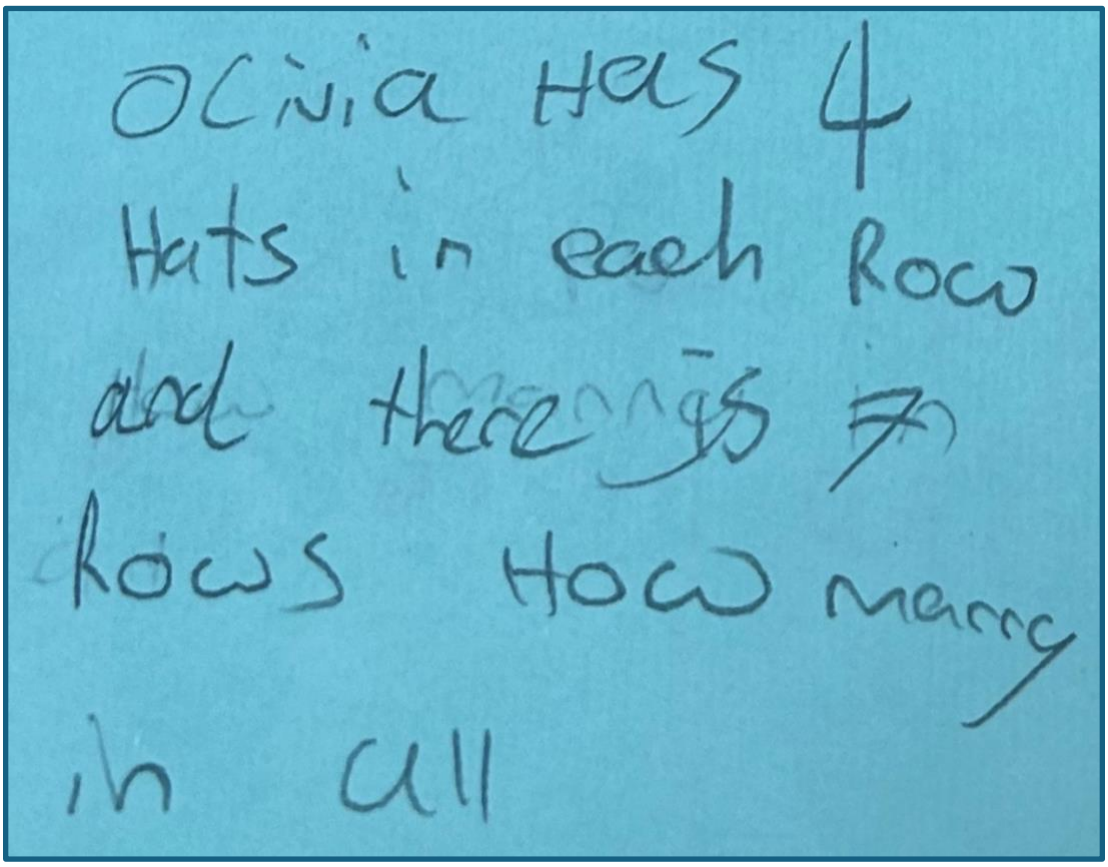
Appendix B: Student Work Sample – Cooperative Learning Story Problems



Appendix B: Photograph of story problems written and solved by students in a gallery walk

(cooperative learning structure).

Appendix C: Student Work Sample – Written Response Exit Ticket



Appendix C: Example of a student's written response exit ticket that was used to assess understanding of writing story problems.

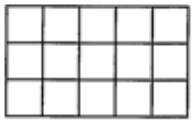
Appendix D: Multiplication & Division Checkpoint (Post-Assessment)

Unit 5 Module 2 | Session 4 *class set*

NAME _____ DATE _____

Multiplication & Division Checkpoint

1 Write two multiplication and two division equations (a fact family) to describe this array.



____ × ____ = ____ ____ ÷ ____ = ____

____ × ____ = ____ ____ ÷ ____ = ____

2 Multiply.

3 × 7	4 × 5	10 × 10	6 × 6	8 × 3	7 × 7	9 × 2
5 × 5	3 × 6	7 × 10	4 × 6	9 × 3	0 × 6	1 × 8

3 Divide. (Hint: Use the multiplication problems above to help.)

18 ÷ 3 = ____ 21 ÷ 3 = ____ 20 ÷ 4 = ____ 27 ÷ 3 = ____

36 ÷ 6 = ____ 25 ÷ 5 = ____ 24 ÷ 3 = ____ 18 ÷ 2 = ____

4 Fill in the answer to both equations. Then write a story problem to match each one.

a 4 × 7 = ____

My Story Problem

b 16 ÷ 4 = ____

My Story Problem

Appendix D: Multiplication & Division Checkpoint given to students after approximately 2 and a half weeks of instruction to assess their understanding of skills up to that point.

Appendix E: Division Checkpoint (Post-Assessment)

Unit 5 Module 4 | Session 1 *class set plus 1 copy for display*

NAME _____ | DATE _____

Division Checkpoint

1 Solve each story problem. Use numbers, labeled sketches, or words to show your thinking, and write the answer. Then write an equation to match the problem.

a The Bead Store just got lots of new beads. Addy is going to take 24 of the new glass beads and put them into bags. If she puts 8 beads in each bag, how many bags does she need?

Work:

Answer: Addy needs _____ bags.

Equation: _____

b Tim comes into the Bead Store and buys 36 of the new beads. He is planning to use them to make 4 bracelets. If he uses all the beads and divides them evenly, how many will he have for each bracelet?

Work:

Answer: Tim will have _____ beads for each bracelet.

Equation: _____

2 Anna is doing her homework. She has to solve some division problems. Her big sister says that if Anna thinks of the multiplication facts she knows, it will make the work easier. For each of the division problems below, circle the multiplication fact that would help Anna the most. Then write the answer to the division problem.

24 ÷ 4 = _____	3 × 8 = 24	4 × 6 = 24	2 × 12 = 24
30 ÷ 6 = _____	3 × 10 = 30	2 × 15 = 30	6 × 5 = 30
36 ÷ 4 = _____	4 × 9 = 36	6 × 6 = 36	4 × 8 = 32
28 ÷ 7 = _____	7 × 6 = 42	7 × 4 = 28	2 × 14 = 28
35 ÷ 5 = _____	5 × 5 = 25	1 × 35 = 35	5 × 7 = 35

Appendix E: Division Checkpoint given to students after approximately 3 and a half weeks of instruction to assess their understanding of the remaining skills (not assessed on the Multiplication & Division Checkpoint).