GRADE 5 MATHEMATICS

Statistics and Probability

Grade 5: Statistics and Probability (Data Analysis) (5.SP.1, 5.SP.2)

Enduring Understandings:

Graphs are a way of organizing, representing, and communicating information.

General Outcome:

Collect, display, and analyze data to solve problems.

Specific Learning Outcome(s):	Achievement Indicators:
5.SP.1 Differentiate between first-hand and second-hand data. [C, R, T, V]	➛ Explain the difference between first-hand and second-hand data. ➛ Formulate a question that can best be answered using first-hand data and explain why. ➛ Formulate a question that can best be answered using second-hand data and explain why. ➛ Find examples of second-hand data in print and electronic media, such as newspapers, magazines, and the Internet.
5.SP.2 Construct and interpret double bar graphs to draw conclusions. [C, PS, R, T, V]	➛ Determine the attributes (title, axes, intervals, and legend) of double bar graphs by comparing a set of double bar graphs. ➛ Represent a set of data by creating a double bar graph, label the title and axes, and create a legend with or without the use of technology. ➛ Draw conclusions from a given double bar graph to answer questions. ➛ Provide examples of double bar graphs used in a variety of print and electronic media, such as newspapers, magazines, and the Internet. ➛ Solve a problem by constructing and interpreting a double bar graph.

Prior Knowledge

Students may have had experience with the following:

- Collecting first-hand data and organizing it using tally marks, line plots, charts, and lists
- Constructing and interpreting bar graphs and pictographs involving many-to-one correspondence to draw conclusions
- Classifying objects or items into groups
- Making reasonable estimates of quantities
- Demonstrating an understanding of kilograms and grams
- Describing and representing decimals to hundredths

Related Knowledge

Students should be introduced to the following:

- Representing and describing whole numbers to 1 000 000

Background Information

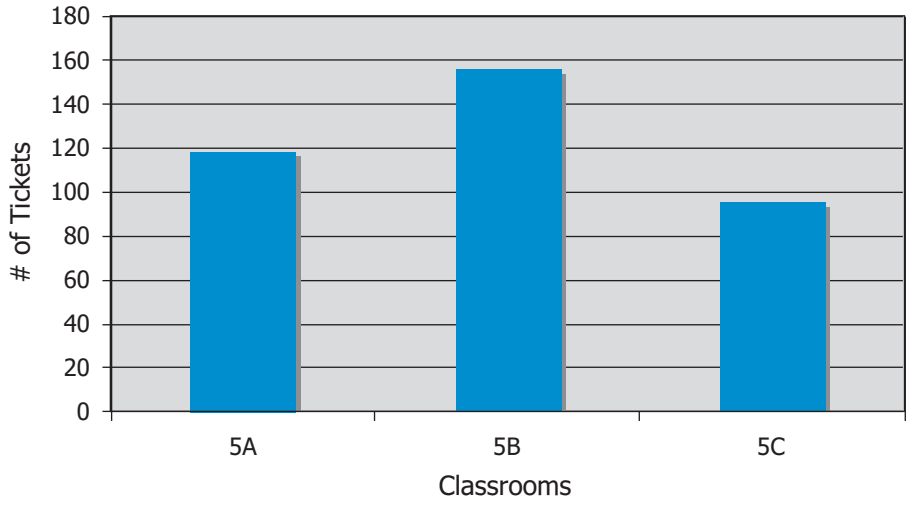
Graphs are visual displays of data that provide an overall picture of the information that has been collected. There are many types of graphs, the most common of which are bar graphs, line graphs, circle graphs, and pictographs. Before students can decide on which graph to use, they need to know what type of data have been collected. More specifically, the data that they collect can be either discrete or continuous. **Discrete data** involve observations that are separate and distinct and that can be counted. Shoe sizes, the number of students assigned to each classroom in a school, and the animals on a farm are all examples of discrete data. **Continuous data** involve observations that can take on many values within a finite or infinite interval. Height, temperature, and age are examples of continuous data. Bar graphs, circle graphs, and pictographs are used to illustrate discrete data. Line graphs are used to illustrate continuous data. In addition, students need to be aware of the advantages and disadvantages of using each type of graph. This will enable them to select an appropriate graph for their data and to defend their choices.

The data that students collect and display can be either first-hand or second-hand. **First-hand data** provide information that an individual obtains directly by asking questions, measuring, observing, or experimenting. Asking Grade 6 students what their favourite CD is, or observing the number of times the copy machine is used in a day, are examples of first-hand data. **Second-hand data** provide information that is readily available and only needs to be extracted from sources such as newspapers, electronic media, magazines, almanacs, and journals. Using a company's records to obtain information about the number of sales over a five-year period, and using census data to find information about Canadian households, are examples of second-hand data.

