Rich Mathematical Task – Grade *K* – *Mixed Up Math Blocks*

Task Overview/Description/Purpose:

- In this task, students will organize a set of shapes into appropriate groups according to similar and different attributes/characteristics.
- The purpose of this task is for students to recognize that a group of objects with various attributes can be classified and sorted in different ways.

Standards Alignment: Strand – *Computation and Estimation*

Primary SOL: K.12 The student will sort and classify objects according to one attribute.

Related SOL: 1.11, 1.13

Learning Intention(s):

- **Content -** I am learning to sort and classify shapes.
- **Language -** I am learning to use math vocabulary to describe how a set of shapes has been sorted.
- **Social -** I can communicate my thinking and describe how a set of shapes was sorted.

Success Criteria (Evidence of Student Learning):

- I can identify the attributes of shapes.
- I can sort shapes in different ways based on their attributes.
- I can name multiple ways to sort a set of shapes.
- I can communicate my thinking clearly to my classmates and describe how a set of shapes was sorted.
- I can listen as my classmates share their math ideas.

Mathematics Process Goals

Problem Solving	• Students will apply their understanding of similarities and differences among shapes to sort, compare, and classify the collection of shapes in the task.
Communication and Reasoning	• Students will use math vocabulary to justify their mathematical decisions through their representations and labeling their shape sort.
Connections and Representations	• Students will use a representation, with accurate labels, to sort the collection of shapes. • Students will make connections between their representations.

Task Pre-Planning

Approximate Length/Time Frame*:* 60 minutes

Grouping of Students: Begin with a whole class launch of the task. After introducing the task, students work individually to solve the task. If some students solve before group discussion time, encourage them to find other solutions and/or share their thinking with a classmate who has also completed task.

This task can be given at any time to see how students are progressing with the concept of sorting and classifying shapes by attributes. If you choose to give it before starting the unit, you can see what knowledge the students already have regarding sorting and classifying by attributes. If you give the task during your unit, you can see how students are progressing with sorting and classifying attributes and what additional supports they may need. If given at the end of the unit, the task can be a good assessment of the student's knowledge of sorting and classifying attributes.

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Task Pre-Planning	
Materials and Technology: • copy of task and blocks for each student and/or partner groups • scissors • paper and pencil	**Vocabulary:** • sort, classify • attributes • subsets (categories) • label • size, shape, color
Anticipate Responses: See the Planning for Mathematical Discourse Chart (columns 1-3).	

Task Implementation (Before)

Task Launch:

- In a whole group setting, invite students to connect with the context and activate prior knowledge by asking, "*Have you ever organized something that is mixed up?"* To activate prior knowledge, consider relating to a situation that is familiar for students. For example, picking up a room, putting away craft supplies, cleaning up toys, emptying the dishwasher, etc.
- What does organize mean?
- How did you organize the mixed up stuff?
- How did you know your stuff was not mixed up anymore?
- As the teacher, you want to elicit the ideas of *similarities, differences, sorting, and classifying* through student-shared ideas. For example, students could share ideas through a think/pair/share and then allow 4-5 students to share their idea or their partner's idea with the class.
- Share the learning intentions and success criteria with the students. Clarify any vocabulary you think may be difficult for your students.
- Explain that today's task is about a teacher who finds a box of mixed up math blocks in his classroom. He needs the students' help in organizing the blocks so that they will be easier for his students to use. Your task is to listen to the information in the story and figure out a way to help the teacher with his problem.
- Introduce the task by reading the problem aloud to students. Ask a few students to restate the task in their own words to promote understanding and provide an opportunity to clarify any questions.
- Explain that students will begin working individually on the task and later will work collaboratively with a partner to discuss the task and possible solutions and ways to represent their solutions.
- Redirect them to the language and social learning intentions for this task. After discussing with their partner, they need to be prepared to share their thinking with the class.
- Review the rubric with students. Let them know you are looking for their:
  - Problem Solving
  - Communication and Reasoning
  - Representations and Connections

You may choose to just focus on just one or two of the process goals. Make your selected focus goals clear to students before they begin working on the task.

- Pass out the task to each student to think about and solve individually.
- After students have had some time to think and work on sorting the math blocks, then they can discuss with a partner.
- Implement suggestions for additional student support below as needed.

Task Implementation (During)

Directions for Supporting Implementation of the Task

- Monitor – Teacher will listen and observe students as they work on the task and ask assessing or advancing questions (see potential ideas on the Planning for Mathematical Discourse Chart).

