

Title: High Flying Ads: Choosing the Appropriate Graph to Represent a set of Data

Brief Overview:

Students will show that they know what type of graph can be used to represent a certain set of data. Students will be given a consumer product to research and advertise. They will investigate five sets of data, some of which they will collect themselves through hands-on activities. Then they will organize the information into graphs they deem appropriate for the type of data. These graphs should optimally represent different aspects of the product so that the consumer will be convinced to purchase the product. The students will be assessed on the graphs they chose to represent their data, and their justifications for their choices. They will present their findings in an advertisement to the class, with a name for the product and slogans to encourage consumers to buy the toy.

NCTM Content Standard/National Science Education Standard:

- ❖ Recognize the differences in representing categorical and numerical data.
- ❖ Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.
- ❖ Use measures of center and understand what each does not indicate about the data set.

Grade/Level:

5

Duration/Length:

4 - 5 days. 50 minutes a day.

Student Outcomes:

Students will be able to:

- ❖ Collect, organize, and represent data.
- ❖ Compare different representations of the data and choose the one that shows the most important aspect of the data.
- ❖ Use words and numbers to justify their choice of graphical representation.
- ❖ Compare different measures of central tendencies.

Materials and Resources:

Stopwatch
Meter Stick and/or measuring tape

Scissors
Centimeter rulers
4X6 Index Cards
Scotch/masking Tape
Plastic Straws (Not bendable)
Poster boards
Markers
Crayons
Colored pencils
Graph paper
Resource Sheets (listed below)

Student Resource Sheets

RS 1 Favorite Transportation Toy Survey (Graph)
RS 2 Favorite Transportation Toy Survey (Paragraph)
RS 3 High Flying Ads Assignment
RS 4 High Flying Ads Data Collection
RS 5 Flyer Toy Assembly Instruction
RS 6 How Far Can You Go
RS 7 Flying Toys Sales History
RS 8 Target Practice
RS 9 Flyer Toy Assembly Line
RS 10 Summative Assessment
RS 11 Brief Constructed Response

Teacher Resource Sheets

RS 1 Station Set-up Guide
RS 2 Instructions
RS 3 Our Favorite things
RS 4 How Far Can You Go
RS 5 Flying Toys Sales History
RS 7 Flyer Toy Assembly Line
RS 8 Target Practice
RS 9 Flying Man Graphics
RS 10 Answer Key, Student Resource Sheets 1-10
RS 10 Sample Station Graphs Answer Key
RS 11 Summative assessment Answer Key
RS 16 MSA BCR Rubric

Development/Procedures:

Lesson 1

Preassessment – The students have had prior experience making and reading bar graphs, line plots, line graphs, and stem-and-leaf plots. The students have also had prior experience collecting, organizing, and representing data in graphs. This unit will be taught towards the end of the fifth grade data analysis unit.

Launch – Pass out Student Resource Sheet 1 to one third of the students and Student Resource Sheet 2 to the rest of the students. Students should not look at each other's handout. Ask students questions about the data, such as "How many children prefer airplanes and trains?" (*Ans: 5*) or "How many categories only have one child?" (*Ans: 2*). The children with the graph will be able to answer these questions much faster than the children with the paragraph. Praise the children with the graph. After a few more questions show the whole class why those children had an advantage to answer the questions. Discuss the advantages of displaying data in a graph as compared to a paragraph or written list.

Teacher Facilitation – Refer to Teacher Resource 1 on set up for stations. Student Resource Sheet 3 should be handed out first to students. See Teacher Resource 2. Read through with the students and answer any questions. Explain the stations and show the directions for each station (show overheads of Teacher Resource Sheets 3 – 7). Suggest a timeline: Today they should assemble the toy and test it. Tomorrow and the next day they should collect data on their product. The fourth day they should create their poster to advertise the toy and on the fifth day the students will present their advertisements. Finally, there will be a summative assessment on choosing the appropriate type of graph for a set of data.

Student Application – Students should be grouped into groups of three, with leftover students making up a group of two. They should be assigned group numbers. These should be written on their fliers. They can begin to assemble the product and collect data. Distribute Student Resource Sheets 4 and 5. Use Teacher Resource Sheets 8 and 9 for stations 4 and 5. Assign each group an initial activity. Not more than 25-30 minutes should be needed to complete data collection/analysis on each activity. After the time period, have groups switch stations. Students will need Student Resource Sheets 6-9. An extra period can be given to complete the graphs.

Embedded Assessment – Circulate among the groups as they work together. Check to make sure they are on the right track, working well together, and understanding the concepts in the graphs. Take anecdotal notes about their understanding of the graphs. Keep the students aware of the timeline for the project and the due date.

Reteaching/Extension –

- For those who have not completely understood the lesson, review what is needed.
- For those who have understood the lesson, allow them to keep working in the stations and collecting data. Refer to Teacher Resource Sheet 10 for the answer key.

Lesson 2

Preassessment - The students have had prior experience making and reading bar graphs, line plots, line graphs, and stem-and-leaf plots. The students have also had prior experience collecting, organizing, and representing data in graphs. This unit will be taught towards the end of the fifth grade data analysis unit.

Launch – Review the characteristics of each graph. Bar graphs represent categorical information. Line plots require numbers along the x-axis and work best when the numbers are less than 25. Line graphs must show change over time. Stem-and-leaf plots work best when the values are double digits or more. Values of the stems must be decided and they can show the distribution of the data easily.

