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Teaching Methods to Build the Numeracy Skills of Preschoolers with Disabilities and Complex Communication Needs

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TEACHING METHODS TO BUILD THE NUMERACY SKILLS OF PRESCHOOLERS WITH DISABILITIES AND COMPLEX COMMUNICATION NEEDS

by

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Abstract

This project explored the use of a curriculum that incorporates naturalistic and explicit instructional approaches through literature and direct teaching moments on the numeracy skills of three students with disabilities and complex communication needs. The numeracy skills targeted included patterning and sorting, shape discrimination, and quantity discrimination. This project took place during Extended School Year (ESY), a program that extends the traditional school year to provide services to students with disabilities. Student present levels and progress were assessed through a pretest and posttest given on the first and last days of ESY, in addition to progress monitoring data taken during each ESY session. Findings from this project helped me become a better educator of preschoolers with disabilities and complex communication needs by increasing my knowledge of ways to teach early numeracy skills.

Introduction

Early numeracy, also called early number sense, refers to explicit number knowledge, including number recognition, ordinality, counting, comparing, and patterning (Root et al., 2019). Mathematics is the field of study, while numeracy is using math and math concepts in practical ways throughout our daily lives (Davenport & Johnson, 2015). Numeracy and early math skills are important for young children to develop, as they build a foundation for later math learning. Research suggests that numeracy skills at kindergarten entry may be the strongest predictors of both later reading and math achievement (Duncan et al., 2007). However, children with disabilities are more likely to struggle in developing early numeracy and math skills and show less growth in these areas when compared to their peers without disabilities. While working in different preschools over the past four years, I've discovered that preschool teachers have a difficult time implementing numeracy instruction that is intentional in teaching early math skills, particularly for students with disabilities. Some of these students qualify for Extended School Year (ESY), which is a program that extends the traditional school year to provide services to students with disabilities in compliance with their Individualized Education Plans (IEPs) (USBE, 2022). My creative project focuses on a multi-tiered numeracy curriculum, which was implemented during ESY, in an effort to provide increased contact with numeracy instruction for the students who need more support.

Literature Review

Method

To search for relevant publications, I conducted an online search through PsycINFO, EBSCOhost, and Google Scholar by using the following keywords both separately and in

combination: *early childhood, non-verbal, complex communication needs, numeracy, special education,* and *mathematics*. I eliminated any articles that did not include research conducted in early childhood settings and prioritized those in which children with disabilities were the focus of the study. I reviewed over twenty articles that concentrated on numeracy instruction with children in preschool or similar childhood learning environments.

Much of the research on numeracy instruction for young children with disabilities focuses on direct and explicit teaching methods. These interventions are intensive and created to meet the specific instructional needs of students who have or are at risk for a mathematical learning disability (Root et al., 2019). Another approach to numeracy instruction is through naturalistic learning. Naturalistic learning can be described as embedding learning opportunities throughout naturally occurring activities, such as shared storybook reading (Green et al., 2017). Research shows that children best learn early number sense when explicit instruction is combined with naturalistic learning approaches (Green et al., 2017; Lonigan et al, 2011; Wolery & Hemmeter, 2011).

There are two types of subitizing that are important for students to understand. Perceptual subitizing is the ability to quickly or immediately comprehend the magnitude of small numbers (Ingelin et al., 2021). Conceptual subitizing is the ability to immediately know how many dots are present because the pattern is one that is known (Ingelin et al., 2021). One-to-one correspondence is the ability to count objects by assigning a specific number to each object, and no objects are skipped or counted more than once (Ingelin et al., 2021). Number conservation is the ability to recognize that a group of items have the same amount, regardless of how the items are organized (Ingelin et al., 2021). Patterning is the ability to, when presented with a model

pattern and additional materials, reproduce the pattern with the additional materials by including at least three units and no additional objects (Hardy & Hemmeter, 2021). Quantity comparison is the ability to identify which group has more items when presented with two groups of items of different amounts (Hojnoski et al., 2017). Ordinality is the understanding that number words represent that number's position in a sequence (Green et al., 2017). Each of these early numeracy skills is critical for school-entry mathematical knowledge, which is the strongest predictor of later academic achievement (Green et al., 2017; Hojnoski et al., 2017).

Integrating Explicit Numeracy Instruction with Naturalistic Learning Approaches

A quasi-experimental study by Green et al. (2017) examined the effects of an interactive shared reading intervention with 50 three-to-five-year-old children with disabilities to target their one-to-one correspondence, quantity comparison, and oral counting skills. The intervention team, consisting of the principal investigator and a research assistant, integrated literature with math concepts. One of the researchers led a storybook reading while utilizing math-based scripted questioning, elaboration, and discussions. This was followed by a math activity based on the story. They read the stories *A Snowy Day, Goldilocks and the Three Bears*, and *The Very Hungry Caterpillar*. After implementing the intervention three days a week for six weeks, results indicated that children who received this intervention had higher scores in total math ability, quantity comparison, one-to-one correspondence counting, and oral counting than those in the comparison group who received a typical reading of the same three books but without the math-based questions or elaborations and no math activity after the story.

In addition to literature, numeracy instruction can be taught through music, which naturally occurs in many preschool classrooms and can be effective when combined with direct

instruction (McDonel, 2015). McDonel (2015) used an exploratory concurrent mixed-methods study to investigate the impact of an intervention that incorporated math-related songs and music activities to teach and practice math concepts. An early childhood music specialist worked with 10 three-to-five-year-old children without disabilities in an early childhood research center to teach counting, adding, subtracting, and one-to-one correspondence skills through music. This included pointing to and counting the camel's humps while singing "Alice the Camel", holding up fingers while counting forward and backward, and using fingers to show addition and subtraction. This was implemented once a week for fifteen weeks. Results from a paired-samples *t*-test found a statistically significant difference in pretest and posttest numeracy achievement scores, which supports this type of intervention.

Another way to combine explicit and naturalistic teaching is through games. There are many games to support numeracy development, and Cohrssen and Niklas (2019) studied the effects of one packaged intervention called NT Preschool Maths Games. Classroom teachers administered the instruction with 79 preschoolers from multiple classrooms with the goal of improving their number naming, counting, and applied problem solving skills. Based on results from the pretest and posttest, students who were in classrooms in which the NT Preschool Maths Games was implemented demonstrated increases in the skills tested and made greater progress over time than peers in classrooms in which the games were not implemented.

Free choice play allows preschool children to choose the classroom activities with which they want to engage and occurs daily in many classrooms. This provides another opportunity to implement direct numeracy instruction with naturalistic learning. Davenport and Johnston (2014) implemented a study that used a multiple-baseline probe design within

participants and was replicated across participants to measure and/or teach the identified numeracy skills that had been identified as lacking for each student. Participants were three students with disabilities ranging in age from four to five years old in an inclusive classroom. Two participants worked on specific number identification, and the other worked on specific shape identification. The first researcher embedded opportunities for each student to work on the target skills while they were at the art center and the block center. For example, the target skill for one participant was to point to the number symbols “6”, “7”, and “9”. While playing in the block center, the interventionist placed five blocks with the number symbols on a template in a notebook and prompted the participant to touch the block with the stated target symbol. The interventionist did this while using most-to-least prompting and contingent consequences. Students had five learning opportunities per session. There were one to two sessions each day ranging from 5-15 minutes, which occurred four days a week. Results suggest that this intervention was successful in teaching the specific numeracy skills, and that using most-to-least prompting helped the students generalize the skills learned.

Explicit Numeracy Instruction

Although embedding direct numeracy teaching moments within naturalistic learning opportunities is an effective way to support children’s early numeracy development, it is also important for children, especially those with disabilities, to receive intensive explicit numeracy instruction (Hinton et al, 2015). A replication study by Root et al. (2019) used a multiple probe across participants design to measure the effects of least to most prompting and systematic fading on students’ counting, set making and comparing, symbol use, patterning, number identification, measurement, and calendar knowledge. They also measured their ability to

generalize these skills. This intervention used all four units of a curriculum called Early Numeracy and was implemented by the classroom teacher with three autistic kindergarten students during math centers. The teacher began each lesson by reading the thematic story and then re-reading the story. The teacher followed the scripted lesson to incorporate explicit instruction by modeling target skills and providing opportunities for students to independently practice the target skills. For example, during the pirate-themed one-to-one correspondence lesson, the teacher would say, "I can't remember how many coins the pirates found on their treasure hunt. Let's check by counting them on my line counter. Count with me: 1, 2, 3, 4, 5. Your turn," while using least to most prompting when students could not independently respond. After daily implementation across 60 sessions, results from standardized early mathematics scores indicated that the intervention was successful in teaching the targeted early number sense skills, and that generalization occurred.