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Task Implementation (During)

- Select – Teacher will decide which strategies or thinking will be highlighted (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 (following the student task implementation). The teacher should sequence from the least sophisticated strategy to the most sophisticated strategy. For instance, start with a student who sorts by just color, to those who sort by size/shape, to students who go to an attribute like the number of sides, etc. Then end with students who may have sorted by more than one attribute.
- Connect – Teacher will consider ways to facilitate connections between different student responses and representations.
    - As the teacher is monitoring individual students and partner pairs, s/he will look for strategies that are being used and reflect on how they should be sequenced during the follow up discussion.
    - The teacher should use questions to assess or advance student thinking.
    - Students should be encouraged to explore different strategies for sorting and classifying according to attributes, ask their partner questions about their work, and evaluate the reasonableness of their solution.

*The teacher should listen and take notes while students are working and sharing ideas, as some kindergartners may not be fully able to express their mathematical thinking fully in a representation or with written words.

Suggestions For Additional Student Support

May include, among others:

- Create an anchor chart to display task vocabulary.
- Pair vocabulary with visuals.
- Use of graphic organizer or sorting mat for task.
- Prepare student workspace with materials required for task.
- Provide bowls or plates for sorting shapes to support visual-spatial-kinesthetic learning.
- Pre-cut the "Mixed Up Math Blocks" shape cards.
- Decrease the number of "Mixed Up Math Blocks" shape cards used.
- Sentences frames can be used to support student thinking:
    - *I noticed _____ about the mixed up blocks, so I _____.*
    - *I decided to sort the blocks _____.*
    - *The blocks in this group _____.*
    - *First, I _____. Then, I _____.*
- To extend the task, add parameters such as: *Can you think of other blocks that would fit into this group of blocks? How do you know that this block would fit?*
- To extend the task, add parameters such as: *Can you think of another way to sort the blocks? Why do you think there is more than one way to sort them?*
- To extend the task, add parameters such as: *Can you think of a way to sort by two attributes at the same time (For example, small and gray)?*

Task Implementation (After) 15-20 minutes

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

- Based on the actual student responses, sequence and select students to present their mathematical work during class discussion. Consider sharing one strategy that shows a common misconception, and two other strategies that can connect to each other. For example, begin with students who sort by just color, to those who sort by size/shape, to students who go to an attribute like number of sides, etc. Then end with students who may have sorted by more than one attribute. Facilitate a discussion about similarities and differences between the strategies for sorting shapes.

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Task Implementation (After) 15-20 minutes

- 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 sorting strategies:
  - How are these sorting strategies alike? How are they different?
  - _____'s sorting strategy is similar to _____'s sorting strategy because _____.
  - How do these connect to our Learning Intentions?
  - Why is this important?
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion (opportunity for gallery walk or think/pair/share with a partner or small group).
- As students share their work ask questions like:
  - How can you prove (convince us) that your sort makes sense?
  - Do you agree or disagree? Why?
  - Did anyone think about sorting the blocks in a different way?
  - What are you noticing about the blocks?
  - That was a big math idea, who can restate it?
  - Who can add onto this idea?
  - Is there just one way to sort these shapes or more than one? Explain your thinking.
- Close the lesson by returning to the success criteria. Have students reflect on their progress toward the criteria.

Teacher Reflection About Student Learning

- Use the rich mathematical task rubric to evaluate students' progress toward the process goals.
- How will the evidence provided through student work inform further instruction? Analyze student work to determine who was unable to demonstrate proficiency with the following mathematical ideas.
  - Who had difficulty getting started with the task?
  - Who sorted blocks randomly without any regards to attributes?
  - Who sorted blocks by their appearance rather than by the attributes/properties of shapes?
  - Who sorted blocks by size only and did not consider the attributes/properties of shapes when sorting?
  - Who inaccurately sorted blocks by the attributes that they identified for each category?
  - Who appropriately sorted the blocks but his/her explanations or descriptions were not fully developed?
  - Who was unable to complete the task, even when additional support was provided?
  - Who was able to sort the blocks accurately using at least one attribute/property of shapes?
  - Who was able to find multiple ways for sorting the blocks in this task?
  - Who was able to sort the blocks by two or more attributes at the same time?

Planning for Mathematical Discourse

Mathematical Task: Mixed Up Math Blocks Content Standard(s): SOL K.12

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* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response A: Student has difficulty getting started.	• Can you retell the problem to me? • Tell me about your thinking. • What is an attribute? • What do you notice about the blocks? • What is the same? What is different? • How are you going to get started?	• What attribute could help you sort the blocks so they would not be mixed up? • How could you sort the blocks?		
Anticipated Student Response B: Student randomly sorts shapes without regards to attributes.	• Tell me about your thinking. • What block did you start with when sorting the blocks? Why? • Which attribute did you use to decide how to sort the blocks? • How did you decide how to sort this block? • What is the same about the blocks in this group? • What is different about the blocks in this other group?	• Are there other blocks you could put into this group? • Are there any shapes that do not belong in this group? • How could you sort these blocks so that there is something similar about them in this group? • How will you describe each category of blocks to the class?		

