

Grade 4: Collecting, Organizing, and Representing Data - Multiple-Bar Graphs

Too Much Gaming!

(Adapted from Grade 4 Learning Activity: Too Much TV - “Guide to Effective Instruction: Data Management”)

Big Idea	Curriculum expectations
Collection and organization of data; data relationships ***Students will need experience analyzing different types of graphs (including stem-and-leaf plots and multiple bar graphs) and finding the mean, median, and mode using sets of data before engaging in this multi-day lesson.	D1.3 select from among a variety of graphs, including multiple-bar graphs, the type of graph best suited to represent various sets of data; display the data in the graphs with proper sources, titles, and labels, and appropriate scales; and justify their choice of graphs C4 apply the process of mathematical modelling to represent, analyse, make predictions, and provide insight into real-life situations
Learning Goals	Success Criteria
Students will: - Collect data by conducting a survey or experiment to do with themselves, their environment, and record observations and measurements - Collect and organize discrete primary data and display data using charts and graphs, including step-and-leaf plots and double bar graphs. - Read, interpret, and draw conclusions from primary data and from secondary data - SEL: Represent math concepts in meaningful ways (pictures, tools, graphs, charts, words, symbols, etc.)	- I can conduct a survey to collect data. - I can organize data into graphs (stem-and-leaf plot and multiple bar graphs). - I can look closely at the data and compare similarities and differences between data sets. - I can organize my thinking (using patterns, charts, graphs, diagrams, etc.)
Materials	Math Language / Vocabulary
Video Game Statistics: https://www.statista.com/outlook/203/108/video-games/canada#market-arpu	- Collect - Organize - Graph

[Anticipation Guide](#)

[Gaming Habits Parent Communication Letter](#)

[Rubric](#)

SEL Self-Assessments (French and [English](#)) and [Teacher Rubric](#)

- Data
- Survey
- Table
- Primary Data
- Secondary Data
- Median
- Stem-and-leaf Plot
- Double Bar Graph / Multiple Bar Graph
- Mode

Prior Knowledge

KEY CONCEPTS:

- Multiple bar graphs show comparisons. They have bars in which data sets are shown side by side to compare two aspects of the data.

GLOSSARY

double bar graph

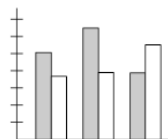
See multiple-bar graph.



GLOSSARY

multiple-bar graph

A graph that combines two or more bar graphs to compare two or more aspects of the data in related contexts; for example, comparing the type of pet that students in different grades have. A graph that compares two sets of data is called a *double bar graph* or a *comparative bar graph*.



- Multiple bar graphs can be created in more than one way, including with horizontal and vertical bars.
- The source, titles, labels, and scales provide important information about the data in a graph or table:
 - The source indicates where the data was collected.
 - The title introduces the data shown in the graph or table.
 - Labels provide additional information, such as the labels on the axes of a graph describe what is being measured (the variable).
 - Scales are indicated on the axis showing frequencies in bar graphs and in the key of pictographs.
- The numerical values of the frequencies need to be considered when a scale is chosen.

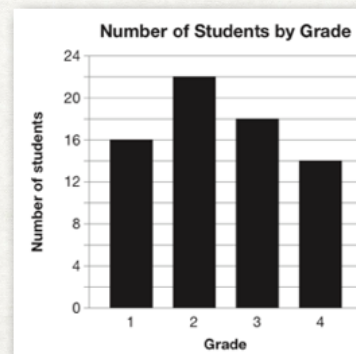
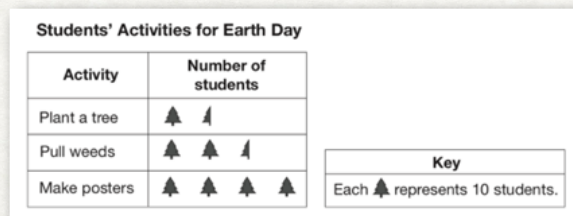
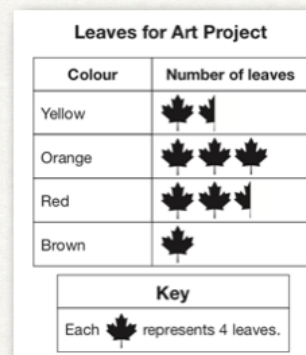
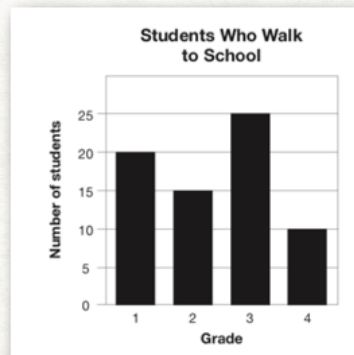
- Depending on the scale that is chosen, the length of the bars on a bar graph may need to be estimated.