Hinton et al. (2015) investigated another explicit intervention to measure its effectiveness on three types of counting skills. Resultative counting is starting with the number one, counting on, and knowing that the last number you say is how many you have. Graphic counting is also called subitizing and is knowing how many without counting the objects or pictures. Shortened counting combines graphic counting with resultative counting. In this study, the lead researcher, lead teacher, and assistant teachers used a multiple probe across behaviors design with four preschool students who had a developmental delay or at-risk label. Students were given objects in a bowl or a picture with circles that were inside a square. There were also objects outside the bowl or circles outside the square. Students were told to count the objects in the bowl or circles in the square without touching, then touch and count objects outside the bowl or circles outside

the square. The intervention lasted for 15 minutes and was implemented three days a week for 15 weeks. Results indicate that the intervention was successful in teaching the three types of counting skills and that participants maintained these skills over time. This intervention also efficiently used limited classroom time and resources and could feasibly be implemented in classrooms with both small groups of children and one-on-one settings.

A study with a multiple baseline across participants design conducted by Ingelin et al. (2021) adapted a packaged intervention called Number Talks to target the subitizing, one-to-one correspondence, number conservation, and magnitude discrimination skills of three autistic preschoolers. Number Talks uses systematic instruction within fifteen-minute mini-lessons where adults facilitate and scaffold conversations while providing opportunities for students to engage with their peers about math concepts. Researchers altered the original intervention by providing a speech-language pathologist, modeling mathematical language, and adding visual supports to increase preschoolers' early numeracy skills. The first researcher implemented the adapted Number Talks three days a week for 15-20 minutes and across 23 sessions. Results from probes taken across baseline and intervention phases show that the students' correct responses increased immediately upon intervention implementation, indicating that making adaptations to packaged interventions like Number Talks and using systematic instruction is an effective way to increase preschoolers' early number sense.

Adaptations for Students with Complex Communication Needs

Students with disabilities who also have complex communication needs often use augmentative and alternative communication (AAC) devices to communicate. It is important for these students to receive numeracy instruction as well, and for them to demonstrate their early

number sense. One way this can be done is through single switch voice-output devices. Hudson et al. (2015) used a multiple probe design to examine the use of an individualized instructional package with embedded numeracy skills on elementary students with multiple severe disabilities and complex communication needs who used voice-output single switch devices to respond to instruction and assessment. The students' special education teacher implemented the intervention, which contained five different math lessons with twelve early numeracy skills embedded in each lesson. Each lesson was taught at least three times, and between three to four times a week. The special education teacher used systematic prompting and feedback to teach the numeracy skills, and scripted prompts were provided for each lesson to support individual student learning. Students actively participated in numeracy lessons by using their switch devices to count and answer yes/no questions, in addition to touching story-related manipulatives and feeling the number line and counters. Results show that the students' correct responses immediately increased following intervention implementation, indicating the intervention's effectiveness.

A study by Jowett et al. (2012), used a multiple baseline study design to measure the impact of an iPad-based video modeling package when teaching a five-year-old boy with autism how to identify, write, and quantify numbers one through seven. In this intervention, implemented by the first author, the researchers created video clips showing multiple examples of the numeracy task modeled with different prompt levels that were faded over time (video footage with voice-over, video footage without voice-over, still shot of completed target task). The student was given an opportunity to write each numeral and then identify the quantity that corresponded to the number symbol. The results indicate that the student displayed a high level

of acquisition across all the targeted numbers once the video modeling intervention was implemented, suggesting that video modeling can be an effective way to teach numeracy skills to students with disabilities and complex communication needs.

Conclusions

Preschool-aged children can gain early numeracy knowledge that is foundational to later mathematical learning. It is important for them to be taught with both naturalistic and explicit teaching approaches. Naturalistic methods embed direct numeracy instruction throughout children's typically occurring school activities, such as singing, reading, and free choice play time. Intensive explicit numeracy teaching through methods like systematic prompt fading and systematic instruction provide opportunities for learners to practice target skills. Adaptations for students with complex communication needs can be made whether naturalistic or explicit instructional approaches are employed. Modifications can include using iPads, single switch voice-output devices, and other AAC systems, in addition to including speech and language professionals as facilitators.

Introduction to Reports

With the knowledge gained from the literature review, I created a numeracy intervention that combined naturalistic and explicit methodologies to increase the early geometry, patterning, and discrimination skills for preschool students with disabilities and complex communication needs (Intervention Report). I also developed accompanying progress monitoring and pre/post assessments to implement with the numeracy intervention (Assessment Report). The objective of this creative project was to increase the early numeracy knowledge of three preschoolers with disabilities. The intervention specifically targeted their early geometry, patterning, and

discrimination skills. These numeracy skills, particularly geometry and patterning, are highly predictive of later mathematical achievement (Nguyen et al., 2015).

Setting and Participants for Intervention and Assessment Reports

During the 2024 session of Extended School Year (ESY), I worked as an assistant teacher in a preschool classroom in Cache Valley. Students with disabilities have access to ESY, which runs during the summer, based on their Individualized Education Plan (IEP) team's determination that (a) they will likely show substantial regression if they do not receive services for a period of time, (b) the amount of time to recover skills or behaviors will be longer than that of students without disabilities, or (c) there are predictive factors indicating the necessity of ESY services (USBE, 2022).

Students with disabilities can make gains in numeracy skills in a short amount of time through a combination of explicit and naturalistic teaching approaches (Green et al., 2017). With this knowledge, I implemented an intervention that combined both approaches to understand what kind of progress the students in my ESY class could make. All three of the students on whom I collected data were females, ranging in age from 3.5 to 5 years of age. These three students were chosen because they were scheduled to attend all sessions of ESY, compared to the others who were scheduled for two or three days a week. All three students had a developmental delay classification in addition to a speech delay and received pull-out speech and language services for 15 minutes during the day. Two students used regular iPads as an AAC device to assist them in verbal communication, while one student had an orthopedic disability and used an adapted iPad as an AAC device (see Table 1 for student information). Prior to the beginning of ESY, I made sure the students' AAC devices included the information they would need to

participate during the naturalistic instruction part of the intervention and demonstrate their knowledge during the explicit instruction portion.

Book reading took place in the classroom's library center, while the explicit instruction and activity occurred immediately after at one of the designated work tables. The intervention was implemented during the daily allotted small group work time. All six of the students in ESY participated in both the naturalistic and explicit numeracy activities, but I only took data during small group explicit instruction time on three students.

Table 1. Student Information

Student	**Age**	**IEP Disability Classification**	**AAC Use**
Student 1	3.5 years	Developmental Delay	Unadapted iPad; used for expressive language assistance
Student 2	5.1 years	Developmental Delay	iPad adapted with screen/section dividers for motor delay; used as primary modality for expressive language
Student 3	4.5 years	Developmental Delay	Unadapted iPad; used for expressive language assistance

Intervention Report

Notice: This report contains confidential information to be made available to authorized personnel only. Although names of individuals have been removed and pseudonyms substituted, descriptions of events may still result in identification of the individual involved. Therefore, only authorized personnel (such as Utah State University course instructors) should be given

access by the writer to the reports. Access to other individuals, such as school district personnel, is the responsibility of the report writer. Additionally, please note that the information contained in this result is not intended for research purposes. The process and findings reported on are solely for the sake of providing supports to a student with a disability and improving a master's student's professional practice. The results are not generalizable to a broader population or other purposes.

I implemented a numeracy intervention that combined naturalistic and explicit methodologies to increase the early geometry, patterning, and discrimination skills of three preschool students with disabilities and complex communication needs. This intervention was based on a study by Green et al. (2017) that integrated math with children's literature to increase the participants' total math ability, quantity comparison, one-to-one correspondence counting, and oral counting abilities. This intervention also incorporated AAC device use, as all three students had iPads to assist in communication. We know from Green and colleagues' study that by using both naturalistic and explicit teaching approaches, children with disabilities are capable of discernible numeracy growth in a short amount of time. See Appendix A for the daily lesson structure and procedures.