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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* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response C: Student inaccurately sorts shapes by the attribute the student has described for each category.	• Tell me about your thinking. • What attribute did you use to sort? How did the attribute help you sort the blocks? • Where should this block go? Why? • Compare these two blocks. How are they the same? How are they different? • Why does it make sense to put block ___ in this group?	• Are there any blocks that would fit better in another category? • Were there blocks that fit into more than one category? What attribute did you use to make that decision? • How will you describe each category of blocks to the class?		
Anticipated Student Response D: Student appropriately sorts shapes but his/her explanations or descriptions of why are not fully developed.	• Tell me about your thinking. • What attribute did you use to sort the blocks? How did this attribute help you sort the rest of the blocks? • Why did you put this block into this group and not this one? • How are the blocks in this group different than the other categories you made?	• Were there blocks that fit into more than one category? What attribute did you use to make that decision? • How will you describe each category of blocks to the class?		
Anticipated Student Response E: Student sorts the shapes accurately using one attribute	• Tell me about your thinking. • How did you decide what categories to use for sorting and classifying the blocks?	• Is there another attribute that you could have sorted by?		

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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* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
	• Were there some blocks you struggled placing into groups? Why were these blocks so difficult? • How many attributes does this block have?	• Can the blocks be sorted in more than one way? • Would it be possible to consider two attributes for sorting the blocks at the same time? • What can you add to your description about the blocks in this group? • Why are attributes important? How do they help organize a group of blocks?		
Anticipated Student Response F: Student is able to sort the shapes accurately using more than one attribute.	• Tell me about your thinking. • Were there blocks that fit into more than one category? What attribute did you use to make that decision? • Were there some blocks you struggled placing into groups? Why were these blocks so difficult?	• Why do you think there are blocks that fit into more than one category? Why do you think that can happen? • Why are attributes important? How do they help organize a group of blocks? • What else did you discover while you were sorting the blocks?		

Name _____ Date _____

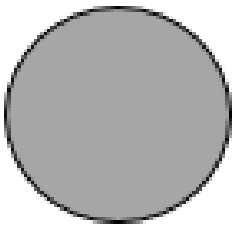
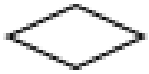
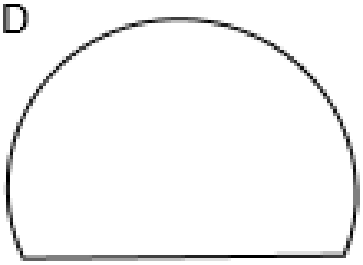
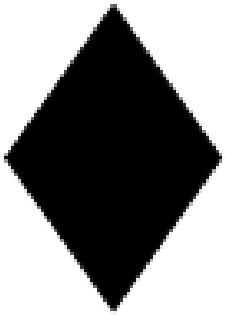
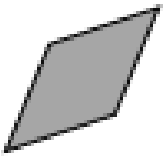
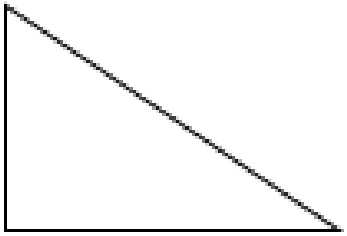
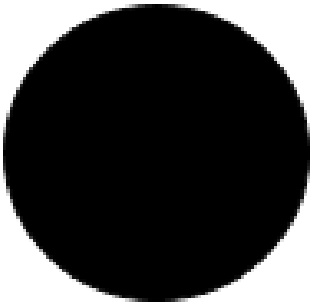
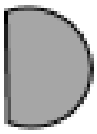
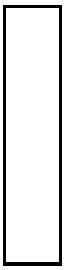
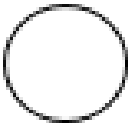
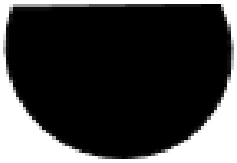
Mixed Up Math Blocks

Mr. Walker opened a box and noticed that someone had mixed up the math blocks in his kindergarten classroom. He needs your help organizing them.

How could you sort the mixed up math blocks so they will be easier for his students to use? Cut out the math blocks and sort them into groups so each group has math blocks that are alike or similar in some way.

Show your work and explain your thinking.

