Rich Mathematical Task – Grade 1 – *Playing with Patterns*

Task Overview/Description/Purpose:

- In this task, students will transfer and extend a growing pattern using pictures, symbols, numbers, or words.
- The purpose of this task is for students to explore and deepen their understanding of growing patterns.

Standards Alignment: Strand – *Patterns, Functions, and Algebra*

Primary SOL: 1.14 The student will identify, describe, extend, create, and transfer growing and repeating patterns.

Related SOL: K.13, 2.16

Learning Intention(s):

- **Content -** I am learning to transfer and extend a given growing pattern.
- **Language -** I am learning to describe growing patterns so I can transfer and extend them.
- **Social -** I am learning explain my thinking as it relates to growing patterns. I am learning to listen to and explain my peers' strategies, and connect them to my own strategy.

Success Criteria (Evidence of Student Learning):

- I can recognize a growing pattern and explain how it is different from a repeating pattern.
- I can transfer a given growing pattern and represent it using different pictures, symbols, numbers, or words.
- I can extend a given growing pattern using new pictures, symbols, numbers or words.

Mathematics Process Goals

Problem Solving	• Students will engage in problem solving as they identify a growing pattern, then transfer and extend the pattern using a different representation.
Communication and Reasoning	• Students will communicate orally to explain their thinking. This may include describing the given growing pattern and justifying how their pattern follows the same pattern. • Students will communicate through writing by using pictures, symbols, numbers, or words to create a new representation of a given growing pattern.
Connections and Representations	• Students will represent a given growing pattern using new pictures, symbols, numbers, or words. • Students will make connections between a given growing pattern and their transferred representation of the pattern.

Task Pre-Planning

Approximate Length/Time Frame*:* 45 minutes

Grouping of Students: After completing the launch activity, students should begin the task independently. After actively monitoring student responses, the teacher should purposefully pair students together to share ideas. Following partner work, the teacher should purposefully choose 3-4 students to share their work with the class in a whole group setting.

Materials and Technology:

- Student task template
- Virtual Implementation Google Slides
- Pencils, crayons, colored pencils
- Manipulatives that work well for patterns (examples: colored squares, connecting cubes,

Vocabulary:

- repeating pattern
- growing pattern
- part or term
- transfer
- model

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Task Pre-Planning	
counting bears, etc.) • Chart paper/markers	• extend, continue • representation
Anticipate Responses: See the Planning for Mathematical Discourse Chart (columns 1-3).	

Task Implementation (Before) 10 minutes

Task Launch:

- **Anticipate prior knowledge:** The teacher will introduce the task by reviewing repeating patterns. To keep students active and engaged, the teacher can have students practice repeating patterns using movement. Some examples may include: touch your shoulders, touch your toes, touch your shoulders, touch your toes (ABAB), or snap, snap, jump, snap, snap, jump (AAB).
- Have students turn-and-talk with a classmate and share examples of other repeating patterns. The teacher can create an anchor chart and record student responses of various repeating patterns.
- Setting the stage for exploration of growing patterns without explicit introduction
    - Say, "Today we are going to learn about a new kind of pattern. I want to show you an example."
    - Using movement, the teacher should model an example of a growing pattern (example: jump, snap, jump, snap, snap, jump, snap, snap, snap…)
    - Ask students to think about how that pattern is different than the examples of repeating patterns.
    - Tell students they will explore a task with this new type of pattern today, and will discuss this new type of pattern at the end of the lesson.
- **Ensure understanding of the task:** The teacher will read the task aloud to all students. Discuss what you know from the task. Have students stand up and practice Ricardo's pattern of clapping and stomping.
- **Establish clear expectations:** Review the expectations of working on the task with students. This may include reviewing:
    - the task rubric
    - the expectations for independent work or partner work
    - the procedures for whole group discussions
    - the procedures and expectations for using classroom materials and/or manipulatives

