**Posing Questions and Collecting Data**

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| This lesson is an introduction to a three-part lesson experience with data collection and the analysis process. The three lessons in this series stand alone. In this first lesson, students discover the purpose of collecting and representing data as they work individually, in pairs, or in small groups to:   * pose questions that yields data in up to four categories, * devise a plan for data collection, and * construct a frequency table to collect data from third graders at their school. |

**NC Mathematics Standard(s):**

**Measurement and Data**

**NC.3.MD.3** Represent and interpret scaled picture and bar graphs:

* Collect data by asking a question that yields data in up to four categories.
* Make a representation of data and interpret data in a frequency table, ~~scaled picture graph, and/or scaled bar graph with axes provided.~~
* ~~Solve one and two-step “how many more” and “how many less” problems using information from these graphs~~

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

4. Model with mathematics.

5. Use appropriate tools strategically.

**Student Outcomes:**

* I can ask a question that yields data with up to four categories.
* I can devise a plan for fairly collecting data.
* I can construct a frequency table to collect data from third graders at my school.

**Math Language:**

Data collection

Frequency table

Category

Represent

**Materials:**

* Paper, pencils, post-it notes

**Launch:**

1. Setting the Stage for Collecting Data: Choosing a Question To Ask and Deciding on Process for Collecting Data (about 20 minutes)

Think about some things you’d like to know about the third graders in our school. What if we were planning a spring field trip? What kind of questions could we ask 3rd graders at our school to determine where we should go? If we were planning a reward for the classes, what would be good questions to ask? Say: Asking questions and collecting data can be useful to help us make decisions, and it can also be a great way to get to know about our friends.

Students brainstorm a list of questions they could ask classmates that would help to get to know each other better or would give us useful information. Examples include: What is your favorite snack, animal, author, place to vacation, outdoor activity, book, etc.

Pick a question from the list, such as: “What is your favorite snack?” Say: So, if we choose the question, “What is your favorite snack?” Why might I want to know the favorite snack of third graders at our school? Maybe if we wanted to have a special snack for everyone? What if I wanted to know because we are going on a field trip and we want to provide a snack for all third graders? If we go on a field trip, there are certain snacks that would be really good to take, and some that would not be good (a large sheet cake has to be cut and we’d also have to take plates and forks, ice cream may melt, etc.). So how could we refine our first question, “What is your favorite snack?” to help us collect data that would be most useful to help us plan a snack for our field trip? We want the snack to travel well, not have to be refrigerated, have little clean up, be somewhat healthy, etc. Students may settle on a question such as, “What is your favorite fruit for a field trip snack?” Being specific with the question helps us in the collecting useful data, and also in the representation, analysis and interpretation.

Ask: If we asked each third grader at our school, we could get lots of ideas, right?

Sometimes, it helps to give people a few choices and let them choose their favorite from the options. Teachers may decide to guide students to limit the number of categories (tell students to select from four choices) before they collect data, or teachers may want students to collect all possible responses and then limit the number of categories after the data is collected. Since this standard calls for up to four categories, teachers could direct students to choose the three most popular choices and then have an “other” category. This is something teachers can scaffold as students work in the explore section of the lesson.

Ask: How we would collect this data? What things do we need to consider? What if I only asked my best friends? …only boys? …only girls? Would that be fair? How will we know if a student votes more than once?

This lesson could be as structured or as inquiry-based as the teacher prefers (see Extension note below). Some teachers may choose to provide more structure, so tables are provided for structure, but their use is optional. If teachers choose for this part to be more structured, model how students could use Table 1 below.

Say: We could use the chart to help us collect the data. We could ask each student to write his/her name under his/her favorite fruit. Draw a sample chart on the board and ask each record their responses in Table 1. For example:

What Is Your Favorite Fruit for a Field Trip Snack?

|  |  |  |  |
| --- | --- | --- | --- |
| Apple | Orange | Bananas | Other |
| Leanne | Robin | Meg |  |
| Thad | Luke | Kaneka |  |
| Kevin |  |  |  |

(Note: Table 2 is provided as an alternate format for students to collect data.)

Now we’ve got all this data. We still need to represent it in a way that can help us represent it or answer our question. How can use the information from Table 1 to construct a frequency table? Say: We can transfer that data to a frequency table, a way to record how often each value in a set of data occurs, to help us combine totals and eventually to represent this data with a pictograph or bar graph. Ask specific groups to count the total number of student names in each category to find the total number for each fruit. Draw a Frequency Table draft on the board and ask students to help determine what should go in each cell. An example is below:

Third Graders’ Favorite Fruit for a Field Trip Snack

|  |  |
| --- | --- |
| Favorite Fruit | Frequency |
| Apple | 37 |
| Orange | 58 |
| Banana | 26 |
| Other | 19 |

Say: We will design and conduct an experiment to collect data on a question that we want to know about third graders at our school. We will use this data in another lesson, when we construct graphs with it. We will then use that data to decide what questions to ask and answer questions about our third grade students.

Possible questions:

Which fruit do you think will be most popular?

Which fruit do you think the class will like the least?

Which fruit should we not select as a healthy snack for our class?

**Explore:**

1. Choose a Question (5-7 minutes)

Students work individually, in pairs, or in groups to choose a question to ask classmates that would them you get to know each other better or would give useful information. The teacher is careful not to provide too much guidance, but asks probing questions to help students determine the best way to ask their question.

