Content Validation of Math Vocabulary Lessons for Students with Developmental Language Disorder (DLD)

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Introduction

- Children with Developmental Language Disorder (DLD) have difficulty using and understanding language, which makes it difficult for them to learn new words. Students with DLD represent the largest proportion of those receiving special education services nationwide through the Individuals with Disabilities Education Act.
- Research about math knowledge and vocabulary in school-age children with developmental language disorders (DLD) has indicated that vocabulary is an important area to target for students with DLD (e.g., Alt et al. 2014) and that students with DLD require repeated and direct exposure to vocabulary in order to learn and use new words (McGregor, 2021).
- An important consideration for speech language pathologists (SLPs) to support students with DLD in school settings it is provide support with math related vocabulary.
- To meet this challenge, we developed and received feedback on an intervention designed to support math vocabulary deficits commonly found in the population based on the review of research.
- The purpose of this study was to develop a tier 2 intervention to provide students with DLD with experience and exposure to math vocabulary and receive feedback from experts as part of content validation.
- This study reports on the development of initial lesson plans designed to support math learning in second grade students with DLD, and the feedback received from an expert in math education and another in speech language pathology.

Acknowledgements:
- We thank the expert reviewers and clinicians for their time and feedback.
- This poster can be accessed at the following website: https://blogs.shu.edu/row-lab/
- Correspondence about this project should be directed to anthony.koutsoftas@shu.edu

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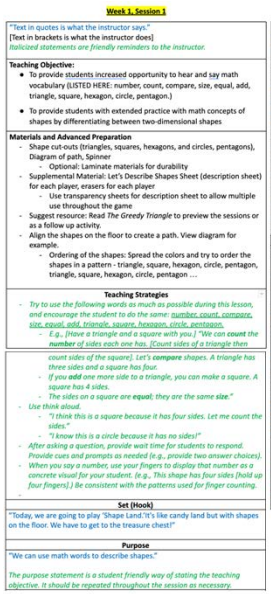
Sample Intervention Materials


Week 1, Session 1

"Text in quotes is what the instructor says."
[Text in brackets is what the instructor does]
Italicized statements are friendly reminders to the instructor.

Teaching Objective:
- To provide students increased opportunity to hear and say math vocabulary (LISTED HERE: number, count, compare, size, equal, add, triangle, square, hexagon, circle, pentagon.)
- To provide students with extended practice with math concepts of shapes by differentiating between two-dimensional shapes

Materials and Advanced Preparation
- Shape cut-outs (triangles, squares, hexagons, and circles, pentagons), Diagram of path, Spinner
- Optional: Laminate materials for durability
- Supplemental Material: Let's Describe Shapes Sheet (description sheet) for each player, erasers for each player
  - Use transparency sheets for description sheet to allow multiple use throughout the game
- Suggest resource: Read *The Greedy Triangle* to preview the sessions or as a follow up activity.
- Align the shapes on the floor to create a path. View diagram for example.
  - Ordering of the shapes: Spread the colors and try to order the shapes in a pattern - triangle, square, hexagon, circle, pentagon, triangle, square, hexagon, circle, pentagon ….

Teaching Strategies
- *Try to use the following words as much as possible during this lesson, and encourage the student to do the same: number, count, compare, size, equal, add, triangle, square, hexagon, circle, pentagon.*
  - *E.g., [Have a triangle and a square with you.] "We can count the number of sides each one has. [Count sides of a triangle then count sides of the square]. Let's compare shapes. A triangle has three sides and a square has four.*
  - *If you add one more side to a triangle, you can make a square. A square has 4 sides.*
  - *The sides on a square are equal; they are the same size."*
- *Use think aloud.*
  - *"I think this is a square because it has four sides. Let me count the sides."*
  - *"I know this is a circle because it has no sides!"*
- *After asking a question, provide wait time for students to respond. Provide cues and prompts as needed (e.g., provide two answer choices).*
- *When you say a number, use your fingers to display that number as a concrete visual for your student. (e.g., This shape has four sides [hold up four fingers].) Be consistent with the patterns used for finger counting.*

Set (Hook)
"Today, we are going to play "Shape Land."It's like candy land but with shapes on the floor. We have to get to the treasure chest!"