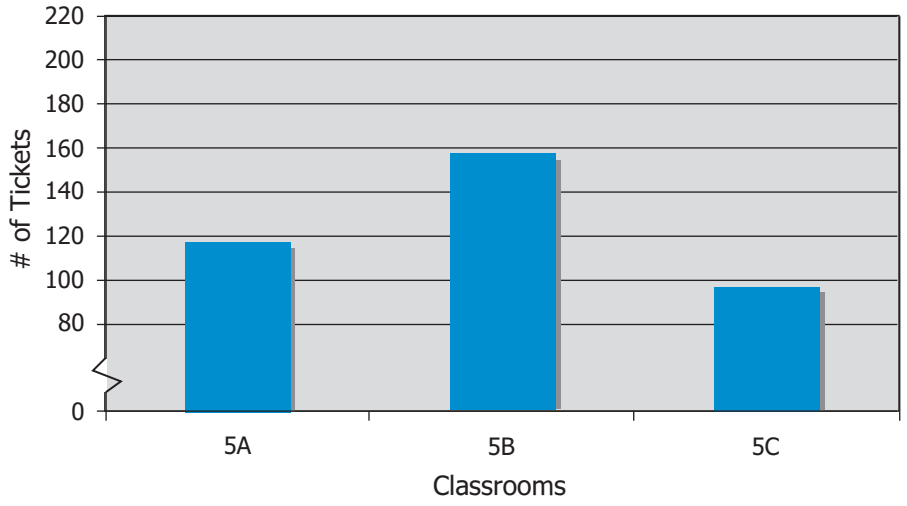
All graphs should have a title, labels, and neat and concise entry of data. When graphs show increments, those increments should start at 0, be of equal size, and be numbered. **The axes**—the horizontal and vertical line segments that divide the coordinate plane into quadrants—must also be labelled.

Bar graphs compare the frequency of discrete data. Data are displayed using a number of rectangles (bars) that are the same width. Each bar represents one of the categories that the data have been sorted into. The bars are displayed either horizontally or vertically with a space between them. The height (or length) of a bar represents the number of observations in that category. The numbers on the *y*-axis of a vertical bar graph or the *x*-axis of horizontal bar graph are called the scale. Sometimes a bar graph will have a squiggle in its scale. This means that part of the scale has been omitted. However, the use of a squiggle tends to give a misleading visual picture (see Graph 2 below).

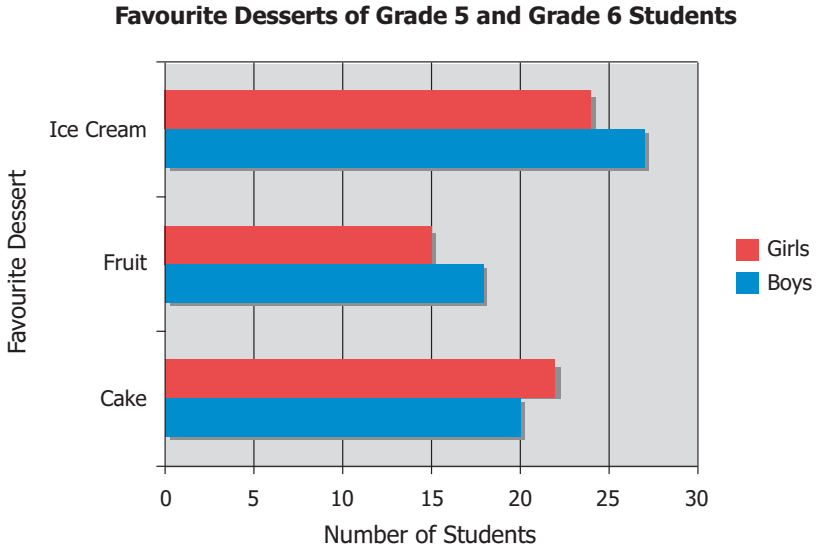
Number of Raffle Tickets Sold by Grade 5 Students (Graph 1)



Number of Raffle Tickets Sold by Grade 5 Students (Graph 2)



Double bar graphs are used to make comparisons between and among sets of data (e.g., the double bar graph shown below compares the desserts favoured by boys with the desserts favoured by girls).



In addition to knowing the different types of graphs and how to construct them, students need to know how to read and interpret them. Curcio (2001) identifies three levels of graph comprehension: reading the data, reading between the data, and reading beyond the data.

Note: The Statistics Canada Website at <www.statcan.gc.ca> is an excellent source of second-hand data.

- **Reading the Data**

  This level of comprehension requires a literal reading of the graph. The reader simply "lifts" data explicitly stated in the graph, or the information found in the graph title and axes labels, from the graph. There is no interpretation at this level. Reading that requires this type of comprehension is a very low-level cognitive task.

- **Reading between the Data**

  This level of comprehension includes the interpretation and integration of the data in the graph. It requires the ability to compare quantities (e.g., greater than, tallest, smallest) and the use of other mathematical concepts and skills (e.g., addition, subtraction, multiplication, division) that allow the reader to combine and integrate data and identify the mathematical relationships expressed in the graph.