As students choose a question, ask questions to encourage them to consider a context and refine their question based on that (field trip example). Being specific with the question helps us in the collecting useful data, and also in the representation, analysis and interpretation.

Decide how to collect the data (12 minutes)

Students decide how to collect data. As students work, the teacher observes how they are devising their plan. Observe:

* How students plan to organize and represent their thinking.
* How students make sense of the task.

Carefully select students to share their questions and data collection process with the class. Look for students who attend to keeping track of student responses. Also look for thinking that will generate discussion to help others move toward a deeper understanding of the mathematical goal.

**Discuss:**

1. Share Questions and Data Collection Plans (10-15 minutes)

Bring the class back together and have selected students share their questions and their strategies for collecting data. Ask students to share their ideas to make thinking visible – what they had considered about but decided against, and how they settled on their question and data collection process. Encourage students to share their strategies with one another and describe how they plan to ensure that they’ve asked each student and not collected data from a student more than once. Allow students to ask questions of each group (pair, or individual) as they present to assist them with their thinking. Allow each group to reflect on the discussion and make revisions to their data collection plan as necessary.

Possible points to address and questions to ask:

* Is your question specific enough?
* How will you know when you have responses from all students?
* How you will make sure each student is not counted twice?

**Additional Activities**

1. Collect and Represent Data on Frequency Chart (Amount of time ranges depending on number of classes and methods of collecting. It could be stretched out over a couple of days, or could be collected electronically). Students collect data. After they collect the data, students display their data in a frequency table, which will be used to construct graphs in Lesson 2 (Graphing Data About Third Graders).

**Evaluation of Student Understanding**

**Informal Evaluation:**

Observe and monitor students as they work to devise questions and collect data. How are they making sense of the task?

**Formal Evaluation/Exit Ticket:**

The question and data collection plan are collected and feedback is given. The completed data chart and frequency table can serve as a formal evaluation. Students can reflect in journals on the data collection process and explain the purpose of a frequency table.

**Meeting the Needs of the Range of Learners**

**Intervention:**

* A copy of Table 1 with student names already filled in could be provided so students focus is on collecting data rather than keeping track of who they have (or have not) collected data from.
* Teacher could provide data from other third grade classes (numbers from each category and each class) and ask students to collect data on their class only for the remaining data.
* If students need more structure, teachers may choose to encourage students to use Table 2 at the bottom of the lesson to provide support.
* In a group, some students could be responsible for collecting data and others could be responsible for constructing the frequency chart once data is collected.

**Extension:**

* This lesson could be as structured or as inquiry-based as the teacher prefers. Some teachers may want students to devise their own plans for collecting data, ensuring that each student in the class (or grade level) responds once and provide less scaffolding and modeling during the launch.

**Possible Misconceptions/Suggestions:**

|  |  |
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| **Possible Misconceptions** | **Suggestions** |
| Student questions could be too vague to represent in a bar or pictograph with four or less categories. | * Encourage students to frame their question to give students choices to pick from rather than an open-ended question (ex: “What is your favorite food?” could yield too many responses for four categories.) * What would you like to know about your classmates? * If someone were going to ask you a question about yourself what would you want them to ask you? What types of food do you like? |
| Students have difficulty coming up with 4 possible choices. | * How can we come up with 4 choices that your classmates are likely to choose? * What are some choices you think your classmates would choose? * How would you answer this question? |
| Student questions could generate numerical, rather than categorical, data, which may not lend to representing it on bar graphs or pictographs. | * Discuss different types of data – categorical and numerical. * Discuss the questions chosen before data collection starts, unless you want students to discover and identify how they could have done it differently after they’ve collected the data. |
| Students may have a tendency to collect data from only some students. | * Assist students with ideas for devising a process to collect data from all third graders. |

**Special Notes:**

* This lesson only addresses a part of the NC.3.MD.3 standard.
* This lesson is one of a series that takes students through the PCAI (pose a question, collect data, represent data and data analysis, with some guided interpretation) model.
  + **In the first lesson, students decide on a question and collecting the data.**
  + In the second lesson, students represent the data on a scaled picture or bar graph.
  + In the third lesson, students writing questions based on graphs and answer classmates’ questions to analyze the data on their classmates’ graphs

**Possible Solutions:** Questions, data collection and frequency tables will vary.

**Activity Sheet Table 1 (optional)**

|  |  |  |  |
| --- | --- | --- | --- |
| Category 1 | Category 2 | Category 3 | Category 4 |
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**Frequency Table**

|  |  |
| --- | --- |
| **Category** | **Frequency** |
|  |  |
|  |  |
|  |  |
|  |  |

**Table 2 (optional)**

|  |  |  |
| --- | --- | --- |
| **Category** | **Tallies** | **Frequency** |
|  |  |  |
|  |  |  |
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**Graphing Data about Third Graders**

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| In this lesson, students work individually, in pairs, or in small groups to narrow down the categories of data from a frequency table to four or less (if necessary) and represent data from those frequency tables in scaled picture and/or bar graphs.  This is the second of a three-part lesson experience with data collection and the analysis process. The three lessons in this series stand alone, so it is not required that you do the first lesson, however, participation in all three provides a richer experience. |

**NC Mathematics Standard(s):**

**Measurement and Data**

**NC.3.MD.3** Represent and interpret scaled picture and bar graphs:

* ~~Collect data by asking a question that yields data in up to four categories.~~
* Make a representation of data and interpret data in a frequency table, scaled picture graph, and/or scaled bar graph with axes provided.
* ~~Solve one and two-step “how many more” and “how many less” problems using information from these graphs~~

**Standards for Mathematical Practice:**

4. Model with mathematics.

5. Use appropriate tools strategically.

**Student Outcomes:**

* I can make decisions about data on a frequency table to represent data a scaled picture or scaled bar graph with up to four categories.

