

Rich Mathematical Task – Grade 6 – *Screen Time*

Task Overview/Description/Purpose:

- Students will be presented with a data set that represents the first 13 days of screen time for Jasmine. The students are asked to determine the greatest amount of minutes for Day 14 in order for Jasmine to stay within the guidelines set by her parents.
- In this task, students will explore finding the mean of a set of data and how adding a data point effects the different measures of center.
- This task is intended to be given to students before they are taught the mathematics content for Standard 6.11. This task is a real-life scenario that models this sixth grade standard.

Standards Alignment: Strand – *Probability and Statistics*

Primary SOL: 6.11a The student will

- a) represent the mean of a data set graphically as the balance point.
- b) determine the effect on measures of center when a single value of a data set is added, removed, or changed.

Related SOL (within or across grade levels/courses): 4.14, 5.16, 5.17

Learning Intention(s):

- **Content** – I am learning to represent the mean of a data set graphically as the balance point, as well as determine the effect of measures of center when a single value of data is added, removed, or changed.
- **Language** – I am learning how to justify and explain my thinking when solving real-world problems involving measures of center.
- **Social** – I am learning how to communicate my thinking process in solving a mathematical problem with my peers.

Success Criteria (Evidence of Student Learning):

- I can represent the mean of a data set graphically as the balance point represented in a line plot.
- I can determine the effect on measures of center when a single value of a data set is added, removed, or changed.
- I can use mathematical language and logical reasoning to justify my thinking in solving problems set in real-world situations.
- I can work with a partner to give and receive feedback when solving mathematical problems.

Mathematics Process Goals

Problem Solving	<ul style="list-style-type: none"> • Students will apply prior knowledge in the area of line plots and measures of center to explore a problem which is an application of using the measures of center.
Communication and Reasoning	<ul style="list-style-type: none"> • Students will justify the number of minutes they choose for Day 14 based on their understanding of measures of center.
Connections and Representations	<ul style="list-style-type: none"> • Students may represent the data in a line plot or place the data in sequential order to assist in finding the correct number of minutes for the mean and to determine if the median or mode will provide Jasmine more screen time.

Task Pre-Planning

Approximate Length/Time Frame: 50 minutes

Rich Mathematical Task – Grade 6 – Screen Time

Task Pre-Planning	
<p>Grouping of Students: The teacher will launch the task with the whole class allowing students to read the task and ask clarifying questions before any mathematics work is started. The task will be distributed for students to work on individually for 5-10 minutes. After 5-10 minutes, students will collaborate in small groups (teacher can choose the groups or students can create their own) to refine their strategies and/or compare strategies. This collaboration will take no more than 5-10 minutes (possibly with pencils down and just talking and no writing). The students will then go back and work individually to complete the task. Students should prepare a strategy to share (or multiple strategies to share) with the whole class. The teacher should alert individual students whose work she/he plans to share so that the students will be prepared. In order to reflect and move forward, the grouping will return to whole class so that the teacher can orchestrate sharing out of strategies in order to make connections and promote discovery of the 6.11 Standard.</p>	
<p>Materials and Technology:</p> <ul style="list-style-type: none"> • calculators (Desmos or handheld scientific) 	<p>Vocabulary:</p> <ul style="list-style-type: none"> • average • balance point • bimodal • fair share • line plot • mean, median, mode • measures of center
<p>Anticipate Responses: See Planning for Mathematical Discourse Chart (Columns 1-3)</p>	
Task Implementation (Before)	
<p>Task Launch:</p> <ul style="list-style-type: none"> • As a whole class, the teacher should introduce a brainstorming session where students are instructed to provide any information they have in their “measures of center toolbox.” Students may brainstorm the following content: <ul style="list-style-type: none"> ○ Grade 5 Content <ul style="list-style-type: none"> ▪ describe mean, median, and mode as a measure of center ▪ describe mean as fair share ▪ describe the range of a set of data as a measure of spread ▪ determine the mean, median, mode, and range of a set of data ▪ represent data in line plots ▪ interpret data in line plots ○ Grade 4 Content <ul style="list-style-type: none"> ▪ Organize data into a chart or table • To prevent compromising the integrity of the task, teachers should record all prior knowledge shared by students (without applauding any particular item or adding to the list themselves). • After the brainstorming session, teachers should explain to the students that they will be participating in a task that is asking them to draw from all of their prior knowledge. • The teacher should ask the students to keep their pencils/pens down. • The class should read the task together. • The teacher should make sure that all students understand the task at-hand and that all of the words used are clear to them as readers. • The teacher should discourage any discussion of strategy at this point. 	

