Be Mathletic!

Brief Overview:

In this fun and active unit, students will be encouraged to "Be Mathletic!" Students will encounter statistical concepts by collecting and analyzing data. With engaging athletic activities, students will extend their learning by organizing collected data using bar graphs, line plots, and stem-and-leaf plots.

NCTM Content Standard/National Science Education Standard:

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Grade/Level:

Grades 4-5

Duration/Length:

Three lessons-60 minutes per lesson

Student Outcomes:

Students will:

- Design investigations to address a question and consider how data-collection methods affect the nature of the data set
- Collect data using observations, surveys, and experiments.
- Represent data using tables and graphs such as line plots, bar graphs, and stem and leaf plots.

Materials and Resources:

- Paragraph of data (Student Resource 1)
- Bar graph of data (Student Resource 2)
- Questions about data (Teacher Resource 1)
- Interpreting data worksheet (Student Resource 3)
- The Magic Ball Cap by David A. Ham and Janice B. Sibley
- Frequency chart (Student Resource 4)
- Frequency chart key (Teacher Resource 2)
- Graph paper
- Bar Graph Story (Student Resource 5)
- Cardboard box with a different color of felt on each side. Bottom cut out, and a hole in the top for a head to come out so it can be worn

- 20 velcro balls
- Line plot with questions (Student Resource 6)
- Line plot answer key (Teacher Resource 3)
- Three-word flip chart (Teacher Resource 4)
- 4-5 basketballs
- Compare/contrast line plots and bar graphs (Student Resource 7)
- Stem and leaf plot transparency (Teacher Resource 5)
- 10 Beach balls
- Stem and leaf plot questions (Student Resource 8)
- Summative Assessment (Student Resource 9)
- Summative Assessment key (Teacher Resource 6)

Development/Procedures:

Lesson 1

Pre-Assessment

- Half of the students will receive data in a paragraph format (Student Resource 1) and the other half of the students will receive the same data in a bar graph format (Student Resource 2). Immediately start asking questions about the data (Teacher Resource 1) and have students call out the responses.
- Conduct a conversation on why some students were able to answer the questions more quickly than others. Then have them display their data to each other.
- Students will write a brief paragraph on why they believe the graph was better than the paragraph for interpreting data (Student Resource 3).

Launch

- Read the story, The Magic Baseball Cap, by David A. Ham and Janice B. Sibley.
- Initiate a discussion about how the class could display the regions in the United States (northeast, west, southeast, southwest, midwest) the hat had traveled.
- Informally assess the students based on their responses and discussion.

Teacher Facilitation

- Demonstrate how to collect data with a frequency chart based on the places that the hat had landed. (Student Resource 4).
- Reread all of the states that were visited and place a tally in the appropriate box. Answers on Teacher Resource 2.
- Demonstrate how to create a bar graph using the data in the table.
- Reinforce all of the areas of the graph: Title, axis, data, labels, and scale.

- Call on students for responses and interpretation of the bar graph.
- Introduce experiment and model the appropriate procedures for completing the next activity.

Student Application

- Choose one student to wear the four-colored box.
- Have the other students each take one velcro ball, and as the student in the box turns, the other students will pitch a ball so that it sticks to the box. (Take a break after every 5 throws so the student in the box does not get too dizzy)
- The students will create their own frequency chart to tally how many balls landed on each color.
- The students will design a bar graph on graph paper to display the results of the ball tossing.

Embedded Assessment

- Informally ask questions to stimulate thinking about the data and the graph. Assess their understanding and mastery of constructing a bar graph through observation.

Reteaching/Extension

Reteaching activity:

- Assemble students who are having difficulty creating and interpreting the data to work in a small group and review the concept at the end of the first day and the beginning of the second day.

Extension activity:

- Students will write a paragraph (Student Resource 5) about their bar graphs. Make sure that they include 4 facts from the data, along with a prediction of why they think the results turned out the way that they did.

Lesson 2

Pre-Assessment

- Students will be presented with a line plot from which they will respond to several questions (Student Resource 6).
- Students will interpret the line plot to determine range, median, and mode in order to assess the students' prior knowledge (Answers on Teacher Resource 3).