**Math Language: What words do I expect students to talk about during this lesson?**

Data

Frequency Table

Scale

Picture Graph

Bar Graph

Category

Represent

**Materials:**

* Data from lesson NC.3.MD.3 part 1 – Posting Questions and Collecting Data OR frequency table from the end of this lesson
* Grid Paper, pencils
* Grid chart paper
* Markers

**Launch:**

1. Thinking About Graphs (10-12 minutes)

Show students the frequency table below. Ask, “Have you ever seen something like this? Where?” Students may have experience with taking a lunch count or food order (such as pizza orders). This is called a frequency table in mathematics.

**Third Graders’ Favorite Fruit for a Field Trip Snack**

|  |  |  |
| --- | --- | --- |
|  | **Tallies** | Total |
| Raspberries | **l** |  |
| Kiwi | **l** |  |
| Blueberries | **ll** |  |
| Red Delicious Apple | Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks |  |
| Pear | **ll**  **ll** |  |
| Grapes | Image result for tally marksImage result for tally marks  **l** |  |
| Banana | Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks |  |
| Orange | Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks  **lll** |  |
| Blackberries | **l** |  |
| Gala Apple | **ll** |  |

Ask:

* What do you notice about this frequency table? What do you wonder?

Record students’ noticings and wonderings. Students may notice that some fruits have very small numbers beside them (1), and others have larger numbers.

* What could have been the question that people were asked to generate this data?
* When we look at the frequency table, does the data answer the question, “What is the favorite fruit of third graders?”
* If we wanted to represent this on a bar graph, could we think about combining some of the fruits into a category so we don’t have to graph so many low numbers?
* If we created a new category, we could group the least popular fruits in that category. What could we call that category? (other) What fruits may be in that “other” category? (Raspberries, Kiwi, Blueberries, Pear, Grapes, Blackberries). Are there other categories we could combine? (We could group Red Delicious Apples and Gala Apples into one category called “Apples.)

Ask specific groups to determine the total number (based on the tallies in the first chart) in each category. Draw a Frequency Table draft on the board and ask students to help determine what should go in each cell. An example is below:

**Third Graders’ Favorite Fruit for a Field Trip Snack**

|  |  |
| --- | --- |
| Favorite Fruit | Frequency |
| Apple | 37 |
| Orange | 58 |
| Banana | 26 |
| Other | 19 |

Ask, “Which fruit is the favorite and which is least favorite? How do you know?” (Students may say the favorite fruit is oranges because it is the one with the highest frequency and the least favorite is bananas because it is the one with the one with the lowest frequency.)

When we collect data, it can be helpful to represent that information in a graph so we can find an answer to our questions, analyze the data, and make generalizations about it. Two graphs we can use to do this are picture graphs and bar graphs. Now you are going to construct graphs from data.

**Explore:**

1. Constructing Graphs From Our Data (35-40 minutes)

**There are two different scenarios for this part of the lesson:**

**Scenario 1 is for students who participated in Lesson 1 (Posing Questions and Collecting Data). These students will use the data they collected to create graphs.**

Earlier we generated questions that we wanted to collect and represent data so we could know the answer. Look at your data recording sheet. Does the data you collected answer your original question? Why or why not?

Since we collected data from a large number of students, we want to consider using a scaled graph to represent the larger numbers. What do we mean when we say “scaled” bar graph?

Discuss examples of scaled picture and bar graph. On a graph, we could use a scale of 2. How would we represent an odd number with a scale of 2? (Color ½ of a square since each box represents two).

If students have more than four categories, ask them to consider ways they could combine and/or group the categories into four or less (to meet the specifications of the standard).

Each group determines their scale and constructs a picture or bar graph to represent data. Students will graph their data in a bar graph or pictograph.

Observe:

* How students determine the number of categories they will represent on their bar or picture graph.
* How students determine and attend to scale.
* How students organize and represent their data on a graph.

**Scenerio 2 is for students who did not participate in Lesson 1 (Posing Questions and Collecting Data). These students will use the data included in the launch of this lesson (Third Graders’ Favorite Fruits) to create graphs.**

Since we collected data from a large number of students, we want to consider using a scaled graph to represent the larger numbers. What do we mean when we say “scaled” bar graph? Discuss examples of scaled picture and bar graph. On these graphs, we could use a scale of 2. How will we represent an odd number with a scale of 2? (by coloring ½ of a square since each box represents two).

Half of the class represents the data in a picture graph. The other half constructs a bar graph of the data. Each group determines their scale and constructs a picture or bar graph to represent data. Students use the data in the table provided at the end of the lesson or teachers can create data for each group to graph.

Observe:

* How students determine and attend to scale.
* How students organize and represent their data on a graph.

**Discuss:**

1. Discussing Our Graphs (10 minutes)

Bring the group back together and have each group of students share their strategies for determining their scale, limiting the number of categories (if needed) and graphing the data. Relate the task to the goal of making a representation of the data in a frequency table, scaled picture graph or scaled bar graph.

Possible points to address and questions to ask:

* What did you learn as you constructed your graph?
* What challenges did you encounter? How did you overcome those challenges?
* What did you consider as you determined the scale for your graph?
* How do you know if your graph accurately represents the data?