Intervention Components

Naturalistic Instruction through Shared Storybook Reading

The first part of this intervention was shared storybook reading with embedded activities to support the targeted numeracy concepts. I used the books *The Very Hungry Caterpillar, The Napping House,* and *Round is a Tortilla*. Each day after participating in a literacy-focused small group session with the lead teacher at a worktable, the students came to the rug. I began by

introducing the book we would be reading and explaining the activity we would be doing throughout the story. For example, on the day we worked on patterning while reading *The Very Hungry Caterpillar*, I had a slideshow prepared with three different pictures of caterpillars with patterned bodies followed by a picture of the metamorphosed butterflies. After the caterpillar pops out of his egg, we talked about how his body was all green and didn't have a pattern. We then looked at the first caterpillar from my slideshow and talked about the pattern on its body. We did this twice more throughout the story, examining the patterns on the real caterpillars. After the caterpillar in the story becomes a butterfly, I showed the students the metamorphosed butterflies of each of the caterpillars we'd discussed. I also incorporated dialogic reading practices to increase student involvement throughout the story. Table 2 below provides the dialogic reading prompts organized by book that I incorporated during each read aloud.

Table 2. Dialogic Reading Prompts

Book	Page Number	Question Prompt	Question
The Very Hungry Caterpillar	3	Wh-inference	What will the caterpillar do next?
The Very Hungry Caterpillar	6	Completion	But he was still _____ (hungry).
The Very Hungry Caterpillar	8	Emotion Identification	Why does the caterpillar have a stomachache?
The Very Hungry Caterpillar	11	Open-ended	What is happening on this page?
The Very Hungry Caterpillar	13	Completion	He was a beautiful _____ (butterfly).

Book	Page Number	Question Prompt	Question
The Very Hungry Caterpillar	End of story	Story Recall	What happened to the caterpillar after he popped out of his egg?
The Napping House	4	Wh-inference	What will happen next?
The Napping House	6, 8, 10, 12, 14	Completion	Where everyone is _____ (sleeping).
The Napping House	26	Recall	What happened to all the people and animals?
The Napping House	28	Distancing	They're playing outside now. What do you do when you wake up from a nap?
Round is a Tortilla	1	Wh-questions	What shape is round like the moon?
Round is a Tortilla	5	Distancing	What are some circles in your
Round is a Tortilla	7	Wh-questions	What shape is this?
Round is a Tortilla	12	Recall	What square things did you see?
Round is a Tortilla	13	Open-ended	What is happening on this page?
Round is a Tortilla	17	Wh-questions	What shapes are these flags?
Round is a Tortilla	22	Open-ended	What are these triangles doing?
Round is a Tortilla	27	Recall	What shapes did we see in this story?

Direct Instruction through Small Group Activities

The students then participated in a direct instruction small group activity that addressed and built the same numeracy skills that were examined throughout each story. Table 2 below shows the numeracy skills that were targeted for each book during direct instruction. The activities were taught in an "I do, we do, you do" sequence where the I modeled the skill, guided the students through skill demonstration, and allowed them to engage in independent skill practice. For example, after reading *The Very Hungry Caterpillar* the students came to the other worktable for explicit instruction on patterning. I first explained that an AB pattern is when two colors, shapes, or objects repeat over and over in the same order. I used colored bear counters to model an AB pattern, and then instructed the students to duplicate my pattern. Each student then received their own bears and we made an AB pattern as a group. We repeated making a pattern altogether before the students independently practiced making their own AB patterns. I also incorporated least-to-most prompting procedures using verbal, gestural, and partial physical prompts during independent practice.

Evaluation of Student Progress During Intervention

I took data on the three students' ability to demonstrate skill knowledge and what level of prompting they needed to do so during small group activities. When patterning, for example, I asked the student to pick two different colored bear counters and I placed those in an AB pattern. The student would touch and label the colors with their AAC device, and I would ask, "Which color comes next?" I took data on the student's ability to correctly tell me which color bear came next in the pattern. I also took data on how much prompting I needed to provide in order for the student to respond correctly. I did not use errorless learning, so I provided a prompt after the

student gave an incorrect response. The other support professionals in the room worked one-on-one with the students on whom I was not taking data, so I was able to focus my attention on the three students on whom I was taking data. After independent patterning practice, the students made their own patterns by coloring a caterpillar's body.

Table 3. Intervention at a Glance

Date	**Book**	**Numeracy Skill**	**Data Collected**
7/2	The Very Hungry Caterpillar	Quantity Comparison	Identify which group of coins contains more
7/8	The Very Hungry Caterpillar	Patterning	Create and extend AB pattern with bear counters
7/9	The Very Hungry Caterpillar	Shape Identification	Name the shape pulled from the bag
7/10	The Napping House	Sorting	Sort cards based on color, shape, or number
7/11	The Napping House	Quantity Comparison	Identify which Lego has more dots
7/15	The Napping House	Patterning	Create and extend AB pattern with pieces of ripped paper
7/16	The Napping House	Shape Identification	Name the foam shape chosen for structure
7/17	Round is a Tortilla	Sorting	Sort chosen shapes into given shape categories
7/18	Round is a Tortilla	Quantity Comparison	Identify which ice cream cone has more scoops

Date	Book	Numeracy Skill	Data Collected
7/22	Round is a Tortilla	Patterning	Create and extend AB pattern with stringing beads
7/23	Round is a Tortilla	Shape Identification	Name the shape on the chosen clothespin

Intervention Duration

When developing this intervention, I planned to implement it over twelve ESY sessions. I was actually able to implement it over eleven sessions. I planned to spend four days on each of the three books. However, I was only able to spend three days on the first book because we had a day off school that I had not anticipated, which is also why I had one less session to implement the intervention than planned. I did spend four days on each of the last two books. Each book reading took approximately fifteen minutes and each small-group activity session lasted fifteen minutes.

I would not make any adjustments to the length of time spent per day in each instructional activity. The fifteen minutes spent during the naturalistic teaching part was enough time to incorporate the planned dialogic reading strategies so the students could engage with the story and make outside connections. It was also the right amount of time for each student to participate in the numeracy activity I embedded throughout the storybook reading. In the future, I would like to spend four days on each book, which is one full school week for preschoolers, so that each book would have equal readings. I also would not make any changes to the length of

time spent in the small group direct instruction portion of the intervention. This duration allowed ample opportunities for each student to practice the target numeracy skill.

Assessment Report

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In conjunction with the intervention report, I completed an assessment report to determine the effectiveness of the intervention for the three students. I used the Pre-Kindergarten Entry and Exit Alternate Assessment (PEEP AA) to collect pretest and posttest data before and after the intervention. I also collected progress monitoring data throughout the intervention.

I used selected questions from the math section of the PEEP AA to measure the early patterning, discrimination, and geometry skills of three of the six students in the class. The PEEP AA is adapted from the general Pre-Kindergarten Entry and Exit Profile (PEEP), and the skills assessed through the PEEP AA align with Utah's Early Childhood Core Standards that are used in the PEEP (USBE, 2019). However, the breadth and complexity of these skills are decreased,

which makes the PEEP AA accessible to students with significant cognitive disabilities. Both the PEEP and the PEEP AA assess the present levels of students' early literacy and numeracy knowledge in connection with the academic and lifelong learning skills that are crucial for them as they enter and exit preschool (USBE, 2019).

The main strands evaluated in the PEEP AA are literacy, numeracy, and lifelong learning practices and health education (USBE, 2020). The skills in the literacy strand are vocabulary, directionality, concept of letter/number, letter recognition, writing strokes, word parts and oral language. The skills in the numeracy strand are shape discrimination, rote counting, numeral recognition, one-to-one correspondence and cardinality, patterning and sorting, and quantity discrimination. The skills in the lifelong learning strand are opportunities to respond, sustained effort, attention and focus, listens and follows directions, quality of response, self-confidence, and task switching. Each skill has a rubric and a scoring sheet. Within the literacy and numeracy strands, the child can earn between one and four points depending on if their skill is "Not Yet Emerging", "Emerging", "Approaching Target", or "At Target". Within the lifelong learning strand, the student can earn between zero and three points on each, depending on the frequency at which they demonstrate the skill. I chose to use the PEEP AA to collect pretest and posttest data because it is sensitive to incremental progress; because ESY only ran four days a week for one month, I expected students' increase in the targeted early numeracy skills to be modest. The questions from the PEEP AA are displayed below in Figure 1.