Launch

- Students will "turn and talk" to discuss various ideas of how to display the total number of baskets made in one minute.
- Monitor students' conversations.
- Allow students to share their possible ideas while facilitating students' feedback.

Teacher Facilitation

- Introduce and model concept of collecting and analyzing data through a line plot.
- Explain that students will collect data (the amount of baskets made within one min.) using tallies.
- In groups of 4-5, students will alternate shooting baskets (with their dominant hand) and recording the amount of baskets in their journal.
- Explain that a line plot is used to show frequency of data using a number line.
- Model the development of a line plot using the data collected.
- Explain that the data can be interpreted by determining the range, median, and mode.
- Identify and explain pertinent vocabulary to create a three-word flip chart defining the meaning of range, median, and mode using Teacher Resource 4.

Student Application

- Students will collect and analyze data using a line plot and determining range, median and mode.
- Data will derive from the number of baskets made in one minute with their non-dominant hand.
- In groups of 4-5, students will alternate shooting baskets (with their non-dominant hand) and record the amount of baskets in their journal.
- Collect and display class data on a transparency.
- Using the data, students will construct a line plot and determine the range, median, and mode.

Embedded Assessment

- By informally observing the students' line plot, assess the students' application and understanding.

Reteaching/Extension

Reteaching Activity:

- In small groups, meet with students who show difficulty understanding the skill. Further modeling and explanation will take place in order for students to acquire the skill.

Extension Activity:

- Students showing mastery of the skill will work in small groups to compare and contrast a line plot and a bar graph and then write about their conclusions (Student Resource 7).

Lesson 3

Pre-Assessment

- Students will be presented with seven numbers and asked to find the range, median, and mode. (24, 23, 13, 17, 23, 21, 30)

Launch

- Review answers from the pre-assessment, and make corrections if necessary.
- Present students with stem and leaf plot transparency (Teacher Resource 5) and ask students to interpret the graph.
- Informally assess students based on their responses and discussion.

Teacher Facilitation

- Explain that students will be collecting data with a partner by bouncing a beach ball with their dominant hand until it falls.
- After collecting data come together as a whole group and record results on the chalkboard.
- Model concept of organizing data onto a stem and leaf plot. Point out that leaves are the ones place and stems are the tens.
- Model determining the range, median, and mode from a stem and leaf plot.

Student Application

- The students will now collect data in pairs by bouncing the beach ball with their non-dominant hands until it falls.
- Come together as a whole group and record everyone's results on the chalkboard.
- With a partner, students will create a stem and leaf plot based on the data collected.
- When the graphs are completed, distribute Student Resource 8 for students to complete.

Embedded Assessment

- Informally assess students during data collection and the construction of the graphs through their conversation and work.

Reteaching/Extension

Reteaching Activity:

- Work in a small group with those students who have difficulty grasping the concept for the completion of Student Resource 8.

Extension Activity:

- Model how to create a double stem and leaf plot.
- Have students create a double stem and leaf plot to display their data from bouncing the ball with their dominant and non-dominant hands.

Summative Assessment:

- Students will take an assessment (Students Resource 9) consisting of two selected response questions, one brief constructed response, and the creation of a graph.
- The questions will cover concepts taught over the past three days and will determine mastery of the topics.
- Answers can be found on Teacher Resource 6.

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Appendix A: Teacher Resources