Number Talk

Which One Doesn't Belong?

WHICH ONE DOESN'T BELONG?

WHY DO YOU THINK SO?



Minds On

Tell students that you have just read an article that discusses the positive and negative effects that gaming has on children. You are wondering how many hours students in your school spend time playing video games each week. Ask students to predict that following:

- How many hours do you spend time gaming each week?
- What is the average for our class?
- Will our class average be different from averages for students in lower grades or higher grades? How? Why?

Facilitate a sharing of ideas and reasons.

Explore the video games statistics at the following link: <https://www.statista.com/outlook/203/108/video-games/canada#market-arpu>. Tell students that they will be conducting a survey of their schoolmates to determine how much time they spend gaming and whether there are differences between grades. Before they conduct this survey, students will collect data from their own class.

Action!

Pose the problem:

“Does the amount of time students spend gaming weekly increase, decrease, or stay the same as they move up through the grades in our school?”

Designing the Survey

Ask students to design the survey they will use to collect the data they need to answer this question.

Students may encounter the following difficulties when designing their survey:

- Times may be reported in different and incompatible formats, such as 10.5 hours, 10 ½ hours, 630 minutes.
- If they pose a question such as “How much time do you spend gaming in a week?” answers might be qualitative (a lot, too much, I don’t know).
- If times are unspecified, some responses might cover only weekdays while others might reflect gaming time over a seven-day week,

Students need to experience these difficulties first hand and work through the “messiness” of fine-tuning questions in order to collect the data they need. Guiding them through the experience, rather than giving them prepared questions that will avoid these pitfalls, will result in more enduring learning. Have students survey their classmates first. This experience will help them prepare and hone the question that they will use to survey the rest of the school. Students can visit this webpage to help them explore/practice questioning when conducting a survey:

<https://www.mathsisfun.com/data/survey-questionnaire.html>.

Collecting the Data

Start by having students track the amount of time they themselves spend gaming in a week. Then ask students to work with a partner and design a survey to collect data on the amount of time each of their classmates spent gaming in that week. In addition to the survey question or questions, have the partners decide on the instrument they will use to gather the data. They could consider a class list or a table. At the end of the week, set aside 20-30 minutes to let students survey their classmates.

After each pair of students has gathered information on all classmates, including themselves, lead a discussion on the process of collecting the data, on the difficulties encountered, and on lessons learned. Ask partners to refine their question.

Lead a class discussion to decide upon the question and data collection tool to be used to survey other students in the school. To keep the data manageable, divide the class into groups of 4 to 6 students and have each group survey students in one other class.

Arrange the class to do a survey of one class per grade between Kindergarten and Grade 6 (including their own class) or of size classes if the school has many combined classes.

*****Distance Learning students can survey other Distance Learning classes/grades within the board. They could create a Google form and share the link with other Distance Learning teachers/classes.**

Analyzing the Data

Ask students to create a stem-and-leaf plot. Ask the following questions to help focus discussion and promote higher-level thinking:

- *What is the general shape of the data?*
- *How is the data spread out? Are there many clusters? Are there unusually high or low values?*
- *What is the mode in this set of data? How did you find it? What does the mode tell us?*
- *What is the median in this set of data? How did you find it? What does the median tell us?*
- *What is the range of values your group thinks is typical?*
- *What can you say about the number of hours you yourself spend gaming in a week? Are the hours similar to those of most of your classmates?*
- *Will the number of hours that students spend time gaming decrease, increase, or stay the same as they get older? What is your group's prediction?*

Answering the Question

To determine whether students spend more time gaming as they grow older, it is necessary for students to compare two sets of data. The mode and median can be used as comparators. Have groups organize the collected information on a separate bar graph for each grade. They can compare Kindergarten data with Grade 6 data, Grade 1 Data with Grade 2 data, and so on, by creating multiple-bar graphs in which two sets of data are shown side by side. Use the following starter questions to help them explore the relationship in the data:

- *Which graph, a stem-and-leaf plot or a multiple bar graph, is most useful in representing and analyzing the data you collected?*
- *According to your group's predictions, which age group spends the most time gaming?*
- *Which age group games the most per week? Which games the least?*
- *Does the number of hours significantly change from one grade to the next?*

- *If there is an increase or a decrease, is it steady and constant or does the number of hours move up and down across the grades?*
- *From the data we have collected, can you predict how many hours a typical Grade 8 student would spend gaming in a week?*

During this time, circulate among the groups and listen to their discussions. Ask more probing questions or lead students back to simpler ideas where necessary.