Figure 1

PEEP AA Questions for Shape Discrimination, Quantity Discrimination, Patterning and Sorting

Pre-K Entry and Exit Profile Alternate Assessment
Utah State Board of Education

Name: _____

Numeracy

	Early Childhood Core Standards	Not Yet Emerging 1 point	Emerging 2 points	Approaching Target 3 points	At Target 4 points
Shape Discrimination (Aligned with PEEP Question 9)	***Math 3 yr.4.1***: Match, point to, and begin to identify basic shapes by name.	☐ Student is not yet demonstrating skills at an emergent level.	☐ Student will match 2 circles that are the same size.	☐ Student will match 2 circles and 2 squares that are the same size.	☐ Student will match all 3 shapes that are the same: square, circle, triangle.

Entry Date: Exit Date:

Passed ADA Accessibility 6/23/20

Kindergarten Entry and Exit Profile Alternate Assessment
Utah State Board of Education

Name: _____

Numeracy

	Early Childhood Core Standards	Not Yet Emerging 1 point	Emerging 2 points	Approaching Target 3 points	At Target 4 points
Quantity Discrimination (Aligned with PEEP Question 14)	***Math 3 yr.3.4***: With prompting and support, compare the number of objects in each category to identify which groups are more, less, or the same.	☐ Student is not yet demonstrating skills at an emergent level.	☐ Student will put 2 objects together in a group.	☐ Student will separate 2 objects into 2 groups.	☐ When given a group of objects student can add one more object. ☐ Student will identify the difference between a single object and a group of objects.

Entry Date: Exit Date:

Passed ADA Accessibility 6/23/20

Kindergarten Entry and Exit Profile Alternate Assessment
Utah State Board of Education

Name: _____

Numeracy

	Early Childhood Core Standards	Not Yet Emerging 1 point	Emerging 2 points	Approaching Target 3 points	Target 4 points
Patterning and Sorting (Aligned with PEEP Question 13)	***Math 3 yr.2.5***: Identify simple patterns in the environment and begin to duplicate and extend simple patterns (for example, ababab). ***Math 3 yr.3.3***: Sort objects into given categories including color, size, shape, etc.	☐ Student is not yet demonstrating skills at an emergent level.	☐ Student will identify if 2 objects are the same color.	☐ Student will sort objects by color, by placing 2-3 objects of same color onto/into a mat/cup of same color as object (for example will place 2 red blocks in the red cup).	☐ Student will match the colored object on a pre-printed pattern mat (for example: student places red and blue tiles on a provided horizontal pattern card). 

Entry Date: Exit Date:

Passed ADA Accessibility 6/23/20

Pretest Scores

I selected the shape discrimination, patterning and sorting, and quantity discrimination sections from the PEEP AA to collect pretest and posttest data. The data are described below and displayed in Table 4. The shape discrimination component is based on Early Childhood Core Standard Math 3 yr.4.1: match, point to, and begin to identify basic shapes by name. To assess this, I had two triangles, circles, and squares that were the same size, and asked the students to match each shape. Student 1 scored one point for "Not Yet Emerging", as she was not able to match any of the shapes. Student 2 matched all three shapes and scored four points for "At Target". Student 3 matched the two circles, scoring two points for "Emerging".

The patterning and sorting component is based on Early Childhood Core Standards Math 3 yr.2.5: identify simple patterns in the environment and begin to duplicate and extend simple patterns, and Math 3 yr.3.3: sort objects into given categories. To assess this, I had a yellow and blue pattern mat and matching colored bears, a yellow and blue cup, and asked the students to match the bears to the pattern mat. Each student was given the opportunity demonstrate the “At Target” skill and I simplified the task if they could not. Student 1 matched two bears that were the same color, scoring two points for “Emerging”. Student 2 matched the bears to the corresponding color on the pattern mat, scoring four points for “At Target". Student 3 sorted the bears into the matching color cup, scoring three points for “Approaching Target”.

The quantity discrimination component is based on Early Childhood Core Standard Math 3 yr.3.4: with prompting and support, compare the number of objects in each category to identify which groups are more, less, or the same. I scored this part out of eight, with the two “At Target” skills worth four points each. This is different than the PEEP AA rubric suggests, and I did this so I could have more information about each students’ ability to complete both tasks within the “At Target" level of the question. I assessed this with several orange and green blocks. I sorted the blocks into two piles, handed the student several orange blocks, and told them to add one more block to the orange pile. I then put one orange block and several orange blocks into two groups and asked the student to touch the group with one block, then to touch the group with more than one block. Each student was given the opportunity demonstrate the two “At Target” skills and I simplified the task if they could not. Student 1 separated the blocks by color into two different piles, scoring three points for “Approaching Target”. She also identified the difference between one object and a group of objects, scoring four points for “At Target” and receiving seven points

total. Student 2 separated the blocks by color into two different groups, scoring three points for "Approaching Target". Student 3 also separated the blocks by the blocks into two different piles, scoring three points for "Approaching Target".

Posttest Scores

Posttest data from the PEEP AA shows that all three students either maintained or made progress in the early numeracy skills that were targeted (see Table 4). Student 1 showed progress in shape discrimination and patterning and sorting and maintained in quantity discrimination. She matched a square, circle, and triangle, scoring four points and demonstrating "At Target" in shape discrimination. She matched the colored bears on the provided pattern card, scoring four points for "At Target" in patterning and sorting. In quantity discrimination, she separated blocks by color into two different groups, scoring three points for "Approaching Target". She identified the difference between one block and a group of blocks, scoring four points for "At Target" and receiving seven points total. Student 1 was not able to add one more object to a group of objects at pre or posttest. Student 2 maintained "At Target" in shape discrimination skills and patterning and sorting. She showed progress in quantity discrimination by identifying the difference between a single block and a group of blocks, reaching "At Target" and scoring four points. She separated blocks by color into two different groups, scoring three points for "Approaching Target" and seven points total. Student 3 showed growth in all three skill categories. In shape discrimination, she correctly matched a square, circle, and triangle, reaching "At Target" and scoring four points. She matched colored bears on a provided pattern card, reaching "At Target" and scoring four points in patterning and sorting. To show quantity discrimination, she successfully separated blocks into two groups based on color, scoring three points for

“Approaching Target”. She added one more orange block to the group of orange blocks, scoring four points for “At Target” and seven points total.

Table 4. PEEP AA Pretest/Posttest Data

Student 1

Skill	**Pretest**	**Posttest**
Shape Discrimination	1/4	4/4
Patterning and Sorting	2/4	4/4
Quantity Discrimination	7/8	7/8

Student 2

Skill	**Pretest**	**Posttest**
Shape Discrimination	4/4	4/4
Patterning and Sorting	4/4	4/4
Quantity Discrimination	3/8	7/8

Student 3

Skill	**Pretest**	**Posttest**
Shape Discrimination	2/4	4/4
Patterning and Sorting	3/4	4/4
Quantity Discrimination	3/8	7/8

Progress Monitoring

Each individual numeracy skill was targeted for an entire day one time per book except for sorting, which was not assessed during *The Very Hungry Caterpillar* because of the holiday break (see Table 2 above). This means that I implemented 11 lessons and there are 11 total progress monitoring data points available. However, there is missing progress monitoring data resulting from days students were absent from ESY. In addition, because I did not use errorless learning and some student responses were marked incorrect and unprompted, the prompts and independent answers do not equal ten.

The progress monitoring data sheet I created for this project is displayed below in Figure 2. At the top of the progress monitoring data sheet there is a place to write the student's name and the target skill. There are sections to write the book we read and the date on which we read it and completed the activity that focused on the specified skill. There are ten boxes, one for each trial, where correct and incorrect responses can be marked. In addition, there is a space to write the amount of prompting the student needed in order to provide a correct response, with a key at the bottom explaining the prompting levels. The progress monitoring data is displayed in Figures 3, 4, 5, and 6 for each student by numeracy skill.