Purpose
"We can use math words to describe shapes."

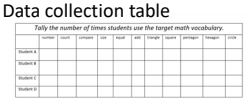
The purpose statement is a student friendly way of stating the teaching objective. It should be repeated throughout the session as necessary.

Input
"We are going to describe shapes by playing Shape Land! We're going to have four shapes in the game."
[Take out one of each shape, one by one: triangle, square, hexagon, circle, pentagon]
[Use your finger to show the student how to trace each side while counting.]
"The number of sides is what tells us what shape it is. This shape has 3 sides. Let's count them. 1, 2 ,3. This is a triangle."
"This shape has 4 sides. Let's count them. 1, 2 ,3, 4. This is a square."
[Have the student help you trace each side while counting.]
"This shape has 5 sides. Let's count them. 1, 2 ,3, 4, 5. This is a pentagon"
[Have the student help you trace each side while counting.]
"This shape has 6 sides. Let's count them. 1, 2 ,3, 4, 5, 6. This is a hexagon."
[Have the student help you trace each side while counting.]
"This shape has no sides. Let's use our fingers to trace the round shape. This is a circle."
[Have the student help you trace each side while counting.]

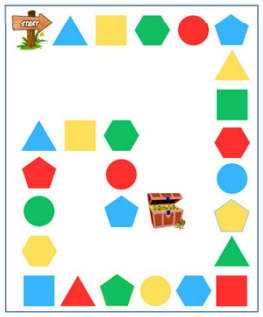
Modeling
Teacher's Turn
[Stand on the start space.]
"Let me show you how to play this game. Here is where we start the game. I'm going to spin to see which shape I should go on."
[Spin the spinner.]
"It landed on blue. I have to find the closest shape that is the color blue. Here's one!"
[Walk over to the nearest blue shape.]
"Now, I'm going to fill out my description sheet. First question: How many sides does this shape have? To find out, I'm going to count the number of sides this shape has."
[Use your finger to trace each side while counting out loud.]
"This shape has 3 sides. I'm going to write '3' sides on my sheet. Now I have to answer, "What is the name of this shape?" It's a triangle because a triangle has 3 sides!"
[Write '3' on the description sheet to indicate the number of sides the shape has. Then, write 'triangle' to name the shape.]
"Great practicing! Now, it's your turn!"
Adjust pacing based on the student's instructional level. Provide the student with appropriate support (i.e. cues, prompts) as needed.
Before each round, have students erase their description sheets in preparation for the new round.

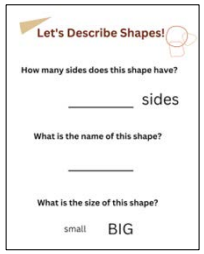
Checking for Understanding
Student's Turn
"(student's name) it's your turn!"
[Have the student begin on the start space.]
"First, spin to see which color shape you should go on."
[Have the student spin the spinner.]
"What color did it land on?"
[Listen to the student's response.]
If the student does not respond or responds incorrectly, you can say, "It landed on (color name)."
"Now, you have to find the closest (color name) shape."
[Encourage the student to walk over to the nearest shape that matches the color they spun.]
If the student is having trouble finding the shape, think aloud with them. You can say, "This shape is ____ that's not what we're looking for. Let's look at the next shape. This shape is yellow!"
"You found the closest (color name) shape. Now, you can fill out your sheet. How many sides does this shape have? Count the number of sides to find out."
[Encourage the student to use their finger to trace each side while counting out loud.]
"Yes the shape has (# of sides) sides. You can write the number (# of sides)."
If they miscounted, provide guidance. For example, "Nice job counting the 3 sides. I think we have one more side to count. 1, 2, 3, …4 sides!"