- **Reading beyond the Data**

  This level of comprehension requires the reader to predict or infer from the data by tapping existing schemata (i.e., background knowledge, knowledge in memory) for information that is neither explicitly nor implicitly stated in the graph. Whereas reading between the data might require the reader to make an inference that is based on the data presented in the graph, reading beyond the data requires that the inference be made on the basis of information in the reader's head, not in the graph.

Mathematical Language

Bar graph	Interval
Data	Legend
Double bar graph	Scale
Estimate	Second-hand data
First-hand data	Vertical axis
Horizontal axis	

Learning Experiences

Assessing Prior Knowledge

Materials: Graph paper, BLM 5.SP.1&2.1, markers or crayons, straight edge

Organization: Individual/Whole class

Procedure:

a) Have students complete the activity shown below (BLM 5.SP.1&2). Let them know that the purpose of the activity is to find out what they know about bar graphs.

1. Louis is doing a project on animals. He found that animals have different heart rates (e.g., he found that a cow has a heart rate of 60 to 80 beats per minute). Here are some of the heart rates he found.

Cow	60 to 80	Cat	110 to 140
Horse	30 to 40	Chicken	300 to 350
Rabbit	140 to 160	Sheep	70 to 140

   Make a bar graph of the highest heart rate of each animal.

2. Study your graph. List three conclusions you can draw from it.
3. If you added the heart rate of a mouse to your graph, which animals do you think would have a slower heart rate than the mouse? Explain your answer.

b) Have students share their graph and conclusions with the rest of the class.

Observation Checklist

Use the following checklist to assess students' knowledge of bar graphs.

Makes a Bar Graph that Includes	Yes	No	Comments
A title			
Category labels			
A label for each axis			
Bars whose lengths correctly represent the number of observations in each category			
Bars the same width			
Spaces between bars			
An appropriate scale with equal increments that starts at zero			
An interpretation of bar graphs			
Reading between the data (Question 2)			
Reading beyond the data (Question 3)			

- **Explain the difference between first-hand and second-hand data.**
- **Formulate a question that can best be answered using first-hand data and explain why.**
- **Formulate a question that can best be answered using second-hand data and explain why.**
- **Represent a set of data by creating a double bar graph, label the title and axes, and create a legend with or without the use of technology.**

Materials: BLM 5.SP.1&2.2, two bar graphs, one illustrating first-hand data and one illustrating second-hand data, math journal

Organization: Pairs/Whole class

Procedure:

a) Tell students that in the next few lessons they will be doing some graphing. Explain that graphs are a quick and easy way to illustrate information. Ask students what a bar graph is and where they have seen one.

b) Show students the two bar graphs and have them discuss how they are alike and how they differ. Encourage students to think about how the information in the graphs was obtained.

c) Tell students that each of the following statements represents information that can be graphed. Have them sort the statements into two groups in as many ways as they can and to record their findings (BLM 5.SP.1&2.2).

- Names of the highest mountains in North America
- Students in the class who have pets
- The won/lost record of the Winnipeg Goldeyes
- The makes of cars parked in a shopping centre parking lot
- The sum of the numbers rolled when two dice are thrown
- The population of Canadian provinces
- The number of people who have immigrated to Manitoba
- How far students in Grade 7 can throw a softball
- The number of cm a plant grows over a five-week period
- The number of houses sold in Winnipeg last year

c) Have students share their classifications with the other members of the class.

d) Explain that information we collect ourselves is called first-hand data, and information that we get from other sources, such as newspapers, magazines or the Internet, is called second-hand data. Have students decide which statements are examples of first-hand data and which are second-hand data.

e) Introduce the never-ending graphing project. Tell students that they will be making a book of graphs. Each week, they will be making a graph that organizes information they have collected about themselves, their community, or any other topic of interest. Ask students what they would like to know about their classmates and their community. Make a list of their questions and have students determine which questions are best answered with first-hand data and which are best answered with second-hand data.

Note: Questions can be added to the list throughout the year. Each time a new question is added, students should discuss whether the question is best answered with first- or second-hand data. The graphing activities can be integrated into other subject areas (e.g., in language arts, students could make a graph illustrating the number of books they have read, and in science they can make a graph comparing distances different-sized balloons travel in a jet expulsion experiment. Also, the activities should be structured so students have opportunities to practice creating and interpreting different types of graphs [pictographs, bar graphs, and double bar graphs].).

f) Have students answer the following questions in their math journals. Encourage students to give examples that have not been discussed in class.

- "What are two examples of first-hand data"
- "What are two examples of second-hand data?"
- "What is the difference between first- and second-hand data?"