Figure 2

Progress Monitoring Data Sheet

Student: Skill:

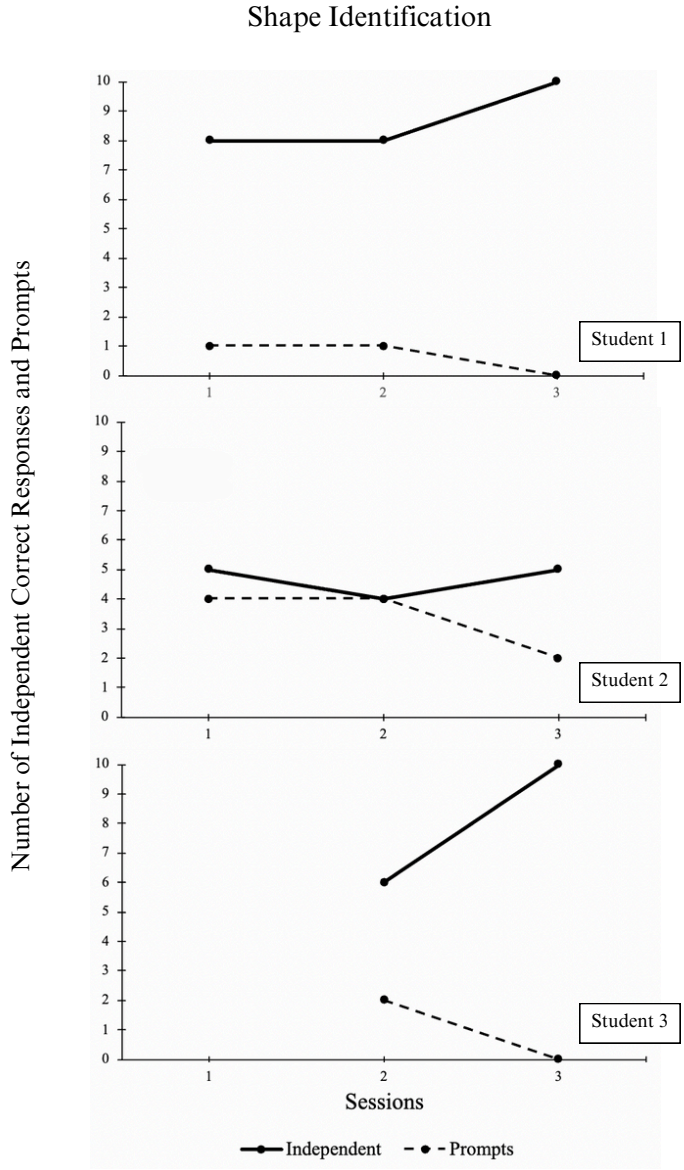
Date	Book	Trial # and Prompt Level										Total	% Correct
		1	2	3	4	5	6	7	8	9	10	/	
		1	2	3	4	5	6	7	8	9	10	/	
		1	2	3	4	5	6	7	8	9	10	/	
fp = full physical prompt pp = partial physical prompt					g = gestural prompt v = verbal prompt					p = picture prompt			

Shape Identification

Figure 3 shows the progress monitoring data for shape identification. Student 1 made progress in her shape identification skills as she was able to correctly name the given shapes 10/10 times by the third session. From session one to session three, Student 2's shape identification skills maintained at 5/10, but decreased to 4/10 in the second session. Student 3 demonstrated growth in her shape identification knowledge by increasing from 6/10 to 10/10 correct responses.

Figure 3

Shape Identification Progress Monitoring Data



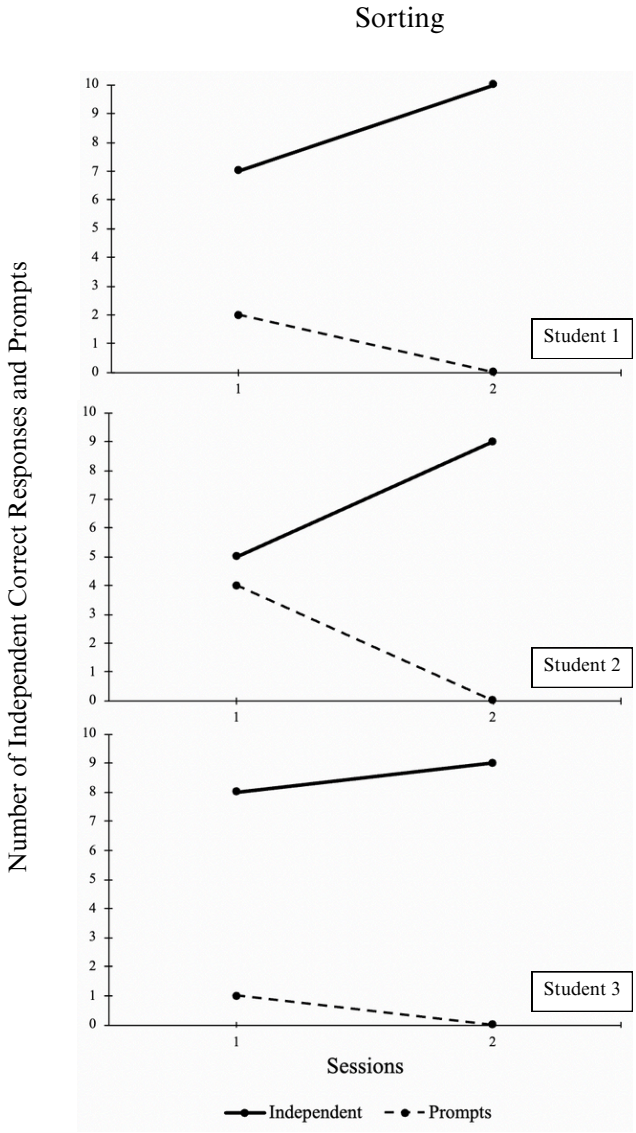
Sorting

Figure 4 shows the progress monitoring data for sorting. Student 1 made progress in her sorting abilities, and at session two was able to correctly sort items based on a specified characteristic 10/10 times. Student 2 increased her sorting skills across the two sessions by

increasing from 5/10 to 9/10 correct responses. Student 3 was able to correctly sort items by a specific characteristic 8/10 times in the first session and 9/10 times in the second.

Figure 4

Sorting Progress Monitoring Data

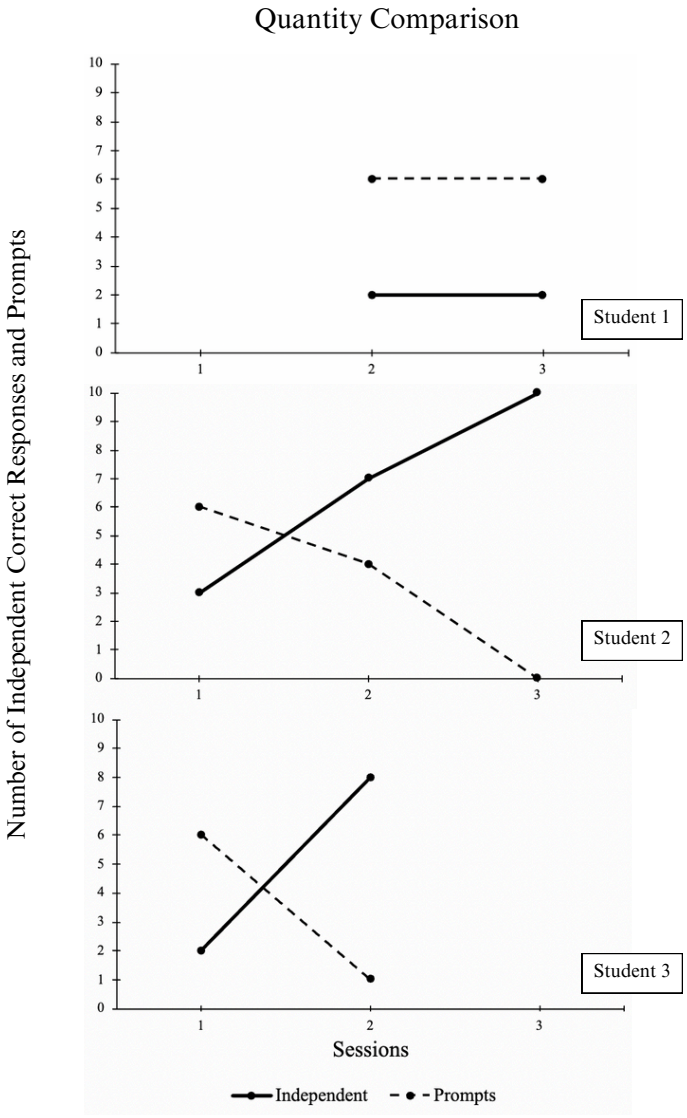


Quantity Comparison

Figure 5 shows the progress monitoring data for quantity comparison. Student 1's quantity discrimination skills maintained at 2/10 in the two sessions she attended. Student 2 made growth in her quantity discrimination skills, identifying which group had more items 3/10 times in session one, 7/10 times in session two, and 10/10 times in session three. Student 3 also made progress in her quantity discrimination skills, correctly identifying which group had more 2/10 times in the first session and 8/10 times in the second.