Consolidation

Reconvene the class. Ask the groups to share their findings with one another. Discuss the relative usefulness of the measures of central tendency for this situation (for example, although the mode might be useful if the data are limited to whole hours, it is not useful if fractions or minutes are used).

Pose the following questions to students:

- *Did the data support your predictions?*
- *What trends did your group observe when you compared the various class data?*
- *Which was more useful to you in determining trends: the mode or the median? Why?*
- *What reasons can you give to explain the shape of the data?*
- *Would you expect the data you have collected to be representative of other schools in our community? Across Ontario? Across Canada? Around the World? → This could possibly lead to an extension by going to: <https://censusatschool.ca> and creating a class project.*

Independent Tasks / Assessment Opportunities

Observation:

Observation and discussion guided by key questions can provide a good sense of student understanding. Consider the following:

- Can students collect, organize, and display primary data using a variety of graphs, including stem-and-leaf plots and multiple bar graphs?
- Can students distinguish among methods of data organization?
- Can students describe similarities and differences between two sets of data?
- Can students choose appropriate scales to display the range of data?
- Can students describe the shape of a set of data, using mathematical vocabulary?
- Can students read, interpret, and draw conclusions from primary and secondary data?
- Can students use a variety of tools to present data graphically?
- Can students find the median in a set of data?
- Can students compare the median and mode and explain the information these measures provide?
- Can students explain the stability of the median? In other words, what effect do extreme values in a set of data have on the median?

Performance Tasks:

The following are some possible assessment tasks for students:

- Using a set of data provided, represent the data graphically, using a stem-and-leaf plot, a multiple bar graph, and one other graph of your choice. Explain which graphic representation would be most appropriate and why.
- Using multiple sets of data, calculate the median and mode and explain what information these measures give up
- Using one set of data, manipulate the data to change the median, and describe the effect this change has on the mode and median.

[Rubric](#)

SEL Self-Assessments (French and [English](#)) and [Teacher Rubric](#)

Extension Activities

Ask students to use the collected data to answer the following non-mathematical questions:

- *What factors may affect the amount of time various age groups spend time gaming in a week?*
- *What possible positive and negative effects might gaming have on a student's health and fitness? General knowledge? Contact with family members? Involvement in other activities? Homework completion? Consumer habits? Contact with friends?*
- *Considering the data you collected, the research you did, and the answers you gave to the previous question, do you feel that you, your classmates, and/or your schoolmates spend too much time gaming? If so, what steps would you like to take to communicate that message? If you don't think you spend too much time gaming, how could you encourage those who do to change their habits?*

Advertising Campaign: Have the class design an advertising campaign to encourage classmates and schoolmates to spend less time gaming and be more physically active in their leisure time. Ask students to present arguments in their campaign that will make sense and be convincing, and to use the data they have collected to support their arguments. (Could use: iMovie, Keynote, Pages / Possible cross-curricular connections to Health, Oral Language, Art)

Surveying Adults: As a follow-up activity, students can survey adults in their own home and adults among family and friends to find out how many hours they spend gaming in a week. Students can organize and graph the results and ultimately compare them with the data collected from students of various age groups. Focus in-class discussions on whether the trends observed in the original data still hold true when survey results from adults are examined and compared with student survey results.

Exploring the Median: To extend the lesson, give students a number and identify it as the median from a set of data. Explain that their task is to describe what the values in the set might look like. Tell them that the set must have at least 10 values and that no value can be repeated. Students can choose to have an odd or an even number of values in the set. The same task can be set using the mode.

Change Over Time?: Ask students to collect data again after one month (using the same question) and compare the original set of data with the

new set. In a follow-up discussion, ask students to use the data to determine whether their advertising campaign has been successful.

Infographic Lesson Plan: (See link to Summative lesson plan)

https://docs.google.com/document/d/1PKBM8puFfg6UDmHWQaeR6L9tpk-S9eO_s2kXRr-VloE/edit?usp=sharing

Technology



iMovie



Keynote



Pages



Google Forms