Observation Checklist

Examine students' responses to determine whether they can do the following:

- ❑ formulate a question that is best answered with first-hand data and explain why
- ❑ formulate a question that is best answered with second-hand data and explain why
- ❑ provide examples of first-hand data
- ❑ provide examples of second-hand data
- ❑ explain the difference between first- and second-hand data

- **Explain the difference between first-hand and second-hand data.**
- **Represent a set of data by creating a double bar graph, label the title and axes, and create a legend with or without the use of technology.**
- **Solve a problem by constructing and interpreting a double bar graph.**

Materials: Graph paper, markers, pink and yellow sticky notes

Organization: Whole class

Procedure:

a) Select one question that students have about their classmates (e.g., "What is your favourite pizza topping?"). Have students identify three different toppings (e.g., pepperoni, mushrooms, and sausage).

b) Have the girls record their favourite topping on the yellow sticky notes and the boys on the pink sticky notes. Write pepperoni, mushrooms, and sausage on the board and have students place their sticky notes under the appropriate heading and find the total number of students in each category.

c) Have students make a bar graph illustrating their favourite pizza topping and write a paragraph explaining what the graph means to them. When students finish writing their paragraphs, have them share their paragraph with a partner. The graph and paragraph can be the students' first entry into their graphing book (introduced in Part E of the previous learning experience).

d) Ask students how they can show how many girls like each topping and how many boys like each topping. Have students sort the sticky notes under each heading into two groups and find the total number in each category.

e) Show students how to make a double bar graph that compares girls' favourite pizza toppings with boys' favourite pizza toppings. Have them make a double bar graph along with you. Help students interpret their graph by asking questions such as the following:
   - "What topping do girls like the most? The least?"
   - "What topping do the boys like the most?"
   - "How many more girls like _____ than boys?"
   - "If you order pizza for the class and can only pick two toppings, which two would you pick? Why?"
   - "Does the graph illustrate first-hand or second-hand data? Explain."

f) Have students compare the bar graph of favourite pizza toppings with the double bar graph of favourite pizza toppings. Ask, "How are they alike? How do they differ?"

Observation Checklist

For Part C, use the following checklist to determine whether students can create and interpret an appropriate bar graph.

Makes a Bar Graph that Includes	Yes	No	Comments
A title			
Category labels			
A label for each axis			
Bars whose lengths correctly represent the number of observations in each category			
Bars the same width			
Spaces between bars			
An appropriate scale with equal increments that starts at zero			
An interpretation of bar graphs			
Reading between the data (Question 2)			
Reading beyond the data (Question 3)			

Observation Checklist

Observe students' responses to Parts E and F to determine whether they can do the following:

- ❑ make the double bar graph correctly
- ❑ interpret the double bar graph correctly
- ❑ recognize that both bar graphs and double bar graphs include a title, labelled axes, and a scale with equal increments that begin at 0
- ❑ recognize that double bar graphs need a legend
- ❑ recognize that bar graphs illustrate one set of data and double bar graphs compare two sets of data

- **Determine the attributes (title, axes, intervals, and legend) of double bar graphs by comparing a set of double bar graphs.**
- **Represent a set of data by creating a double bar graph, label the title and axes, and create a legend with or without the use of technology.**
- **Draw conclusions from a double bar graph to answer questions.**
- **Solve problems by constructing and interpreting a double bar graph.**

Materials: Two packages of assorted bags of candy for each group (e.g., two bags of jelly beans, two bags of gum drops, two bags of skittles), large graphing paper, markers, BLM 5.SP.1&2.3, BLM 5–8.4, paper plates for sorting the candy, self-assessment sheet

Organization: Groups of three or four

Procedure:

a) Tell students that they will be investigating what is inside a package of assorted candy. Explain that each group will get two packages of the same type of candy. There are different colours of candy in each package, and it is their job to determine whether the number of pieces of each colour in the package is the same or whether one colour appears more often than another. When they finish their investigation, they should be able to answer the question, "How assorted is a package of candies?"

b) Have each student complete the recording sheet (BLM 5.SP.1&2.3). Explain that the members of each group will need to work together to make a double bar graph that they will present to the rest of the class.

c) Have each group present its graph and its findings to the rest of the class.

d) Have the students compare all the double graphs. Ask them how the graphs are alike and how they differ and if there are any common patterns and relationships among them.

Observation Checklist

Monitor students' responses to determine whether they can do the following:

- ❑ make reasonable estimates of quantities
- ❑ identify the attributes (title, axes, intervals, and legend) of double bar graphs
- ❑ represent sets of data by creating a double bar graph that includes a title, labelled axes, appropriate intervals, and a legend without the use of technology
- ❑ draw conclusions from a double bar graph that illustrate that they can read between and beyond the data
- ❑ solve a problem using double bar graphs

Self-Assessment

Have students do a self-assessment (BLM 5–8.4) of how they work in a group.