Rich Mathematical Task – Grade 6 – Screen Time

Task Implementation (During)

Directions for Supporting Implementation of the Task

- Monitor – Teacher will listen and observe students as they work on task and ask assessing or advancing questions (see chart on next page)
- Select – Teacher will decide which strategies or thinking that 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 (after student task implementation)
- Connect – Teacher will consider ways to facilitate connections between different student responses

Suggestions For Additional Student Support

- Some students may benefit from graph paper to help them organize a table or line plot.
- Calculators may be used for computation.
- The teacher should ask question of students, in both assessing and advancing formats (see monitoring document below), to help students refine their strategies.
- Students who need more language support could benefit from visual word walls or small glossary (e.g., screen) during brainstorm session
- For ELs with first language literacy, try to provide prompt, or parts of prompt, in their home language.
- Read the prompt aloud.
- For students need support in justifying their thinking, you may choose to provide them with the sentence frames below.
 - What I know about the problem is...
 - My method for solving the problem was...
 - When I calculated the median. I got ... but the when I solved for mode, I got...

Task Implementation (After)

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

- 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 to bring closure to the task. Possible questions and sentence frames to connect student strategies:
- How are these strategies alike? How are they different?
- Where do you see _____'s strategy in _____'s strategy?
- What conclusions can you draw about the relationship between mean, median, and mode? Which one is most affected by an outlier?
- Why is this important?
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion.

Teacher Reflection About Student Learning:

- Student understanding of the content through the use of the process goals will be assessed with the Rich Mathematical Task Rubric.
- When this task is used to introduce the 6.11 content, students cannot be expected to perform at a proficient or advanced level in all four sections of the rubric.
- The results of this task will help the teacher assess background knowledge and give the students an opportunity to apply this knowledge to a new situation.
- Teachers may choose to revisit this same task at a later date in order to document student growth.

Rich Mathematical Task – Grade 6 – Screen Time

Planning for Mathematical Discourse

Mathematical Task: _____

Content Standard(s): _____

Anticipated Student Response/Strategy <i>Provide examples of possible correct student responses along with examples of student errors/misconceptions</i>	Assessing Questions – Teacher Stays to Hear Response <i>Teacher questioning that allows student to explain and clarify thinking</i>	Advancing Questions <i>Teacher questioning that moves thinking forward</i>	List of Students Providing Response <i>Who? Which students used this strategy?</i>	Discussion Order - sequencing student responses <ul style="list-style-type: none"> • <i>Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion</i> • <i>Connect different students' responses and connect the responses to the key mathematical ideas.</i> • <i>Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion</i>
Anticipated Student Response: Non-starter	<ul style="list-style-type: none"> • What are you thinking? • Is there anything that you need me to clarify about the task? • What vocabulary do you not understand? • What do you predict the solution might look like? • What do you wonder/notice? 	<ul style="list-style-type: none"> • Can you organize your data in a way that might help? • What are the measures of center? • How do you find the measures of center? 	Student E	
Anticipated Student Response: Student creates a line plot to organize their data	<ul style="list-style-type: none"> • Can you tell me what this line plot represents? • What question are you answering in this task with this line plot? • What is your plan? 	<ul style="list-style-type: none"> • How does the visual in the line plot relate to the questions you are asked in the task? • How can you use the line plot to help you find the measure of center? 		