Data collection table


Tally the number of times students use the target math vocabulary.

	number	count	compare	size	equal	add	triangle	square	pentagon	hexagon	circle
Student A											
Student B											
Student C											
Student D											





Feedback from Math Instructor	How we addressed
• Replace "square" with "quadrilateral", as this is the term second graders are expected to learn. • Clarify the difference in sides for shapes used and that all quadrilaterals have four sides and squares are a type of quadrilateral that has four equal sizes.	• Because of the purpose of the lesson to support vocabulary of math, the term "square" was retained. However, additional direct instruction using the term quadrilateral is provided.
• In line with academic standards, include a pentagon in addition to a hexagon.	• Pentagon was added to the list of shapes included in the game
• For the shape recording sheet, change the question to: How many sides does this shape have? And, What is the name of this shape? • Avoid confusing children with colors and clarify that the size of the shape does not impact the type or kind of shape that is being described.	• Because of the focus on basic concepts, we retained the "size" component to conserve math vocabulary included. • Clarifications were made to ensure that the color of shapes was differentiated through the lesson plan such that each shape was included with each color. • The following question was added to the shape recording sheet, "What is the name of this shape?" • Clarifications were made to draw students' attention to the difference between size and shape, and that these are not related.
• For closure, it is important to review the terms (maybe point to each one and ask the students to give its name and number of sides).	• Closure was updated to reiterate the shapes, and concepts included in the lesson with the instructor restating the key vocabulary targeted in the lesson. • Students have plenty of opportunities to use the target vocabulary during the lesson so the additional trials at closure was included as a suggestion to instructions if time allowed.
• A wonderful book that the lesson might open with is called The Greedy Triangle.	• This book was included as a suggested resource for a follow up activity or to preview the sessions.
• Modify the teaching objective to include target shape vocabulary.	• The target shape vocabulary was included as part of the goal.

Feedback from SLP	How we addressed
• Clarifications for specific examples of activities or language used in the lesson plans.	• Each of the specific feedback provided by the SLP for clarifications was addressed.
• Increase opportunities and be explicit with these to incorporate the variety of vocabulary words included in the lessons. • Include close sentence opportunities for target words.	• Each section of each lesson plan now includes designated opportunities for the instructor to elicit target vocabulary.
• Include more opportunities to use the target vocabulary in general and specific to the word equal, allowing contrast between rectangle and square.	• This was addressed throughout the game and draws direct attention to the contrast between square and rectangle.
• For closure, to more directly reflect the specific vocabulary targeted in the lesson.	• Closure was modified to align with the session objective more clearly with specific use of target words.

Discussion

- These lessons afford students with valuable experiential learning by presenting opportunities for them to listen to and employ mathematical language in discourse.
- The instructional content of the intervention lessons aligns with academic standards.
- This intervention utilizes multiple modalities and decreased verbal demands, which according to research has the potential to enhance math learning in children with DLD (Cross et al. 2019).
- The instructional practices used in these booster lessons have been researched and proven to be effective for teaching struggling students. These practices include explicit and systematic instruction, careful selection of examples, and the use of procedures like direct instruction, modeling, guided practice, and linguistic prompts and scaffolds to support acquisition of mathematics concepts (Bryant et al. 2008).
- Lessons will be revised based on additional feedback from a speech language pathologist.
- Further improvements will be made to the lessons based on overall feedback and implementation
- The initial lessons will be expanded and extended with the development of additional lessons.

Limitations and Future Directions: While more feedback would be helpful, the next step will be to validate this work with 2nd grade students with DLD who receive speech and language services. If the intervention is successful, additional topics and grade levels will be developed. If the intervention is unsuccessful, results will be shared with experts and their feedback will be used to refine the intervention.

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