Questions specific to scenario 2:

* Why is the favorite and the least favorite fruit the same on the bar graph representation and the picture graph? (The same data set was used to construct both).
* Which fruit is the favorite if you use the bar graphs to compare them? (Oranges) Which fruit was the least favorite? (Other)
* Which is the favorite (least favorite) if you use the picture graph to compare them? (Oranges, Other)
* Why is the favorite and the least favorite fruit the same on the bar graph representation and the picture graph? (The same data set was used to construct both).

**Evaluation of Student Understanding**

Informal Evaluation:

Observe and monitor students as they work to represent data on graphs. How are they making sense of the task?

Formal Evaluation/Exit Ticket:

The completed graphs can serve as a formal evaluation.

**Meeting the Needs of the Range of Learners**

**Intervention:**

* Provide students with data sets that match their level.
* Assist with (provide scaffolding for) developing scale as necessary.
* Provide a template for creating a graph with the scale already provided.
* Give students stickers for constructing their picture graphs. Discuss how to accommodate numbers that fall within the scale range. (If the scale is 2, how would we represent 3?)

**Extension:**

* This lesson could be as structured or as open-ended and inquiry-based as the teacher prefers. Some teachers may want students to devise their own plans for constructing graphs entirely with little help with scale or structure.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| * Students may have no previous experiences with picture graphs or bar graphs; therefore, they may not be able to construct one. | * Show examples of picture graphs and bar graphs if students have no prior knowledge. Discuss how they represent data and how they are constructed. |
| * If allowing students to use their own data (from part 1), they may have many categories. This standard specifies up to four categories. | * Guide students on how they could combine like categories or create a group such as “other.” |
| * Students may not understand how to create a bar graph with a scale other than 1. | * Provide examples of bar graphs and picture graphs with a scale other than 1. Students may need guidance in choosing a scale for their numbers. How do we represent an odd number (say, 5) if our scale is even (say, 2)? |

**Special Notes:**

* The lesson series takes students through the PCAI (pose a question, collect data, represent data and data analysis, with some guided interpretation) model.
* The focus of the first lesson is deciding on a question and collecting the data.
* **The focus of the second lesson is representing the data on a scaled picture or bar graph.**
* The focus of the third lesson is on writing questions based on the graphs and answering their classmates’ questions to analyze the data on graphs their classmates constructed.

**Possible Solutions:**

Solutions will vary.

Possible data to use for Scenerio 2: You may use either of the tables below, or you may choose your own.

Third Graders’ Favorite Fruit for a Field Trip Snack

|  |  |
| --- | --- |
| Favorite Fruit | Frequency |
| Apple | 37 |
| Orange | 58 |
| Banana | 26 |
| Other | 19 |

**Third Graders’ Favorite Fruit for a Field Trip**

|  |  |  |
| --- | --- | --- |
| **Fruit** | **Frequency** | |
| **Tallies** | **Number** |
| **Apple** | Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks  **ll** |  |
| **Orange** | Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks  **lll** |  |
| **Banana** | **l**  Image result for tally marksImage result for tally marksImage result for tally marksImage result for tally marksImage result for tally marks  **llll** |  |
| **Other** | Image result for tally marksImage result for tally marksImage result for tally marks |  |

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| \_\_\_\_\_\_\_\_\_\_  (Category 1) | \_\_\_\_\_\_\_\_\_\_\_  (Category 2) | \_\_\_\_\_\_\_\_\_\_\_  (Category 3) | \_\_\_\_\_\_\_\_\_\_\_  (Category 4) |

**Analyzing Data about Third Graders**

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| In this lesson, student work individually, in pairs, or in small groups to construct one-step and two-step “how many more” and “how many fewer” questions from those graphs. They share their graphs and questions with classmates and analyze the data on classmates’ graphs as they solve the problems written for other (not their own) graphs.  This is the third of a three-part lesson experience with data collection and the analysis process. The three lessons in this series stand alone, so it is not required that you do the first or second lessons, however, participation in all three provides a richer experience. |

**NC Mathematics Standard(s):**

**Measurement and Data**

**NC.3.MD.3** ~~Represent and~~ interpret scaled picture and bar graphs:

* ~~Collect data by asking a question that yields data in up to four categories.~~
* ~~Make a representation of data and interpret data in a frequency table, scaled picture graph, and/or scaled bar graph with axes provided.~~
* Solve one and two-step “how many more” and “how many less” problems using information from these graphs

**Additional/Supporting Standards:**

**Operations and Algebraic Thinking**

**NC.3.OA.8** Solve two-step word problems using addition, subtraction, and multiplication, representing problems using equations with a symbol for the unknown number.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

**Student Outcomes:**

* I can write one and two-step how many more and how many less questions based on a graph.
* I can analyze information provided on a graph to answer one and two-step how many more and how many less questions.

**Math Language: What words or phrases do I expect students to talk about during this lesson?**

Scale, Picture Graph, Bar Graph, Category, Represent, How many fewer?, How many more?