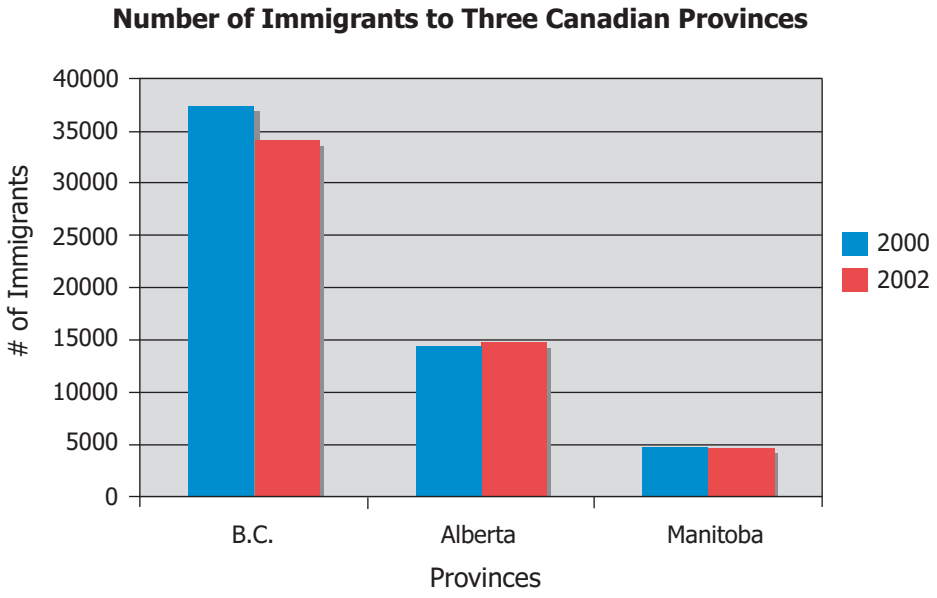
- **Explain the difference between first-hand and second-hand data.**
- **Draw conclusions from a double bar graph to answer questions.**

Materials: Copies of immigration map, math journals, calculators

Organization: Individual/Large group

Procedure:

a) Provide students with the following graph to analyze.



b) Ask students to record their answers to these questions in their math journals. Tell students that they can use a calculator to help them interpret the graph.

1. "What is the graph about?"
2. "Does the graph illustrate first-hand or second-hand data? Explain."
3. "What conclusions can you draw from the data?"
4. "What reasons can you give for the results?"
5. "If you add Ontario to the graph, do you think more people would have immigrated to Manitoba or to Ontario? Explain."

c) Have the students share their responses with the other members of the class. Encourage students to provide reasons for why more people immigrate to one province than another.

d) Ask students what questions they have as a result of analyzing the graph. Make a list of their questions and have students devise a plan for answering them.

Extension: Visit the Statistics Canada Website at <www.statcan.gc.ca> to see if the data have changed since 2008.

Observation Checklist

Check students' answers to determine whether they can do the following:

- ❑ differentiate between first-hand and second-data
- ❑ draw conclusions from a double bar graph that illustrate they can
  - read between the data (e.g., A total of approximately 10 000 people immigrated to Manitoba in the two years)
  - read beyond the data (e.g., More people would immigrate to Ontario than Manitoba)
- ❑ provide appropriate reasons for their conclusions (e.g., More people might have immigrated to B.C. because there were more jobs available)

- **Explain the difference between first-hand and second-hand data.**
- **Represent a set of data by creating a double bar graph, labelling the title and axes, and creating a legend with or without the use of technology.**
- **Draw conclusions from a double bar graph to answer questions.**
- **Solve a problem by constructing and interpreting a double bar graph.**

Materials: Empty cereal boxes, large graph paper, and markers

Organization: Individual or pairs

Procedure:

a) Show students an empty cereal box. Point out that there are many different types of cereal. Ask students why some cereals are considered to be better for them than others.

b) Explain that each box of cereal has a list of nutrients. Have students find the list of nutrients on one of their boxes. Ask them to find the number of grams of fibre in one serving of their cereal. Explain that cereals that are high in fibre and low in sugar content are considered healthier than those that are low in fibre and high in sugar.

c) Tell students that their task is to determine which cereal is better for them. Explain that they need to find the grams of fibre and sugar in three different cereals and represent this information on a double bar graph. Have students discuss whether they will be graphing first- or second-hand data, and how they know.

d) Have students write a paragraph describing their graph and all the conclusions that they can draw from it. Explain that they need to include a statement in their paragraph indicating which cereal is better for them and the reasons for their conclusion.

e) Have students share their graphs with the other members of the class, and explain which cereal they think is better for them. Encourage students to provide reasons for their conclusions.