Figure 5

Quantity Comparison Progress Monitoring Data

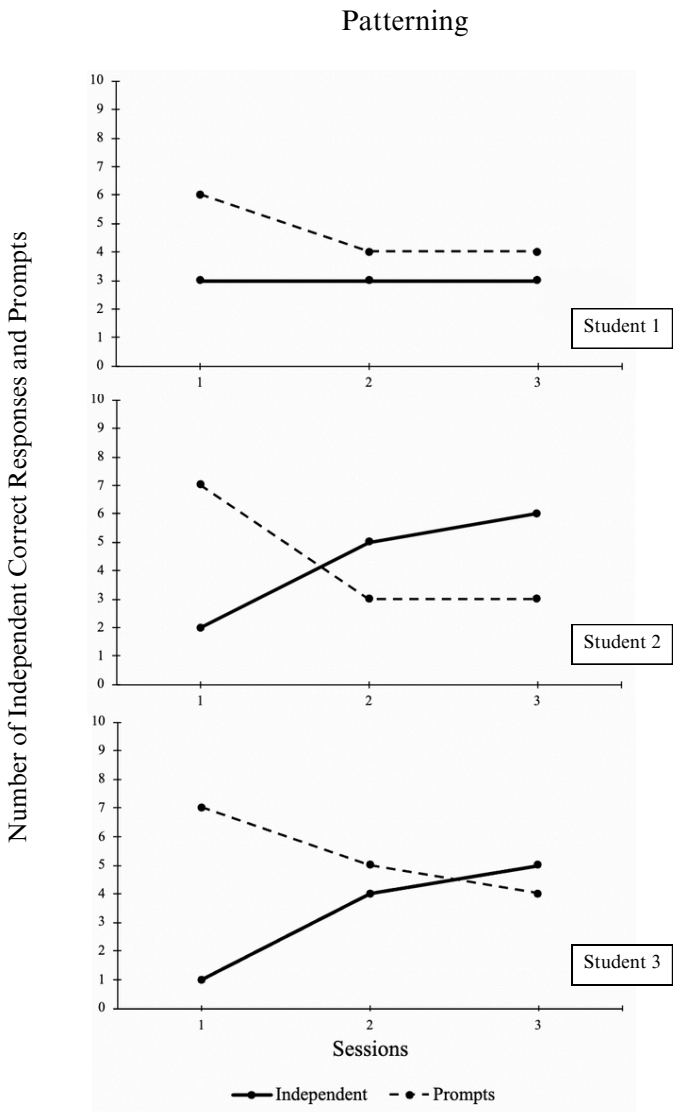


Patterning

Figure 6 shows the progress monitoring data for patterning. Student 1's patterning skills maintained at 3/10 correct responses during all three sessions. Student 2 made progress in patterning, and was able to extend a pattern 6/10 times by the third session. Student 3 also showed growth in her patterning skills and was able to correctly extend a pattern 5/10 times by session three.

Figure 6

Patterning Progress Monitoring Data



Evaluation to Determine Student Response to Intervention

I evaluated student response to intervention by comparing PEEP AA pretest data to posttest data, in addition to assessing the trends in progress monitoring data shown in the graphs. Pretest and posttest data show that Student 1 progressed in two of the three numeracy skills assessed (shape discrimination, patterning and sorting), and maintained "At Target" in the other skill (quantity discrimination). It is interesting that Student 1 demonstrated progress in patterning and sorting on pretest/posttest data, but did not show an increase in patterning knowledge based on progress monitoring data taken during all three sessions. I believe this is because the PEEP AA combines patterning and sorting to have the students match colors on a pre-printed pattern mat, whereas I took progress monitoring data on the students' ability to create and extend a novel pattern. Student 2 maintained "At Target" in two of the three skills (shape discrimination, patterning and sorting), and progressed in the third (quantity discrimination). Student 2 demonstrated at-target shape discrimination skills at pretest and posttest, but did not make progress in shape identification based on progress monitoring data. I believe this is because the PEEP AA has the students match shapes that are the same, whereas I took progress monitoring data on the students' ability to both discriminate between and identify shapes. Student 3 reached "At Target" levels in all three numeracy areas assessed on the PEEP AA posttest and also made progress based on the progress monitoring data I took on the four numeracy skills targeted. Based on pretest and posttest data, Student 3 made progress in all three of the assessed numeracy skills, and Student 1 and Student 2 made progress in the skill areas in which they were not already "At Target" during pretest. All students reached "At Target" levels over the course of the intervention.

Pretest/posttest and progress monitoring data indicate that this intervention was mostly successful in increasing the students' shape identification, patterning, sorting, and quantity discrimination skills. The progress monitoring data also includes the amount of prompting the students required in order to provide correct responses. This information shows that Student 2 and Student 3 needed less prompting in all four of the numeracy areas assessed, and Student 1 needed less prompting in two of the four numeracy areas assessed. Student 1 needed less prompting from sessions one to two and the same amount in session three of patterning, even though she had the same number of correct responses. She also had the same number of prompts and correct answers in sessions two and three of quantity comparison, but I do not have complete data on this skill because of her absence on the first session.

Reflection and Conclusion

I've worked in preschool settings for five years at this point, one as a teacher and four as an educational support professional (ESP). Throughout this time I've noticed that teachers have a difficult time planning and implementing intentional early numeracy instruction for students with disabilities. As an ESP, I did not see students with the most impactful disabilities and especially those who use AAC devices making progress in specific early numeracy areas. Because of this observation, I wanted to create an intervention with two parts: using literature as a way to naturally embed numeracy instruction in whole group, and incorporating intensive explicit numeracy instruction in small groups. This way, students could contact numeracy instruction more frequently and through different instructional approaches.

In the future, I would like to implement this project over a longer period of time, such as the typical school year, and use both the PEEP AA and the PEEP for pretest/posttest data

collection to see subtle and apparent numeracy growth. I would continue to take progress monitoring data to get a more detailed picture of student knowledge over an extended time period rather than a condensed one, and with students who were new to preschool in addition to those who had just completed a typical preschool session. If I extended this project throughout the school year, I would keep the format of the lesson procedures as is because I did not need to make any edits to them as they were implemented.

It was also important for me to ensure that the students' AAC devices were equipped with the information they needed in order to participate. Two of the students' iPads were in the ESY classroom, so prior to the beginning of ESY I accessed the devices to ensure that the necessary words and icons were added. One student had a personal adapted iPad at home, but I had access to the language output application since it was provided by the District and was able to add the words and icons she would need for ESY participation. Once the iPads were set up with the needed information, I did not need to make accessibility adaptations to the intervention throughout its implementation. If I had not had access to these devices or applications before ESY started or if I didn't already know the students from working in their school during the typical school year, I would have created a low-tech AAC device like a communication board in addition to having a high-tech AAC device like a classroom iPad. This way, students I did not previously know or have access to their AAC devices would still have equitable opportunities to participate in the activities.

The information that I gathered from the pretest, posttest, and progress monitoring data helped me both as an ESP and as a future teacher. It shows that I can combine naturalistic and explicit numeracy instruction in a way that is effective in teaching important early math concepts

to preschoolers with disabilities and complex communication needs and incorporates AAC device use. In addition, I found that teaching difficult numeracy concepts can be engaging and enjoyable for both the students and me.

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Appendix A.

Daily lesson structure and procedures

July 2nd

Quantity Comparison and *The Very Hungry Caterpillar*

Lesson Description: While reading *The Very Hungry Caterpillar* with the whole group of students, the teacher will focus on the amount of food the caterpillar eats each day and how it compares to the amount from the previous day. The teacher will then lead a small group activity where students compare quantities of items.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.3.4 (compare number of objects in each category to identify which groups contain more, less, or the same).

Materials: *The Very Hungry Caterpillar*; small objects that can be sorted into groups (ex. Legos, coins, toy cars)

Environmental Arrangement: Prior to implementation, the teacher will have *The Very Hungry Caterpillar* set out at the library center. The objects that will be used for quantity comparison will be at the work table.

Whole group naturalistic instruction:

1. The teacher will read *The Very Hungry Caterpillar* using Dialogic Reading (see Table 2).
2. The teacher will point out that the amount of fruits the caterpillar eats each day is one more than the previous day.
3. The teacher will compare the amount of oranges eaten on day five to the amount of food eaten on day six.
4. The teacher will emphasize that the caterpillar ate more food on day six.