Teacher Resource 1

LITTLE LEAGUE QUESTIONS

1. Which team had the most wins?

2. Which team had the least wins?

3. Which teams had the same amount of wins?

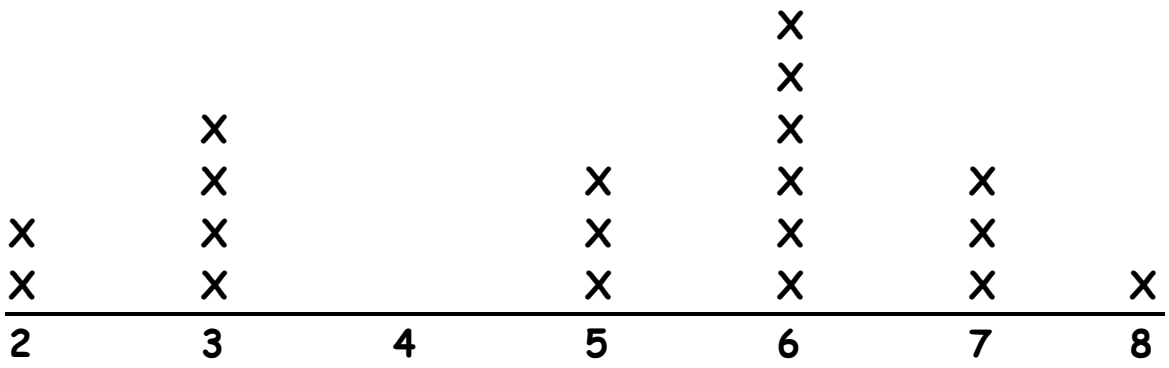
4. Which teams had three more wins than the Pirates?

5. Which team won two less games than the Blue Jays?

Regions The Magic Hat Has Traveled (Key)

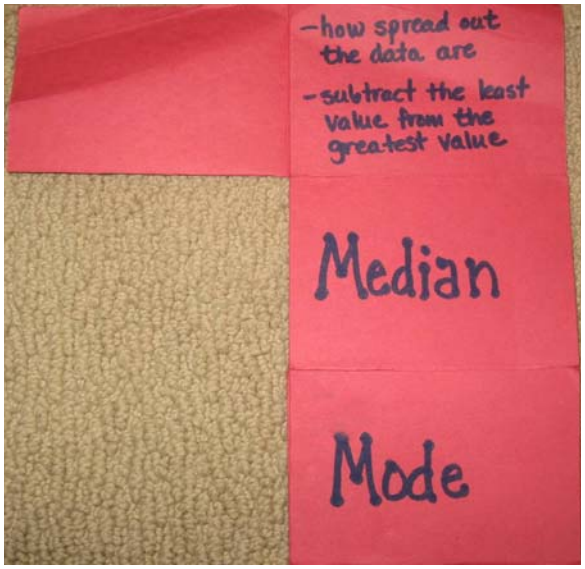
Direction	Tallies	Number
Northeast	| |	2
West	| |	2
Midwest	| |	2
Southeast	|	1
Southwest		0

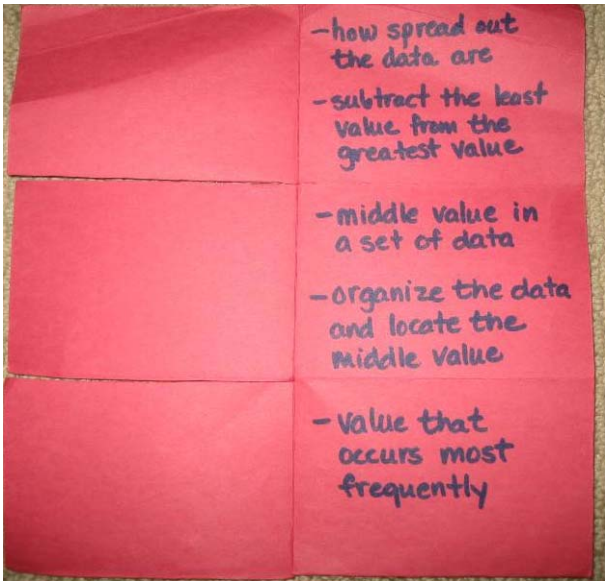
FOUL SHOTS MADE AT BASKETBALL PRACTICE (Key)



1. What was the greatest amount of foul shots made? _6_
2. What is the mode of this data? _____6_____
3. What is the range of this data? _____6___
4. What is the median of this data? _____6____
5. How many people made foul shots at practice? _____19___


Range
Median
Mode


-how spread out the data are
-subtract the least value from the greatest value
Median
Mode


-how spread out the data are
-subtract the least value from the greatest value
-middle value in a set of data
-organize the data and locate the middle value
-value that occurs most frequently

Ages of Teachers at Our School

Stems	Leaves
2	2 2 4 5 8
3	0 3 3 6
4	1 1 1 1 4
5	2 8
6	9

Key:

2 | 2 = 22

Selected Response: (1 point each)
A group of fourth grade students took a mathematics test.
Below is a list of the scores received by the group of students:

95, 85, 88, 95, 77, 90, 80

1. The median grade is:
a. 95
b. 77
c. 88
d. 12

2. The mode is:
a. 95
b. 77
c. 88
d. 12

BCR: (1 point title, 1 point correct data, 1 point key, 1 point stem and leaves labeled)
Choose and create the best graph to organize the data (test scores) above on a separate sheet of paper.