Observation Checklist

Checks students' graphs and their conclusions about them to determine whether they can do the following:

- ❑ represent data on a double bar graph that includes a title, labelled axes, appropriate intervals, and a legend with or without the use of technology
- ❑ draw valid conclusions from the data that illustrate they can read between data
- ❑ solve a problem using a double bar graph

- **Represent a set of data by creating a double bar graph, labelling the title and axes, and creating a legend with or without the use of technology.**
- **Draw conclusions from a double bar graph to answer questions.**
- **Solve a problem by constructing and interpreting a double bar graph.**

Materials: A computer with a spreadsheet program, paper, and pencil

Organization: Individual or pairs

Procedure:

a) Ask, "Which city do you think is colder: Flin Flon or Montreal? Why?" Explain that one way to determine which city is colder is to compare the number of days the temperature in each city is less than or equal to zero.

b) Tell students they are going to find out which cities in Canada are the coldest. Have students go to <www.theweathernetwork.com> and select the statistics link. Tell them to pick any two cities in Canada and find the number of days in each month of the year that each city's temperature is less than or equal to zero.

c) Have students make a double bar graph using a computer spreadsheet program that shows the number of days in each month that each city's temperature is less than or equal to zero.

d) Have students make a list of questions about their graph. Ask them to prepare a poster consisting of the original data, the graph, and the questions that they developed.

e) Display the posters around the room and conduct a gallery walk. Have students answer the questions on each poster. Have students compare all the graphs to determine which city is the coldest.

Observation Checklist

Observe students' responses to determine whether they can do the following:

- ❑ collect second-hand data from an electronic database
- ❑ create a double bar graph using technology
- ❑ draw valid conclusions from the data that illustrate they can read between and beyond the data
- ❑ ask appropriate questions about the data represented on a graph

NOTES

Grade 5: Statistics and Probability (Chance and Uncertainty) (5.SP.3, 5.SP.4)

Enduring Understandings:

Chance is an element of many aspects of our lives. The chance that an event will occur varies from impossible to certain.

General Outcome:

Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

Specific Learning Outcome(s):	Achievement Indicators:
5.SP.3 Describe the likelihood of a single outcome occurring, using words such as ■ impossible ■ possible ■ certain [C, CN, PS, R]	➛ Provide examples of events that are impossible, possible, or certain from personal contexts. ➛ Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain. ➛ Design and conduct a probability experiment in which the likelihood of a single outcome occurring is impossible, possible, or certain. ➛ Conduct a probability experiment a number of times, record the outcomes, and explain the results.
5.SP.4 Compare the likelihood of two possible outcomes occurring, using words such as ■ less likely ■ equally likely ■ more likely [C, CN, PS, R]	➛ Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes. ➛ Design and conduct a probability experiment in which one outcome is less likely to occur than the other outcome. ➛ Design and conduct a probability experiment in which one outcome is equally likely to occur as the other outcome. ➛ Design and conduct a probability experiment in which one outcome is more likely to occur than the other outcome.

Prior Knowledge

Although this is the first time that students should formally encounter the study of chance and uncertainty, students may have had experience with the following:

- Having an understanding of fractions

Background Information

Probability is a measure of the chance that an event will occur. The formal study of probability begins in Grade 5 with the development of the language of probability. Knowledge of the terms associated with probability facilitates students' understanding of the role chance plays in their lives and their awareness that some events are more probable than others.

The learning experiences in this substrand are divided into two parts. The first part focuses on the development of the terms *impossible*, *possible*, *certain*, *more likely*, *less likely*, and *equally likely* and their application to real-life events. The learning experiences in the second part have students applying the language of probability to predict and explain the outcomes (the results) of probability experiments. The research on probability indicates that students often have misconceptions about the outcomes of events. For example, if a coin is tossed three times and lands heads up each time, many students believe the next time the coin is tossed it is bound to land tails up because things will even out. Consequently, the learning activities in this section engage students in generating and analyzing data that will help them overcome their misconceptions and pave the way for a deeper understanding of theoretical probability.

Mathematical Language

Impossible

Possible

Certain

Less likely

More likely

Equally likely

Learning Experiences

- **Provide examples of events that are impossible, possible, or certain from personal contexts.**
- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Materials: *It's Probably Penny* by Loreen Leedy (ISBN-13:978-0-8050-7389-8/ ISBN-10:0-8050-7389-2)

Organization: Whole class

Procedure:

a) Read the book *It's Probably Penny* to the class.

b) Discuss the story. Begin the discussion by asking, "What was Penny's homework assignment? What event did Penny think was possible? What are some other events that are possible? What does possible mean?"

c) Create a class list of events that are

- impossible
- possible
- likely
- certain

Have students explain why they think each event they name is impossible, possible, likely, or certain to occur.

Observation Checklist

Observe the students to determine whether they can do the following:

- ❑ identify events that are impossible, possible, certain, or unlikely
- ❑ provide valid reasons for why an event is impossible, possible, unlikely, or certain

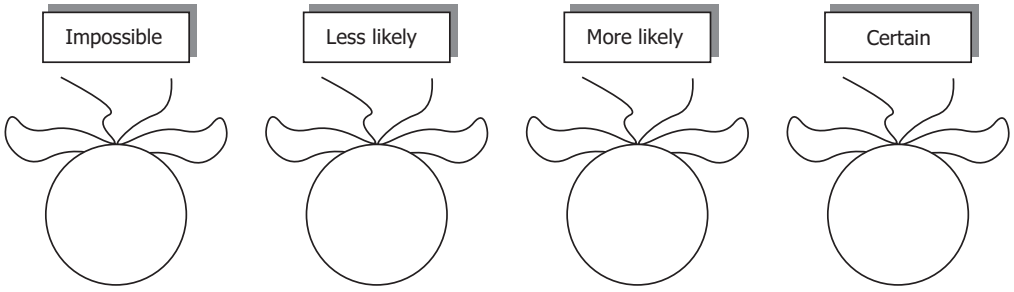
- **Classify the likelihood of a single outcome occurring in a probability experiment as impossible, possible, or certain.**
- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Materials: Event cards and label cards BLM 5.SP.3&4.1, loops made of string or yarn