**Materials:**

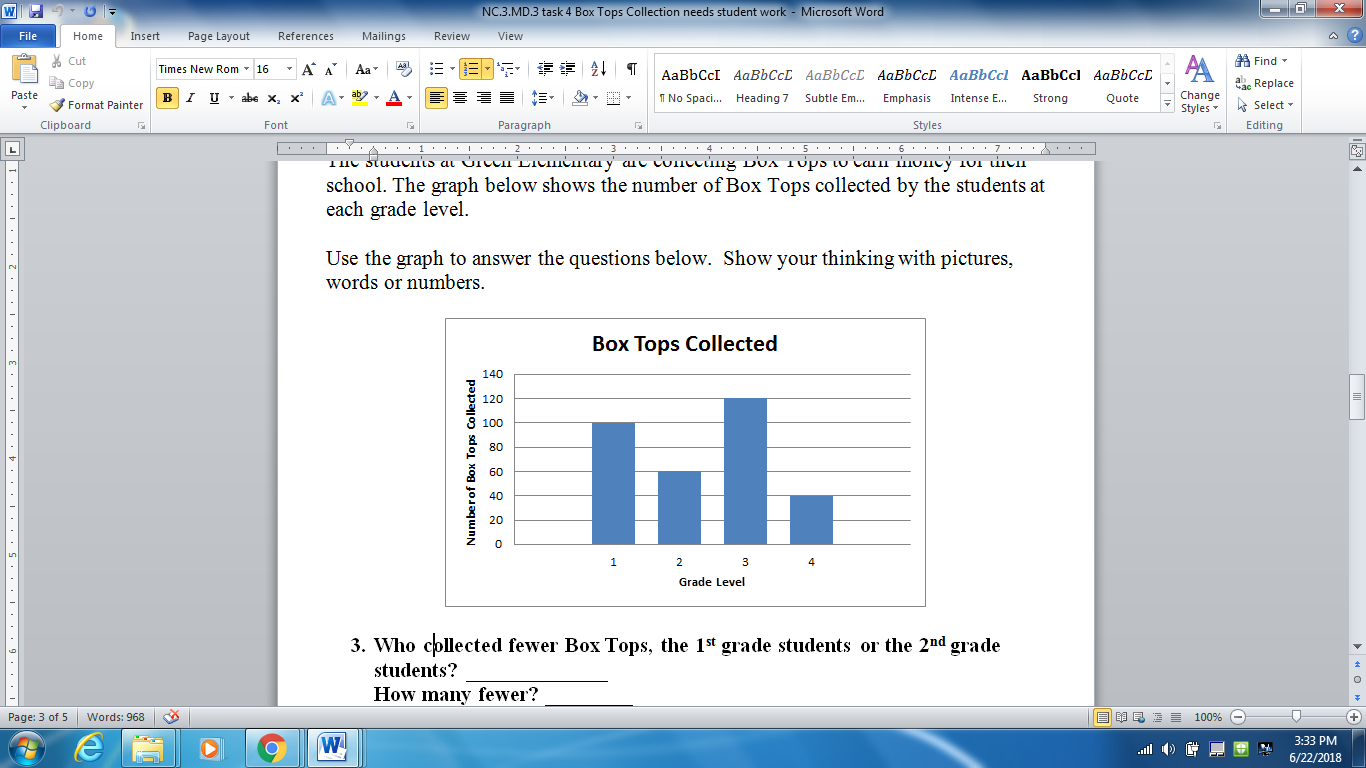
* Paper, pencils, post-it notes

**Launch:**

1. Analyzing Bar Graphs (5-7 minutes)

Present Problem:

Teachers show images of bar graphs (such as the one below) without labels and ask, “What do you notice? What do you wonder?”



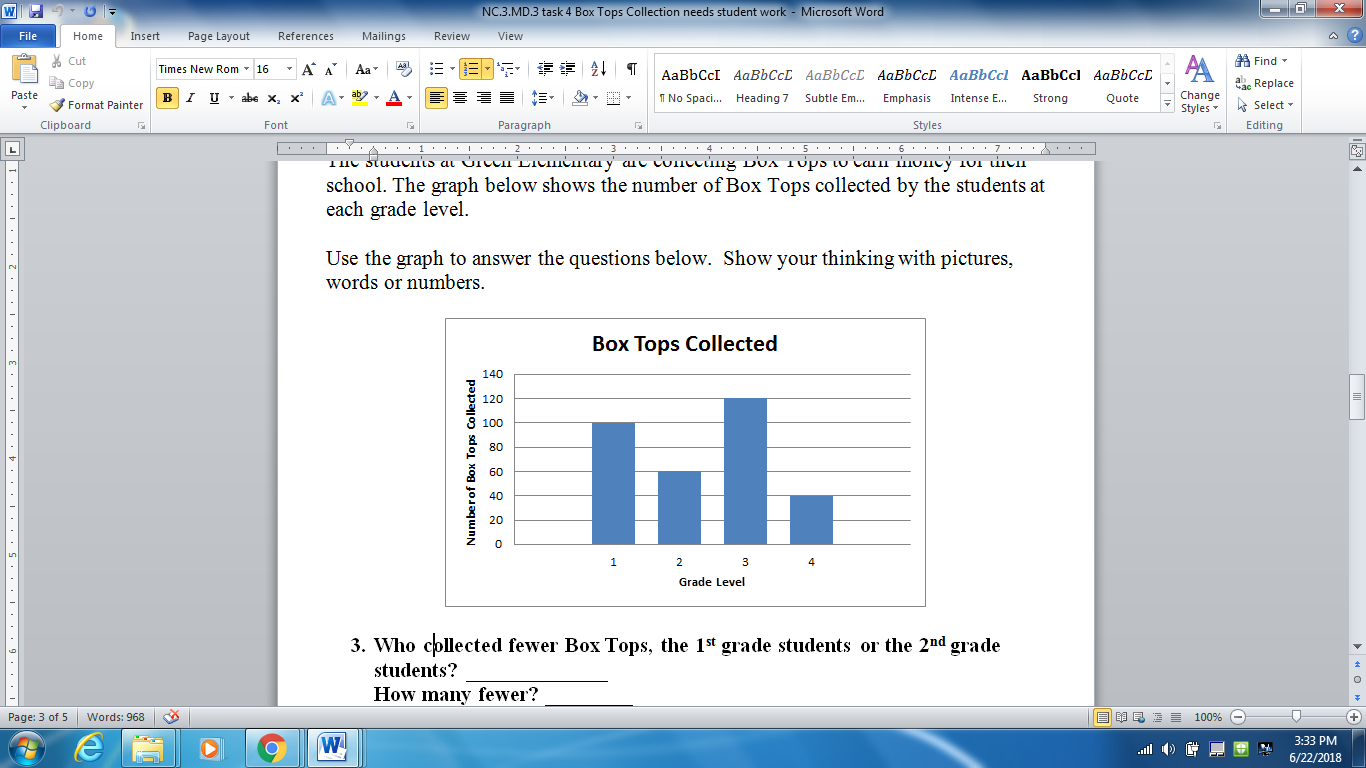
Students may notice:

* There are four bars. Ask: “*What could those bars represent?”*
* Some bars are taller than others. Ask: “*What does that mean?”*
* The third bar is the tallest. Ask: “*What does that mean?”*
* The fourth bar is the shortest? Ask: “*What does that mean?”*
* There’s no title. Ask: “*There’s some information missing, isn’t there? What could a title be?”*

Today we will write questions about graphs to analyze the information they represent.

Show the next graph:

Third Graders’ Favorite Fruit



What questions could we generate from the graph above?

* *Which bar represents the most? What does that mean? Students should recognize that the favorite fruit has the highest bar on a bar graph.*
* *Which bar represents the least? What does that mean?*
* *How can we interpret the data? We can use the data to help answer these questions.*
* *How many more are represented in bar 1 than in bar 2?*
* *If the scale is 5, how many are represented in the first bar? …second? …third? …fourth?*

If students stick questions that require only one-step, suggest some that would require two steps, such as: *How many made choices represented by bar 1 and bar 2 combined? Is that more or less than the number whose choices are represented in bar 3?*

Say, *“Today you will (individually, in pairs, or in a group) construct one and two-step questions you could ask your classmates about the information presented in your graph (either the one you created or the one provided by the teacher).”*

**Explore:**

1. Create Questions to Analyze Graphs (15-20 minutes)

* Individually, with partners or in groups, students brainstorm a list of one step and two-step questions based on their graph (graphs they created in the “Graphing Data About Third Graders” Tools for Teachers lesson or in a graph provided by the teacher if students did not participate in that lesson).
* Students write at least two questions (a one-step problem and a two-step problem) for their graph. They write each question on a post-it note and stick it to the graph. They write the answer to their question on the back of the post-it note.
* Display the graphs and questions (or placed on desks) around the room.
* Students rotate to at least two different graphs and use the information on the graph to solve the corresponding questions written by their classmates. Students check their answers by checking on the back of the post-it note.
* If they have questions about the questions or graphs their classmates constructed or if they find mistakes as they work,
* Students write another question (with the answer on the back) for each graph on a separate post-it note and put on the graph.
* Students may also record questions for the graph creators about the graphs their classmates constructed (or corrections if they find a mistake as they work) on a separate post-it note and leave them with the graph.

As students work, observe:

* How students make sense of the graphs.
* How students use information on the graph to answer the questions.
* How students attend to and make use of scale.
* The different representations used to solve the same question.
* If students correctly solve the one and two-step questions written by their peers.
* Carefully select students to present their graphs and the questions on the post-it notes to the class. Look for strategies or approaches that will generate discussion to help others move toward a deeper understanding of the mathematical goal. Look for students who solved problems with manipulatives, drawings, number lines, and or symbolic notation to share. Encourage students to make connections between the representations.

**Discuss:**

1. Discussion (8-10 minutes)

Bring the group back together and have selected students share their strategies for solving the one and two-step problems. For example, if one student used an open number line to solve an addition problem and another student used an equation, discuss how those two representations are similar and different.

Ask:

* *What did you learn from this activity today?*
* *What was easy about it?*
* *What was difficult? When you encountered an obstacle, what did you do? How did you persevere with solving the problem?*

**Evaluation of Student Understanding**

Informal Evaluation:

Observe and monitor students as they work to devise questions and collect data. How are they making sense of the task?

Formal Evaluation/Exit Ticket:

Student solutions to the questions serve as a formal evaluation.

**Meeting the Needs of the Range of Learners**

**Intervention:**

Some students may need extra support with solving two-step problems. Careful grouping of students is suggested to help assist students who need more support. Some students may benefit from having manipulatives available to use to answer the questions. Other students may benefit from a teacher suggestion about which tools may be helpful as we solve these addition and subtraction problems. Teachers may wish to provide teachers with a scale of 1 or 2 for students who

**Extension:**

Students who need more of a challenge would probably benefit from less structure of this lesson.