Small group explicit instruction:

1. The teacher will model quantity discrimination by placing the objects in two groups and teaching how to determine which has more.
2. The teacher will explain that the other group therefore has less items, as more and less are opposites.
3. The teacher will place an equal amount of objects in two groups and discuss how each group has the same.
4. The students will compare the amount of objects in a group and identify which has more items following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct response.
5. The students will independently practice comparing the quantity of items in separate groups and identifying which group has more items. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct comparison, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently compare the groups. In total, students will have 10 opportunities to compare items and the teacher will record response and prompt level (see Figure 2).

July 8th

Patterning and *The Very Hungry Caterpillar*

Lesson Description: The teacher will read *The Very Hungry Caterpillar* to the whole group of students and show them patterns on real caterpillars. The teacher will then lead a small group activity where the students use small objects to duplicate, extend, and create *AB* patterns, and color their own pattern on a caterpillar coloring page.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.2.5 (duplicate, extend, and create simple patterns).

Materials: *The Very Hungry Caterpillar*; pictures of three patterned caterpillars and their butterfly counterpart; small objects of different colors, sizes, and/or shapes (ex. fruit or bear counters, buttons); crayons; caterpillar coloring page

Environmental Arrangement: Prior to implementation, the teacher will have *The Very Hungry Caterpillar* set out at the library center. The objects that will be used to create patterns, the crayons, and the coloring pages will be at the work table.

Whole group naturalistic instruction:

1. The teacher will read *The Very Hungry Caterpillar* using Dialogic Reading (see Table 2).
2. The teacher will show a picture of a caterpillar and then discuss the pattern on it.
3. The teacher will show the picture of the corresponding butterfly.

Small group explicit instruction:

1. The teacher will use the small objects to model a simple *AB* pattern creation.
2. The students will duplicate the teacher's pattern.
3. The teacher will model how to extend the pattern.

4. The students will replicate the teacher's pattern extension.
5. The students will create and extend a pattern following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct patterning.
6. The students will independently create their own pattern using the objects provided. In the case of an error, the teacher will say "Try again" and prompt the student following least to most prompting hierarchy. Following correct patterning, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently pattern. In total, students will have 10 opportunities to extend their pattern and the teacher will record response and prompt level (see Figure 2).
7. The teacher will provide the caterpillar coloring page and instruct the students to pick two crayons in order to make an *AB* pattern of their own in the circles that make up the caterpillar's body.

July 9th

Shape Identification and *The Very Hungry Caterpillar*

Lesson Description: While reading *The Very Hungry Caterpillar* to the whole group of students, the teacher will provide opportunities for them to find and label rectangles, triangles, circles, and squares throughout the book. The teacher will then lead a small group activity where the students pull shapes from a bag, identify them, and then use play dough shape cutters to make that shape.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.4.2 (identify and name basic shapes regardless of size and/or orientation).

Materials: *The Very Hungry Caterpillar*; bag of different sized triangle, circle, square, and rectangle blocks; play dough; shape dough cutters

Environmental Arrangement: Prior to implementation, the teacher will have *The Very Hungry Caterpillar* set out at the library center. The bag of shapes, play dough, and cutters will be at the work table.

Modifications/Accommodations: Students may use high or low tech AAC devices when identifying the shapes pulled from the bag during the small group activity.

Whole group naturalistic instruction:

1. The teacher will read *The Very Hungry Caterpillar* using Dialogic Reading (see Table 2).
2. While reading, the teacher will model identifying circles, squares, triangles, and rectangles of different sizes and orientation in the pictures.
3. The teacher will give the students turns to find and name the shapes they see.

Small group explicit instruction:

1. The teacher will model pulling a shape from the bag and naming it.

2. The teacher will model using play dough and cutters to make the shape pulled from the bag out of play dough.
3. The students will pull shapes from the bag and name them.
4. The students will use play dough and cutters to make duplicate the shape pulled from the bag following least to most teacher prompting. Students will receive verbal praise and high-fives upon correctly naming the shape.
5. The students will practice independently identifying and naming the shapes they pull from the bag. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct identification, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently name the shape. In total, students will have 10 opportunities to identify the shapes and the teacher will record response and prompt level (see Figure 2).
6. The students will independently practice using play dough cutters to make the same shape they pulled from the bag and correctly identified. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy, and allow the student another opportunity to independently make the shape.

July 10th

Sorting and *The Napping House*

Lesson Description: While reading *The Napping House* to the whole group of students, the teacher will provide opportunities for the students to sort the characters into groups based on whether they are awake or asleep. The teacher will then lead a small group activity where the students sort cards based on number, shape, or color.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.3.3 (classify/sort objects into given categories by specified attributes).

Materials: *The Napping House*; items resembling the people and animals from story; awake/ asleep category cards; set of number/shape/color cards

Environmental Arrangement: Prior to implementation, the teacher will have *The Napping* House, the people/animals, and the awake/asleep category cards set out at the library center. A set of number/shape/color cards will be at the work table.

Whole group naturalistic instruction:

1. The teacher will explain that throughout the story, the students will be sorting the characters into categories based on whether they are awake or asleep.
2. The teacher will read *The Napping House* using Dialogic Reading (see Table 2).
3. The teacher will provide opportunities for students to sort the characters into categories when they are mentioned. The students can change the category into which the items are sorted as the story goes on and the characters wake up.

Small group explicit instruction:

1. The teacher will lay out a card of each color and point out to the students that they also have a number and shape on it.
2. The teacher will explain that they are first sorting the cards based on color.
3. The teacher will then choose a card, show that it matches one of the cards already chosen based on the color, and sort it into the correct pile.
4. The teacher will continue until at least one of each color has been sorted.
5. The students will take turns choosing a card and sorting it based on the color following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct sorting.
6. The students will practice independently sorting cards based on color. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct sorting, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently sort the card. In total, students will have 10 opportunities to sort and the teacher will record response and prompt level (see Figure 2).
7. After students have correctly sorted the cards by color, the teacher can have them sort again by shape, and then by number.

July 11th

Quantity Comparison and *The Napping House*

Lesson Description: While reading *The Napping House* to the whole group of students, the teacher will focus on sequencing as the characters each fall asleep on the bed and then wake up. The teacher will then lead a small group activity where the students compare quantities.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.3.4 (compare number of objects in each category to identify which groups contain more, less, or the same).

Materials: *The Napping House*; items resembling people and animals from story; toy bed; Legos

Environmental Arrangement: Prior to implementation, the teacher will have *The Napping House*, the toy bed, and the people/animals set out at the library center. The Legos will be at the work table.

Whole group naturalistic instruction:

1. The teacher will read *The Napping House* using Dialogic Reading (see Table 2).
2. The teacher will put the bed in front of the students after reading about “a cozy bed”.
3. The students will stack the characters on top of each other on the bed as the story goes on.
4. The teacher will point out that each time a person is added, there is one more on the bed.

Small group explicit instruction:

1. The teacher will show the students the dots on the Legos.
2. The teacher will model comparing two Legos to each other and touching the one that has more dots.

3. The students will practice comparing the amount of dots on the Legos following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct sorting.
4. The students will independently practice comparing two dominoes and touching the one with more dots. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct comparison, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently touch the Lego that has more. In total, students will have 10 opportunities to compare and the teacher will record response and prompt level (see Figure 2).

July 15th

Patterning and *The Napping House*

Lesson Description: While reading *The Napping House* to the whole group of students, the teacher will point out the awake/asleep pattern and have the students use awake/asleep cards to show the pattern. The teacher will then lead a small group activity where the students make their own patterns with ripped paper.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.2.5 (duplicate, extend, and create simple patterns).

Materials: *The Napping House*; awake/asleep faces; different colors of paper; white paper; glue

Environmental Arrangement: Prior to implementation, the teacher will have *The Napping House* and the awake/asleep face cards set out at the library center. The paper and glue will be at the work table.

Modifications/Accommodations: Students with an orthopedic disability may need to use adapted scissors or have additional support when cutting their paper into pieces during the small group activity.

Whole group naturalistic instruction:

1. The teacher will explain that the students will make an awake/asleep pattern as they read the book.
2. The teacher will read *The Napping House* using Dialogic Reading (see Table 2).
3. The students will take turns identifying whether the specific character is awake or asleep, and extending the pattern.

4. The students will continue the pattern until all the characters are sleeping, and then the teacher will finish reading the book.