Organization: Pairs

Procedure:

a) Have the students place the string loops on their workspace and place a label card beside each set.



b) Ask students to place each of the given statements into one of the sets.

c) When students are finished sorting the statements, have them share their answers and explain their reasons for placing an event in a given set.

Observation Checklist

Monitor students to determine whether they have valid reasons for categorizing a given event as impossible, unlikely, possible, or certain, and whether they understand that

- ❑ if an event is impossible, it will not occur
- ❑ if an event is certain, it will occur
- ❑ if an event is possible, it may or may not occur
- ❑ some events are more possible than others

Material: Copies of the learning experience (BLM 5.SP.3&4.2)

Organization: Individual

Procedure:

a) Have students complete the following activity sheet (BLM 5.SP.3&4.2).

b) When students have finished answering the questions, have them share their answers and their reasons for them.

Observation Checklist

Observe students' responses to determine whether they understand the following:

- ❑ the more possibilities there are, the more likely an event will occur
- ❑ if an event is impossible, it will not occur
- ❑ if an outcome is certain, it is the only one
- ❑ if events are equally likely, they have the same chance of occurring

- **Provide examples from events that are impossible, possible, or certain from personal contexts.**

Materials: Journal/Learning log

Organization: Individual

Procedure:

Have the students complete the following statements in their math journals:

1. I am less likely to …..
2. I am more likely to …...
3. I am certain to …….
4. It is impossible for me to…..
5. It is equally likely that …..
6. It is possible that I will ……

Observation Checklist

Examine students' responses to determine whether they can do the following:

- ❑ identify events other than ones discussed in class that are certain, impossible, possible, more likely, less likely, and equally likely to occur
- ❑ understand the meaning of the terms *certain*, *impossible*, *possible*, *more likely*, *less likely*, and *equally likely*

- **Conduct a probability experiment a number of times, record the outcomes, and explain the results.**
- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Materials: A set of cards (BLM 5–8.5)

Organization: Whole class

Procedure:

Show students the cards and then spread them out face down on a table. Have one student select a card and show it to the rest of the class. Ask:

- "Is it possible to pick a number that is greater than the one just selected? Why or why not?"
- "Is it possible to pick a number that is less than the one just selected? Why or why not?"
- "Is the number more likely or less likely to be greater (less) than the one just selected? Why do you think so?"

Have a student pick another card so the class can check their prediction and discuss why their prediction may or may not have been correct.

Repeat the activity several times.

Observation Checklist

Observe students' responses to determine whether they are doing the following:

- ❑ basing their predictions on the relationships between the numbers
- ❑ using the terms *more likely* and *less likely* correctly
- ❑ providing valid reasons for their predictions

- **Conduct a probability experiment a number of times, record the outcomes, and explain the results.**
- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Material: Coloured tiles or blocks, paper bag

Organization: Whole class

Procedure:

a) Ask students, "If you put four blue tiles in a bag and then take one out without looking, can you be sure what colour tile you will get? Why or why not?"

b) Next, ask, "If you put a red tile in the bag with the blue tiles and take one out without looking, can you be sure what coloured tile you will get? Why or why not? Are you more likely or less likely to get a red tile? Why? Are you more likely or less likely to get a blue tile? Why?"

Have students test their answer by placing four blue tiles and one red tile in a bag, and then asking several students to draw a tile from the bag and show it to the rest of the class. Have them put the tile back in the bag before asking another student to draw a tile. Have students keep a record of the number of times a blue tile is drawn and the number of times a red tile is drawn. Discuss the results.

c) Finally, ask, "If you put three red tiles in a bag with seven blue tiles and take one out without looking, is one coloured tile more likely to be drawn from the bag than the other? Why or why not? Are you more likely or less likely to get a red tile?"

Have students test their answer by placing three red and seven blue tiles in the bag. Ask several students to draw a tile from the bag and show it to the rest of the class. Have them put the tile back into the bag before asking another student to draw a tile. Have students keep a record of the number of times a red tile is drawn and the number of times a blue tile is drawn. Discuss the results.

Observation Checklist

Monitor students' responses to the questions to determine whether they are doing the following:

- ❑ basing their predictions on the number of red and blue tiles
- ❑ using the terms *more likely* and *less likely* correctly
- ❑ providing valid reasons for their predictions
- ❑ explaining the results of the experiments

- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Materials: BLM 5.SP.3&4.3

Organization: Pairs

Procedure:

a) Have students examine a spinner (BLM 5.SP.3&4.3) and check their predictions by spinning the spinner 20 tines and recording their results. Complete the BLM.

b) When all pairs have checked the validity of these statements, discuss their results as a class.