Task Implementation (During) 20 minutes

Directions for Supporting Implementation of the Task

- **Monitor** – Students will work independently on the task for 15 minutes. As they work, the teacher will listen and observe students, and ask assessing or advancing questions (see the Planning for Mathematical Discourse chart on next page). As the teacher is monitoring, the teacher will look for strategies that are being used and record on Planning Chart.
- **Select** – The teacher will select students to partner up based on the strategies used. Pairings can include students who used similar strategies or students who used different strategies. Students will explain their thinking as they share their strategies with their partner. The teacher will select 3-4 strategies that will be highlighted during the whole group discussion (after student task implementation) that will advance mathematical ideas and support student learning.
- **Sequence** – Teacher will decide the order in which student ideas will be highlighted (after student task implementation).
- **Connect** – Teacher will consider ways to facilitate connections between different student responses. During the whole group discussion, the teacher will revisit the vocabulary term "growing pattern" and facilitate a discussion to help students make connections about why some patterns are called "growing.

Task Implementation (During) 20 minutes

Suggestions For Additional Student Support

- Sentences frames to facilitate communication:
  - The representation I used to create my pattern was _____.
  - I know my pattern matches Ricardo's pattern because _____.
  - If the pattern continued, the next part would be _____ because _____.
- Vocabulary development:
  - Use Frayer Models to deepen understanding of vocabulary terms.
  - Pair vocabulary with visuals.
  - Keep vocabulary on an anchor chart or word wall and reference the visual as needed to reinforce verbal, written, and graphic representations of new vocabulary words.
- Organization:
  - Use a graphic organizer or graph paper to delineate space for each term in the pattern.
  - Prepare student work space with materials required for task.
  - Encourage students to use two different colors to represent the two parts of the pattern (clapping and stomping).
- Extension Questions:
  - Can you represent the pattern using a different representation?
  - If Ricardo extended his pattern, what would be the 20^{th} (16^{th}, 10^{th}, etc.) sound he would make? Would it be a clap or a stomp?
  - Ricardo wanted to create a different growing pattern using claps and stomps. What is another growing pattern he could create?

Task Implementation (After) 15 minutes

Connecting Student Responses (From Anticipating Student Response Chart) and Closure of the Task:

- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion.
  - Students can participate in a Gallery Walk to view all strategies prior to coming together to discuss selected strategies.
  - Students can use the "Think, Pair, Share" strategy to discuss their solution with a peer.
- Based on the actual student responses, sequence and select particular students to present their mathematical work during a whole class discussion. Some possible big mathematical ideas to highlight could include:
  - A common misconception, such as students who represent a repeating pattern instead of a growing pattern
  - Trajectory of sophistication in student ideas (i.e. concrete to abstract)
- Connect different students' responses and connect the responses to the key mathematical ideas to bring closure to the task. Possible questions and sentence frames to connect student strategies:
  - How are these strategies/representations alike? How are they different?
  - _____'s representation is similar to _____'s representation because _____.
  - How do these connect to our Learning Intentions?
  - Why is it important to understand growing patterns?
- Highlight student strategies to show the connections, either between different ideas for solutions or to show the connection between levels of sophistication of student ideas.
- Provide an opportunity for students to ask clarifying questions.
- Close the lesson by facilitating a discussion about growing patterns. Ask students, "Why do you think they are called growing?" Discuss similarities and differences between growing patterns and repeating patterns.
- Review the success criteria for the lesson. Have students reflect on their progress toward the criteria.

Teacher Reflection About Student Learning

• Teacher will use the chart with anticipated student solutions to monitor which students are using which strategies. This will include: possible misconceptions, learning trajectories and sophistication of student ideas, and multiple solution pathways. Next steps based on this information could include:
  ○ Informing sequence of future tasks. What will come next in instruction to further student thinking about patterns?
  ○ Creating small groups based on student level of understanding during the task. Groups may include students who held misconceptions that were not addressed in sharing or students who excelled with the task and are ready for further extension activities.
• After task implementation, the teacher will use the Process Goals rubric to assess student understanding in relation to the process goals. The teacher may decide to focus on one category. Next steps based on this information could include:
  ○ Informing small groups based on current student engagement with the process goal(s) (i.e. think aloud, using specific sentence frames for communication, etc.).