Small group explicit instruction:

1. The teacher will explain that the students will create their own patterns by tearing up two papers of different colors into pieces and glueing them onto a sheet of white paper.
2. The teacher will model tearing up some paper into pieces, and then using those pieces to create and extend an *AB* pattern.
3. The students will use the pieces of paper the teacher tore and practice putting them into an *AB* color pattern following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct patterning.
4. The students will choose two papers of different colors and tear them into pieces.
5. The students will use their paper pieces to independently practice making and extending a pattern. In the case of an error, the teacher will say "Try again" and prompt the student following least to most prompting hierarchy. Following correct patterning, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently pattern. In total, students will have 10 opportunities to pattern and the teacher will record response and prompt level (see Figure 2).
6. After the students have correctly created and extended their *AB* color pattern, they can glue it onto a sheet of white paper.

July 16th

Shape Identification and *The Napping House*

Lesson Description: While reading *The Napping House* to the whole group of students, the teacher will provide opportunities for the students to identify circles, squares, triangles, and rectangles. The teacher will then lead a small group activity where the students identify shapes and use them to build.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.4.2 (identify and name basic shapes regardless of size and/or orientation).

Materials: *The Napping House*; foam shapes

Environmental Arrangement: Prior to implementation, the teacher will have *The Napping House* set out at the library center. The circle, square, triangle, and rectangle foam shapes will be at the work table.

Modifications/Accommodations: Students may use high or low tech AAC devices when identifying the shapes chosen during the small group activity.

Whole group naturalistic instruction:

1. The teacher will read *The Napping House* using Dialogic Reading (see Table 2).
2. While reading, the students will label the circles, squares, triangles, and rectangles they see in the book.

Small group explicit instruction:

1. The teacher will model choosing a foam shape and identifying it.
2. The teacher will model using the identified shapes to build a structure.

3. The students will identify the foam shapes following least to most teacher prompting. Students will receive reinforcement for correct shape identification by being able to request a shape they want to use to build.
4. The students will practice independently identifying and naming the shapes that are available for building their structure. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct identification, the teacher will provide reinforcement (i.e., option to request another shape) and allow the student another opportunity to independently identify the shape. In total, students will have 10 opportunities to identify shapes and the teacher will record response and prompt level (see Figure 2).

July 17th

Sorting and *Round is a Tortilla*

Lesson Description: While reading *Round is a Tortilla* to the whole group of students, the teacher will provide each student a set of shapes and allow opportunities for them to match the shapes in their own set to the shapes seen in the story. The teacher will then lead a small group activity where the students sort shapes made of different materials.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.3.3 (classify/sort objects into given categories by specified attributes).

Materials: *Round is a Tortilla*; a circle, square, rectangle, and triangle per child; blocks of different types (Legos, pattern blocks, foam blocks)

Environmental Arrangement: Prior to implementation, the teacher will have *Round is a Tortilla* and a shape set for each child set out at the library center. The different blocks will be set at the work table.

Whole group naturalistic instruction:

1. The teacher will read *Round is a Tortilla* using Dialogic Reading (see Table 2).
2. The students will match the shapes from their own shape sets to those identified in the story.

Small group explicit instruction:

1. The teacher will use a shape set to show the categories into which the blocks will be sorted (circle, square, triangle, rectangle).
2. The teacher will model picking a block and sorting it into the correct category.

3. The students will practice choosing a shape and sorting it following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct sorting.
4. The students will independently practice sorting the shapes they pick. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct sorting, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently sort the shape. In total, students will have 10 opportunities to sort and the teacher will record response and prompt level (see Figure 2).
5. The teacher can repeat these steps to have the students sort blocks by material, size, or color.

July 18th

Quantity Comparison and *Round is a Tortilla*

Lesson Description: While reading *Round is a Tortilla* to the whole group of students, the students will graph the shapes they identify in the story and compare the amounts of shapes they graphed. The teacher will then lead an activity where the students compare amounts of ice cream on cones.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.3.4 (compare number of objects in each category to identify which groups contain more, less, or the same).

Materials: *Round is a Tortilla*; bar chart with circle, square, triangle, and rectangle sections; cut-out shapes to graph; glue; plastic ice cream scoops and cones

Environmental Arrangement: Prior to implementation, the teacher will have *Round is a Tortilla,* the bar chart, cut out shapes, and glue set out at the library center. The ice cream scoops and cones will be set at the work table.

Whole group naturalistic instruction:

1. The teacher will explain that the students will glue a circle, square, triangle, or rectangle into a section of the bar chart each time that they identify one in the story.
2. The teacher will read *Round is a Tortilla* using Dialogic Reading (see Table 2).
3. The teacher will help the students graph the shapes they identify.
4. When the story is finished, the teacher will compare the amount of shapes in one section to the amount of shapes in another, and identify which section has more shapes.
5. The teacher will provide an opportunity for each student to compare two sections of the chart, and identify which section has more shapes.

Small group explicit instruction:

1. The teacher will put different amounts of ice cream scoops on two cones.
2. The teacher will model comparing the amounts of ice cream on each cone and identifying the cone with more scoops.
3. The students will put ice cream on cones and identify which has more following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct comparison.
4. The students will independently practice comparing quantities of ice cream on cones. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct comparison, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently compare quantities. In total, students will have 10 opportunities to compare quantities and the teacher will record response and prompt level (see Figure 2).

July 22nd

Patterning and *Round is a Tortilla*

Lesson Description: While reading *Round is a Tortilla* to the whole group of students, the teacher will point out and discuss patterns seen in the story. The teacher will then lead a small group activity where the students string beads in a pattern.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.2.5 (duplicate, extend, and create simple patterns).

Materials: *Round is a Tortilla*; beads; string

Environmental Arrangement: Prior to implementation, the teacher will have *Round is a Tortilla* set out at the library center. The string and stringing beads will be at the work table.

Modifications/Accommodations: Students with an orthopedic disability may arrange the beads in a pattern on the table or a cookie sheet instead of on a string.

Whole group naturalistic instruction:

1. The teacher will read *Round is a Tortilla* using Dialogic Reading (see Table 2).
2. Throughout the story, the teacher will point out patterns on the flags, boats, ice cream cart, and page backgrounds.
3. The teacher will model extending each pattern.

Small group explicit instruction:

1. The teacher will model arranging beads in a pattern on a string.
2. The students will duplicate the teacher's pattern with stringing beads following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct patterning.

3. The students will independently practice stringing beads in a pattern. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct patterning, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently pattern. In total, students will have 10 opportunities to pattern and the teacher will record response and prompt level (see Figure 2).

July 23rd

Shape Identification and *Round is a Tortilla*

Lesson Description: While reading *Round is a Tortilla* to the whole group of students, the teacher will provide opportunities for the students to identify shapes seen in the story. The teacher will then lead a small group activity where the students choose clothespins with shapes on them, identify the shapes, and match them on a shape wheel.

Standard: The Utah Early Childhood Core math standard targeted will be 4 yr.4.2 (identify and name basic shapes regardless of size and/or orientation).

Materials: *Round is a Tortilla*; shape wheel; basket; 24 clothespins with shapes (6 triangles, 6 squares, 6 circles, and 6 rectangles)

Environmental Arrangement: Prior to implementation, the teacher will have *Round is a Tortilla* set out at the library center. The shape wheel and basket of clothespins will be set at the work table.

Modifications/Accommodations: Students may use high or low tech AAC devices when identifying the shapes chosen during the small group activity.

Whole group naturalistic instruction:

1. The teacher will read *Round is a Tortilla* using Dialogic Reading (see Table 2).
2. The teacher will provide opportunities for the students to identify circles, squares, triangles, and rectangles.

Small group explicit instruction:

1. The teacher will model choosing a clothespin from a basket, naming the shape on it, and matching it to the corresponding shape on the shape wheel.

2. The students will practice choosing a shape and naming it following least to most teacher prompting. Students will receive verbal praise and high-fives upon correct identification.
3. The students will then be allowed to match the shape on the clothespin to the corresponding shape on the shape wheel.
4. The students will independently practice naming the shapes on the clothespins they choose. In the case of an error, the teacher will say “Try again” and prompt the student following least to most prompting hierarchy. Following correct identification, the teacher will provide reinforcement (i.e. verbal praise and high-five) and allow the student another opportunity to independently identify the shape. In total, students will have 10 opportunities to identify shapes and the teacher will record response and prompt level (see Figure 2).
5. After the student has independently named the correct shape, they can match it to the corresponding shape on the shape wheel.