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
|  |  |

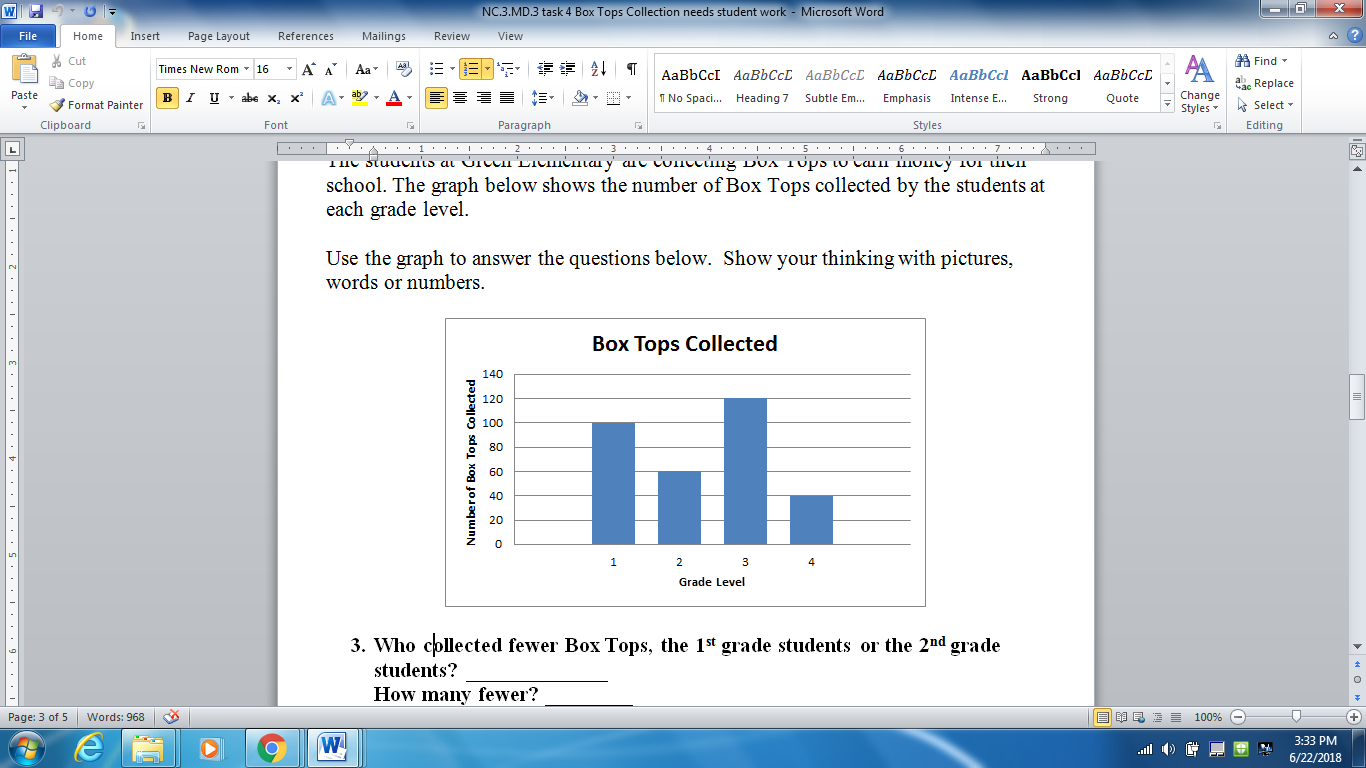
**Special Notes:**

The lesson series takes students through the PCAI (pose a question, collect data, represent data and data analysis, with some guided interpretation) model:

* The focus of the first lesson is deciding on a question and collecting the data.
* The focus of the second lesson is representing the data on a scaled picture or bar graph.
* **The focus of the third lesson is on writing questions based on the graphs and answering their classmates’ questions to analyze the data on graphs their classmates constructed.**

**Possible Solutions:** Answers will vary.

**Activity Sheet**



**What do you notice? What do you wonder?**

What could the bars represent?

Why are some bars taller than others?