Planning for Mathematical Discourse

Mathematical Task: Playing with Patterns Content Standard(s): SOL 1.14

Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions – Teacher Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** • *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* • *Connect different students' responses and connect the responses to the key mathematical ideas* • *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response A: The student states, "I don't know how to do this."	• What do you know about Ricardo's pattern? What do you notice about the claps and stomps?	• Instead of claps and stomps, what other symbols or pictures could you use?		
Anticipated Student Response B: Student uses claps and stomps, demonstrating they are unable to transfer the pattern to new symbols, colors, etc.	• Your pattern is the same as Ricardo's pattern. I wonder if you can create a pattern that is the same as Ricardo but uses a different representation.	• Instead of using claps and stomps like Ricardo, what other symbols or pictures could you use?		
Anticipated Student Response C: Student creates a repeating pattern (i.e. ABAB) instead of a growing pattern.	• It looks like your pattern is a repeating pattern. Does this match Ricardo's pattern? How do you know? • Sometimes mathematicians label their work to gain a better understanding. How	• I wonder how you could use _____ and _____ to show the same pattern that Ricardo created. (Fill in the blanks with the symbols used by the student.)		

Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
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	can you label your pattern? What do you notice now?			
Anticipated Student Response D: Student is able to transfer the pattern correctly, but is unable to extend the pattern.	• How do you know your pattern matches Ricardo's pattern? • What do you notice about the number of claps? Of stomps?	• How can you use the information about the number of claps and stomps to show what comes next in the pattern?		
Anticipated Student Response E: Student is able to transfer the pattern correctly AND is able to extend the pattern correctly.	• How do you know that your pattern matches Ricardo's pattern? • How do you know what came next in the pattern?	• Can you use other pictures, symbols, numbers, or words to represent the pattern in another way? • The teacher may refer to page 3 for extension ideas to further students' thinking.		

Name _____ Date _____

Playing with Patterns

Ricardo created the following pattern using pictures and words:

clap – stomp – clap – stomp – stomp – clap – stomp – stomp – stomp …

- Can you use pictures, symbols, or numbers to create a new representation of Ricardo's pattern? Explain your thinking.

- Extend your representation of Ricardo's pattern until there are 14 parts. Use pictures, symbols, or numbers to show what your pattern would look like. Explain your thinking.

Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	Proficient Plus: ● Uses relationships among mathematical concepts or makes mathematical generalizations	● Demonstrates an understanding of concepts and skills associated with task ● Applies mathematical concepts and skills which lead to a valid and correct solution	● Demonstrates a partial understanding of concepts and skills associated with task ● Applies mathematical concepts and skills which lead to an incomplete or incorrect solution	● Demonstrates no understanding of concepts and skills associated with task ● Applies limited mathematical concepts and skills in an attempt to find a solution or provides no solution
Problem Solving	Proficient Plus: ● Problem solving strategy is well developed or efficient	● Problem solving strategy displays an understanding of the underlying mathematical concept ● Produces a solution relevant to the problem and confirms the reasonableness of the solution	● Problem solving strategy displays a limited understanding of the underlying mathematical concept ● Produces a solution relevant to the problem but does not confirm the reasonableness of the solution	● A problem solving strategy is not evident ● Does not produce a solution that is relevant to the problem
Communication and Reasoning	Proficient Plus: ● Reasoning or justification is comprehensive ● Consistently uses precise mathematical language to communicate thinking	● Demonstrates reasoning and/or justifies solution steps ● Supports arguments and claims with evidence ● Uses mathematical language to communicate thinking	● Reasoning or justification of solution steps is limited or contains misconceptions ● Provides limited or inconsistent evidence to support arguments and claims ● Uses limited mathematical language to partially communicate thinking	● Provides no correct reasoning or justification ● Does not provide evidence to support arguments and claims ● Uses no mathematical language to communicate thinking
Representations and Connections	Proficient Plus: ● Uses representations to analyze relationships and extend thinking ● Uses mathematical connections to extend the solution to other mathematics or to deepen understanding	● Uses a representation or multiple representations, with accurate labels, to explore and model the problem ● Makes a mathematical connection that is relevant to the context of the problem	● Uses an incomplete or limited representation to model the problem ● Makes a partial mathematical connection or the connection is not relevant to the context of the problem	● Uses no representation or uses a representation that does not model the problem ● Makes no mathematical connections