Mixed Up Math Blocks

A 	B 	C 
D 	E 	F 
G 	H 	I 
J 	K 	L 
M 	N 	O 

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

Additional Resources/Graphic Organizers/Etc.

Sentence Stems

I noticed _____ about the mixed up blocks, so I _____.

I decided to sort the blocks _____.

The blocks in this group _____.

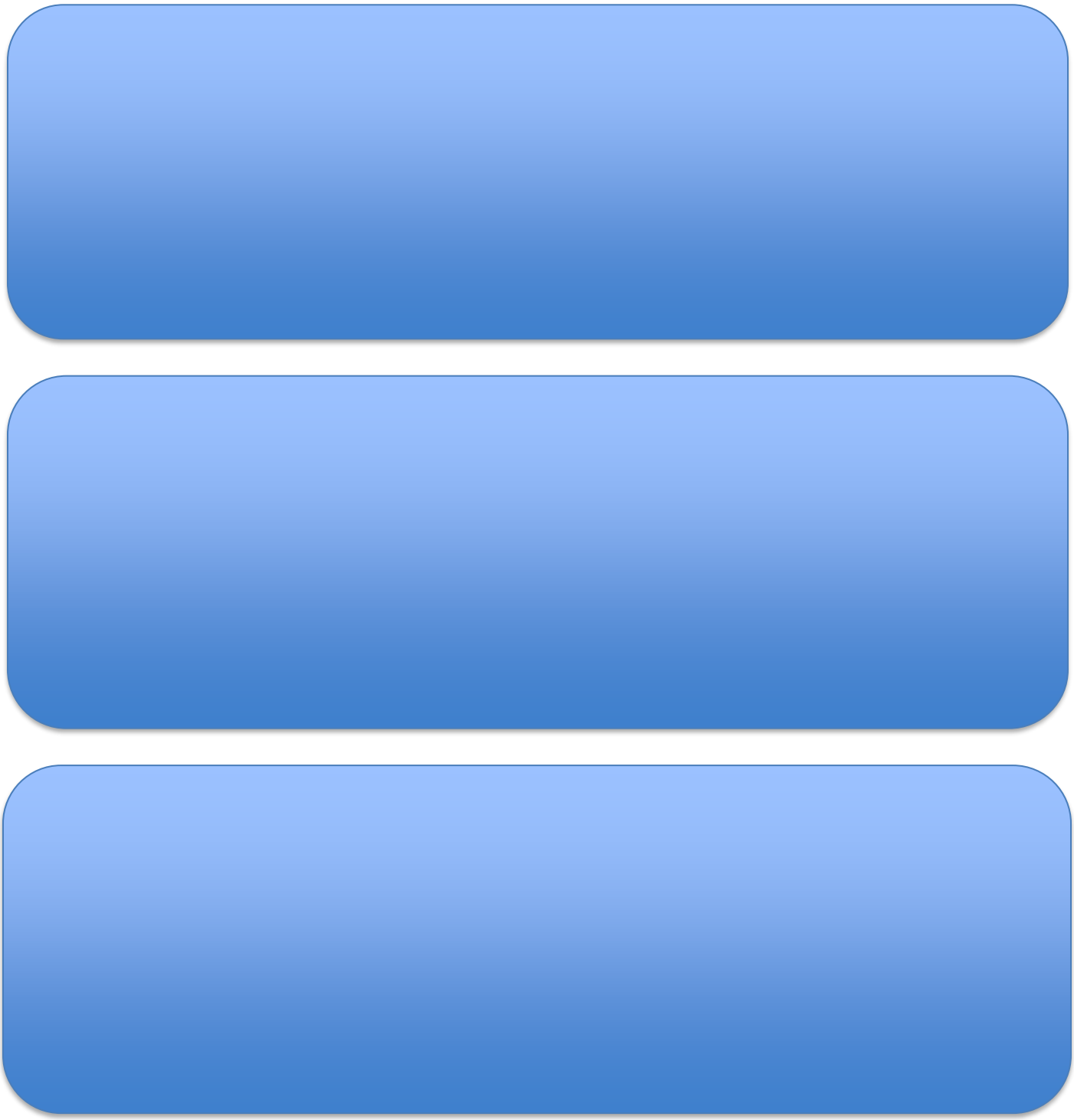
First, I _____. Then, I _____.

Sorting Mat 1

(Students should determine how to sort the mixed up blocks and how many categories will be used.)

Sorting Mat 2

(Students should determine how to sort the mixed up blocks and how many categories will be used.)



Sorting Mat 3

(Students should determine how to sort the mixed up blocks and how many categories will be used.)