Math Test Scores

Stems	Leaves
7	7
8	0 5 8
9	0 5 5

Key:

7 | 7 = 77

Explain why your answer is correct.
Use what you know about organizing data in your explanation.
Use words, numbers, and/or symbols in your explanation. (2 points)

Accept reasonable responses

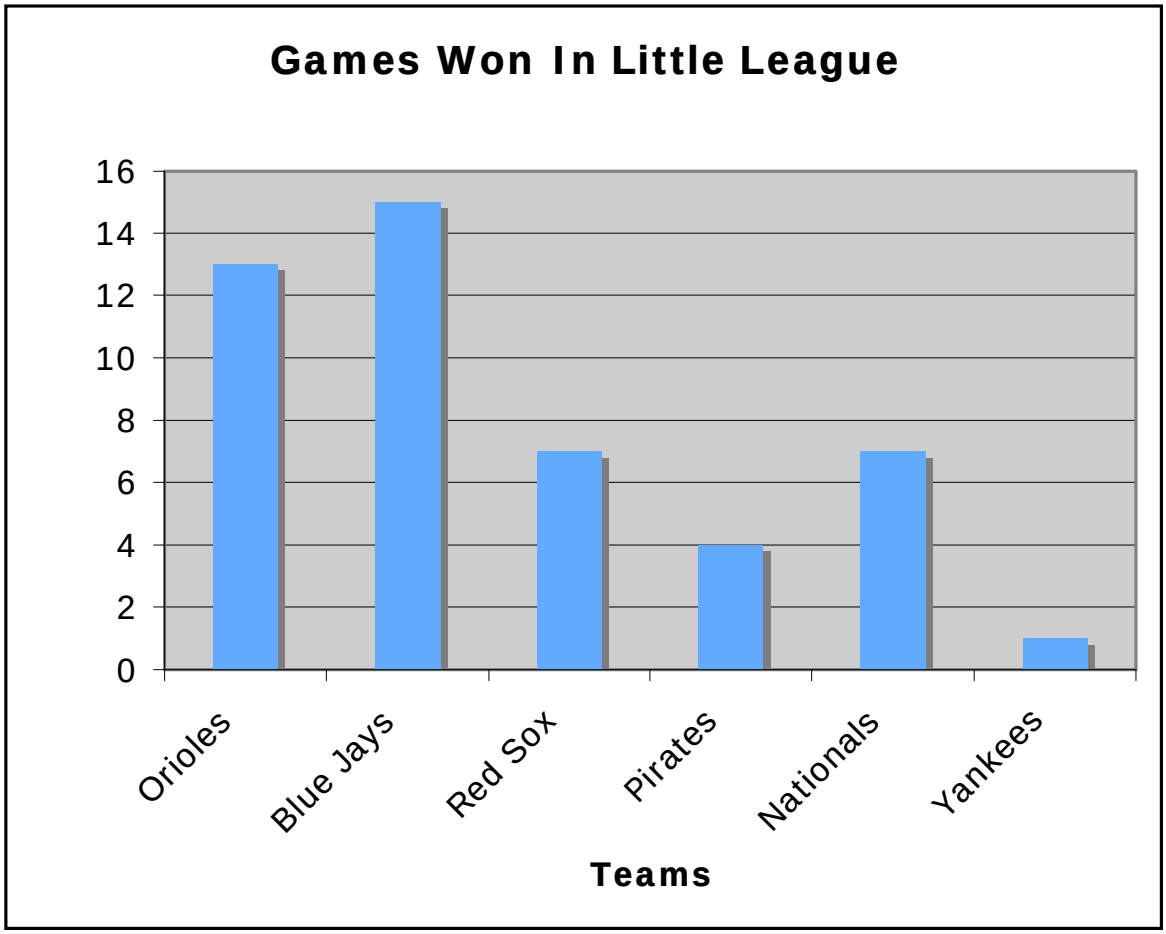
Appendix B: Student Resources

Student Resource 1

LAST YEAR IN LITTLE LEAGUE

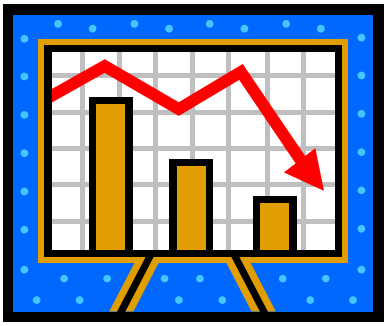
Last season in little league there were six teams that competed. The Orioles won thirteen games, and the Pirates won four games. The Blue Jays did the best by winning fifteen games and the Yankees did the worst by only winning one game. Finally, the Red Sox and the Nationals tied with a total of seven games each.

LAST YEAR IN LITTLE LEAGUE



Name _____ **Date** _____

Why Are Graphs A Better Way To Interpret Data?



_____

_____

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Regions The Magic Hat Has Traveled (Key)

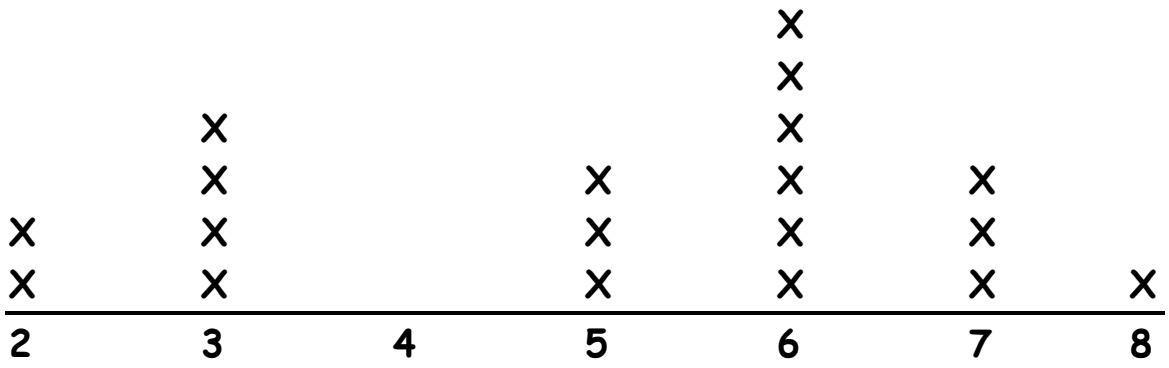
Direction	Tallies	Number
Northeast		
West		
Midwest		
Southeast		
Southwest		

Name _____ Date _____

Every graph has a story. What story does your graph tells? What is some information that is specific to your graph? Can you make any predictions based on the graph?

Name _____ Date _____

FOUL SHOTS MADE AT BASKETBALL PRACTICE



1. What was the greatest amount of foul shots made? _____

2. What is the mode of this data? _____

3. What is the range of this data? _____

4. What is the median of this data? _____

5. How many people made foul shots at practice? _____

Name _____ Date _____

Some graphs are better than others depending on your data. What are the differences and similarities of bar graphs and line plots. Which data would you display on each? Do you have a preference in a graph? Why?

_____

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Bouncy Beach Balls

Based on the stem and leaf plot that you have created, answer the questions below.

1. How many people participated in this survey?
   _____
2. What is the range of this data? _____
3. How was the range found?

   _____
4. What is the median of this data? _____
5. How was the median found?

   _____
6. What is the mode of this data? _____
7. How was the mode found?

_____

Selected Response:
A group of fourth grade students took a mathematics test.
Below is a list of the scores received by the group of
students:

95, 85, 88, 95, 77, 90, 80

1. The median grade is:
e. 95
f. 77
g. 88
h. 12

5. The mode is:
e. 95
f. 77
g. 88
h. 12

BCR:
Choose and create the best graph to organize the data (test scores) above on a separate sheet of paper.

Explain why your answer is correct.
Use what you know about organizing data in your explanation.
Use words, numbers, and/or symbols in your explanation.

_____

_____

_____

_____