Observation Checklist

Observe students' responses to determine whether they can do the following:

- ❑ understand that the spinner is more likely to stop on the section that is the greatest fraction of the whole
- ❑ understand the spinner is less likely to stop on the section that is the least fraction of the whole
- ❑ understand that sections of the spinner that are equivalent fractions of the whole are equally likely to occur
- ❑ provide valid reasons for their predictions
- ❑ explain the results of their experiment and why their results may differ from others

- **Identify outcomes from a probability experiment that are less likely, equally likely, or more likely to occur than other outcomes.**

Materials: Two-coloured chips, paper cups, copies of the instruction for the experiment (BLM 5.SP.3&4.4)

Organization: Pairs

Procedure:

Have students complete activity sheet (BLM 5.SP.3&4.4).

Observation Checklist

Examine students' responses to determine whether they are doing the following:

- ❑ using the terms *more likely* and *less likely* correctly
- ❑ explaining the results of their experiment

- **Design and conduct a probability experiment in which the likelihood of a single outcome occurring is impossible, possible, or certain.**
- **Conduct a probability experiment a number of times, record the outcomes, and explain the results.**
- **Design and conduct a probability experiment in which one outcome is less likely to occur than the other outcome.**
- **Design and conduct a probability experiment in which one outcome is equally likely to occur as the other outcome.**
- **Design and conduct a probability experiment in which one outcome is more likely to occur than the other outcome.**

Materials: Copies of the Mystery Spinner activity sheet (BLM 5.SP.3&4.5)

Organization: Individual

Procedure:

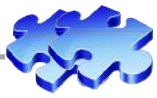
Have students complete the activity sheet (BLM 5.SP.3&4.5).

Observation Checklist

Monitor students' responses to the spinning activities to determine whether:

- ❑ their spinners meet the conditions that were specified
- ❑ they use the terms *more likely*, *less likely*, *impossible*, *certain*, and *equally likely* correctly
- ❑ they refer to the fraction of the whole that each part of their spinner occupies to explain why the conditions that were specified are met

PUTTING THE PIECES TOGETHER



Picturing Probability

Purpose:

The intent of this investigation is to have students demonstrate their understanding of the language of probability by depicting situations that illustrate different degrees of chance. In particular, the investigation is designed to reinforce the meaning and use of the terms

- impossible, possible, and certain
- less likely, equally likely, and more likely

The investigation is also designed to extend students ability to

- communicate mathematically
- use technology
- make connections to other subject areas (LwICT and ELA)
- make connections to real-world situations

Materials/Resources:

- Digital cameras
- Card readers (optional)
- Microphones
- Computer projectors
- Computers
- *Microsoft Photo Story*

Organization: Groups of three or four

Procedure:

a) Tell students that they will be using a digital camera to take six pictures. Each picture should illustrate an event whose likelihood of occurring can be described as impossible, possible, certain, equally likely, more likely, or less likely, using one picture for each word or phrase. The events can be ones they create or ones they actually see occurring.

   The pictures will be used to create a narrated *Microsoft Photo Story**. The narrated story should include the reasons why the event illustrated in each picture is included. The photo stories will be saved (a USB stick or other format can be used for this) and presented to the other members of the class.

   * *Microsoft Photo Story* is an application from Microsoft Office. It is available as a free download from the Microsoft website at <www.microsoft.com/windowsxp/using/digitalphotography/photostory/default.mspx>.

   Instead of using *Photo Story*, students could

   - make a *PowerPoint* presentation
   - dramatize the events they choose
   - make a "likelihood line" poster (order the events from least to most certain to occur)

b) Help students develop assessment criteria for their photo stories. The criteria should consider the following:

   - The correct use of mathematical vocabulary
   - A clear description of the event
   - Proper use of technology (with respect to the LwICT continuum)
   - Presentation skills

c) Have each group discuss how the terms can be illustrated. After they decide how each term can be represented, have them stage or find each event and take its picture.

d) Help students create their photo stories. Discuss with students how they can effectively, accurately, and concisely narrate their stores to entertain and engage their audience.

e) Have each group present its photo stories to the other members of the class.

f) Have students use the assessment criteria they developed to assess

   - themselves
   - their peers

Extension:

a) Have students use the following terms to describe events in the books *Cloudy with a Chance of Meatballs* by Judi Barret and *Dear Mr. Blueberry* by Simon James: *impossible*, *possible*, *certain*, *less likely*, *equally likely*, and *more likely*.

b) Have students look at different weather conditions and use the terms *possible*, *impossible*, *certain*, *less likely*, *equally likely*, and *more likely* to predict the weather.

c) Students may benefit from a connection between this book and Cluster 4: Weather Outcomes, found in the Manitoba Grade 5 Science curriculum.

NOTES