Rich Mathematical Task – Grade 6 – Screen Time

<p>Anticipated Student Response/Strategy Provide examples of possible correct student responses along with examples of student errors/misconceptions</p>	<p>Assessing Questions – Teacher Stays to Hear Response Teacher questioning that allows student to explain and clarify thinking</p>	<p>Advancing Questions Teacher questioning that moves thinking forward</p>	<p>List of Students Providing Response Who? Which students used this strategy?</p>	<p>Discussion Order - sequencing student responses</p> <ul style="list-style-type: none"> 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
<p>Anticipated Student Response:</p> <p>Student organizes their data sequentially (either smallest to largest or largest to smallest)</p>	<ul style="list-style-type: none"> Why did you organize your data this way? How does this help you to answer the question posed in this task? Can you explain your thinking? 	<ul style="list-style-type: none"> In the past, you learned about mean as a balance point. How can you use what you have created, to find the mean? Median? Mode? For part B, how does adding a new value for Day 14 (median or mode), effect the mean (average)? 	<p>Student A, B, C, D, E, F</p>	
<p>Anticipated Student Response:</p> <p>Student does not organize their data but knows the definition of mean (average).</p>	<ul style="list-style-type: none"> What do you estimate the answer might look like? How many data points are given to you? Can you explain your thinking? 	<ul style="list-style-type: none"> Are there other measures of center? How would I find them? Which measure of center benefits Jasmine the most? 		
<p>Anticipated Student Response:</p> <p>Student applies Logical Reasoning through a Guess and Check method.</p>	<ul style="list-style-type: none"> Can you explain your thinking? How are you going to narrow in on a reasonable number for your guess? 	<ul style="list-style-type: none"> What are you trying to find? What is the average that Jasmine's parents will tolerate? 	<p>Student E, F</p>	

Rich Mathematical Task – Grade 6 – Screen Time

Name _____

Date _____

Screen Time

Jasmine turned 12 years old last week and her parents gave her a cell phone as a birthday gift. Jasmine’s parents said that she is allowed to keep the phone as long as her average screen time each day does not go over 240 minutes during any two-week period of time. Jasmine has kept a record of her screen time over the last 13 days.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Screen Time (minutes)	310	195	220	275	190	210	280	215	195	255	275	270	265	

a) Using this information, what is the greatest number of minutes Jasmine can be on her phone for Day 14 to stay within the average of 240 minutes her parents allow? Explain your reasoning.

b) Jasmine wonders if she might get more screen time on Day 14 using the median or mode as the measure of center to stay within her parents’ limit of 240 minutes. Would the **median** or **mode** allow her more screen time on Day 14? Explain your reasoning.

Rich Mathematical Task – Grade 6 – Screen Time

Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Uses relationships among mathematical concepts 	<ul style="list-style-type: none"> • Demonstrates an understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to a valid and correct solution 	<ul style="list-style-type: none"> • Demonstrates a partial understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to an incomplete or incorrect solution 	<ul style="list-style-type: none"> • Demonstrates little or 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	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Problem solving strategy is efficient 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Chooses a problem solving strategy that does not display an understanding of the underlying mathematical concept • Produces a solution relevant to the problem but does not confirm the reasonableness of the solution 	<ul style="list-style-type: none"> • A problem solving strategy is not evident or is not complete • Does not produce a solution that is relevant to the problem
Communication and Reasoning	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Reasoning is organized and coherent • Consistent use of precise mathematical language and accurate use of symbolic notation 	<ul style="list-style-type: none"> • Communicates thinking process • Demonstrates reasoning and/or justifies solution steps • Supports arguments and claims with evidence • Uses mathematical language to express ideas with precision 	<ul style="list-style-type: none"> • 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 with some imprecision 	<ul style="list-style-type: none"> • Provides little to no correct reasoning or justification • Does not provide evidence to support arguments and claims • Uses little or no mathematical language to communicate thinking
Representations and Connections	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Uses representations to analyze relationships and extend thinking • Uses mathematical connections to extend the solution to other mathematics or to deepen understanding 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Uses no representation or uses a representation that does not model the problem • Makes no mathematical connections