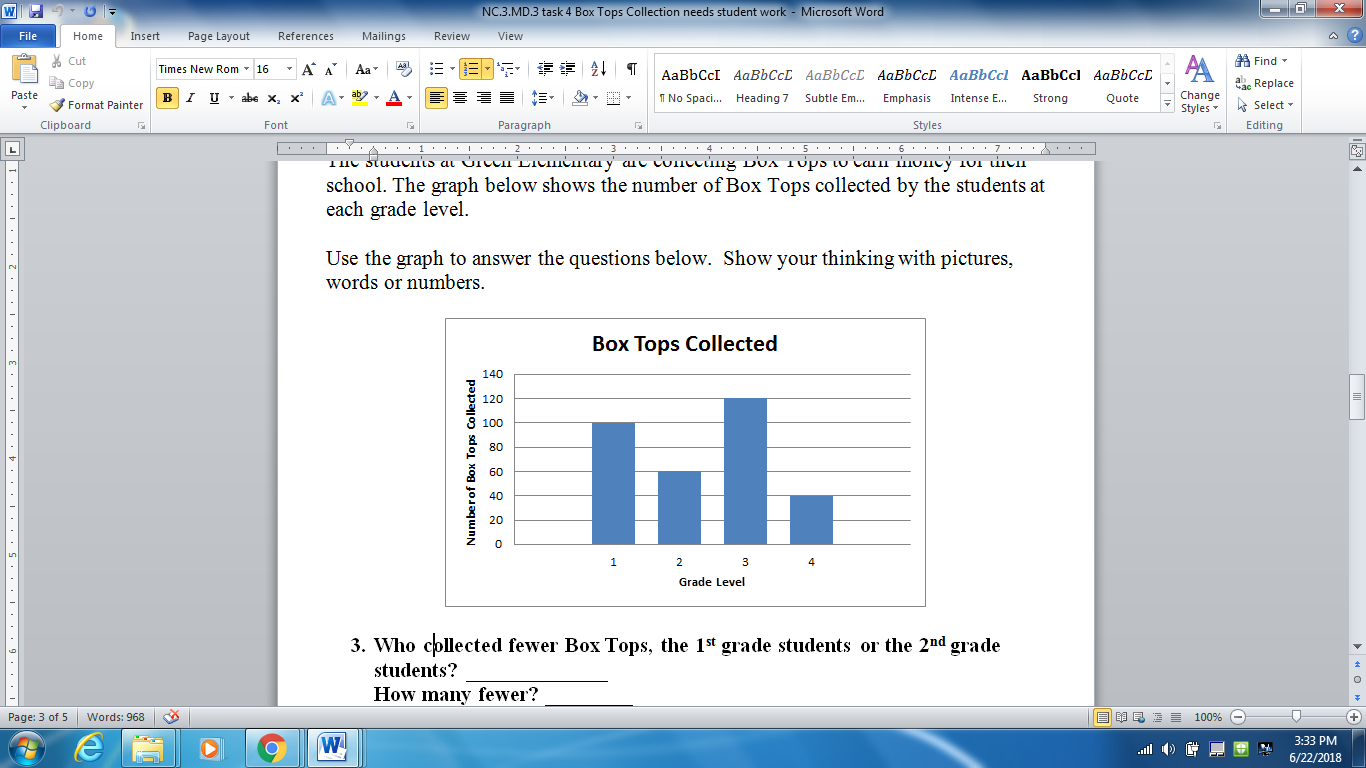
Which bar is the tallest? What does that mean?

Which bar is the shortest? What does that mean?

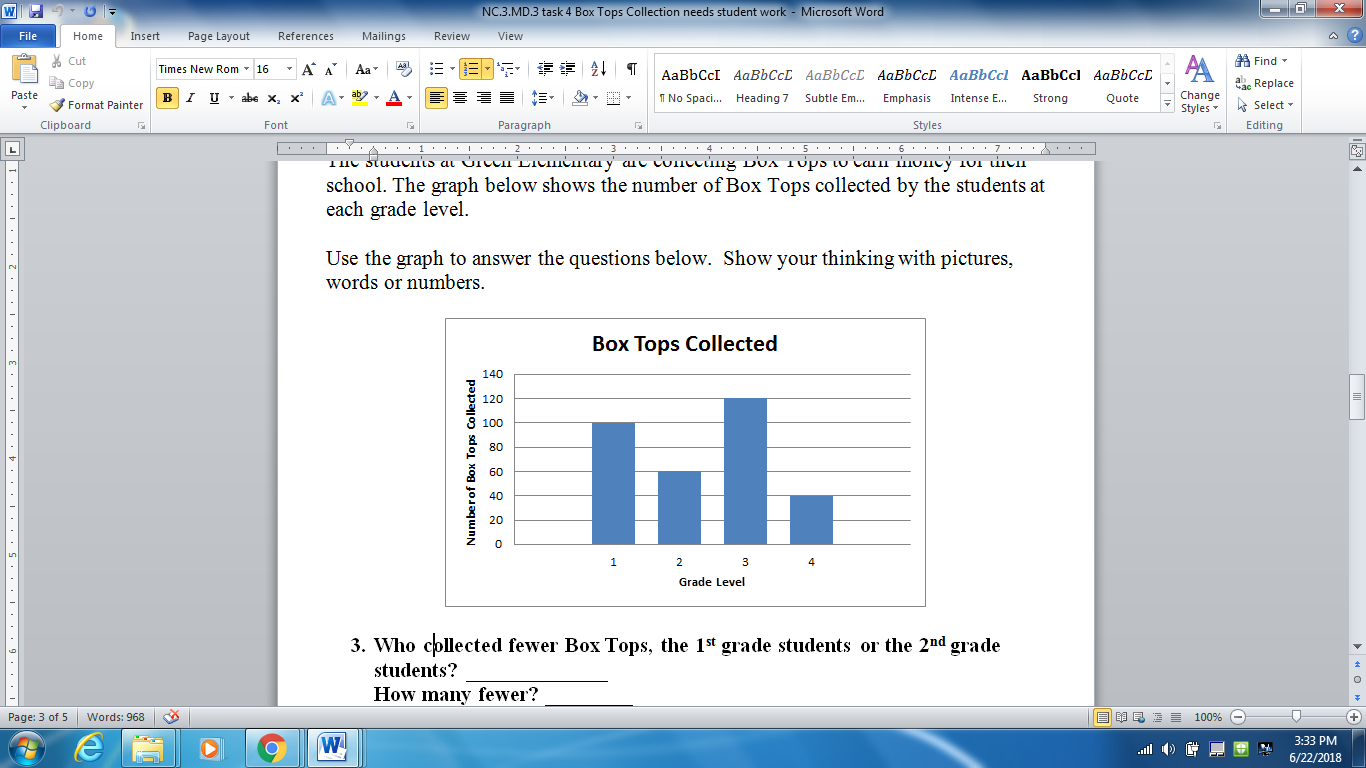
What information is missing from this graph?

What could a title be?”

Third Graders’ Favorite Fruit



Third Graders’ Favorite Fruit



Category 1