Teacher Facilitation – Review expectations and the process that the students should be going through to collect their data, create graphs that appropriately represent the data, and create an advertisement for their toy. Answer any questions.

Student Application – The students will get in their groups and continue working on assembling their toy, collecting data, creating graphs, and creating an advertisement for their product.

Embedded Assessment - Circulate among the groups as they work together. Check to make sure they are on the right track, working well together, and understanding the concepts in the graphs. Take anecdotal notes about their understanding of the graphs. Keep the students aware of the timeline for the project and the due date.

Reteaching/Extension –

- For those who have not completely understood the lesson, review what is needed.
- For those who have understood the lesson, allow them to keep working in the stations and collecting data.
- Suggest to advanced students using measures of central tendencies to represent data.

Lesson 3

Preassessment - The students have had prior experience making and reading bar graphs, line plots, line graphs, and stem-and-leaf plots. The students have also had prior experience collecting, organizing, and representing data in graphs. This unit will be taught towards the end of the fifth grade data analysis unit.

Launch – Literature connection. Teacher can read Tiger Math, by Nagda and Bickel. Other titles include Lemonade for Sale by Stuart J. Murphy.

Teacher Facilitation - Review expectations and the process that the students should be going through to collect their data, create graphs that appropriately represent the data, and create an advertisement for their toy. Answer any questions.

Student Application - The students will get in their groups and continue working on assembling their toy, collecting data, creating graphs, and creating an advertisement for their product.

Embedded Assessment - Circulate among the groups as they work together. Check to make sure they are on the right track, working well together, and understanding the concepts in the graphs. Take anecdotal notes about their understanding of the graphs. Assist students in choosing the correct graph if they are not on the right track. Keep the students aware of the timeline for the project and the due date.

Reteaching/Extension –

- For those who have not completely understood the lesson, review what is needed.
- For those who have understood the lesson, allow them to keep working in the stations and collecting data.
- Suggest to advanced students using measures of central tendencies to represent data.

Lesson 4

Preassessment - The students have had prior experience making and reading bar graphs, line plots, line graphs, and stem-and-leaf plots. The students have also had prior experience collecting, organizing, and representing data in graphs. This unit will be taught towards the end of the fifth grade data analysis unit.

Launch - Discuss the advantages of using graphs in advertising. Discuss how to connect the results of their data collection and analysis to the type of slogan the students will choose. Show examples of advertising and graphs from real life, such as from newspaper clippings. Also, share information from the following website:

<http://www.zillions.org/Features/Toyadtricks/toyad003.html>

Talk about misleading strategies many advertisers use in marketing their product.

Teacher Facilitation - Review expectations and the process that the students should be going through to collect their data, create graphs that appropriately represent the data, and create an advertisement for their toy. Answer any questions.

Student Application - The students will get in their groups and work on creating an advertisement for their product and their presentation.

Embedded Assessment - Circulate among the groups as they work together. Check to make sure they are on the right track, working well together, and understanding the concepts in the graphs. Take anecdotal notes about their understanding of the graphs. Assist students in choosing the correct graph if they are not on the right track. Keep the students aware of the timeline for the project and the due date.

Reteaching/Extension –

- For those who have not completely understood the lesson, review what is needed.
- For those who have understood the lesson, allow them to keep working in the stations and collecting data.
- Suggest to advanced students using measures of central tendencies to represent data
- Ask students what other data collection they could do on their products to make more meaningful graphs.

Lesson 5

Preassessment - The students have had prior experience making and reading bar graphs, line plots, line graphs, and stem-and-leaf plots. The students have also had prior experience collecting, organizing, and representing data in graphs. This unit will be taught towards the end of the fifth grade data analysis unit.

Launch – Depending on the size of the class, the presentations may need to begin at the beginning of the period. Otherwise, students can have a few minutes to prepare their presentations.

Teacher Facilitation – Review expectations for the presentation. The students should explain why they chose their graphs to represent each set of data.

Student Application – The students will present their poster to the class, explain their findings in the graphs, and why they chose the graphs they did. Correct any misconceptions during the discussion.

Embedded Assessment – Students should be assessed on their presentation skills. The poster should be neat and uncluttered. The graphs should be appropriate for the aspect of the data the student is trying to represent. The student should have at least three different types of graphs. The student should be able to explain why he/she chose the graphical representation chosen. Finally the slogan should reflect the strongest feature of the product.

Reteaching/Extension –

- For those who have not completely understood the lesson, review what is needed.

- Suggest to advanced students using measures of central tendencies to represent data.
- Students could take this lesson further by researching and choosing their own products to market and advertise.
- Students could create and videotape a commercial for the product.
- Instead of a presentation, projects can be displayed for a “gallery walk,” where students rotate around the room, viewing each other’s posters for two to three minutes.

Summative Assessment:

The summative assessment included will allow the teacher to determine whether or not the students are able to:

- ❖ Collect and organize data into appropriate graphs.
- ❖ Determine what kind of graph can be used to represent a set of data.

If a student does not successfully answer the three questions, Student Resource Sheet 10, the BCR, Student Resource Sheet 11, and the concepts in this unit should be taught again and retested. See answer key on Teacher Resource Sheet 11.

Authors:

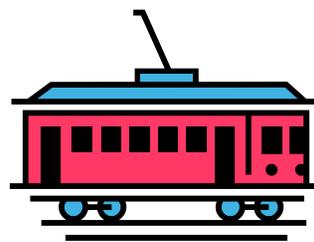
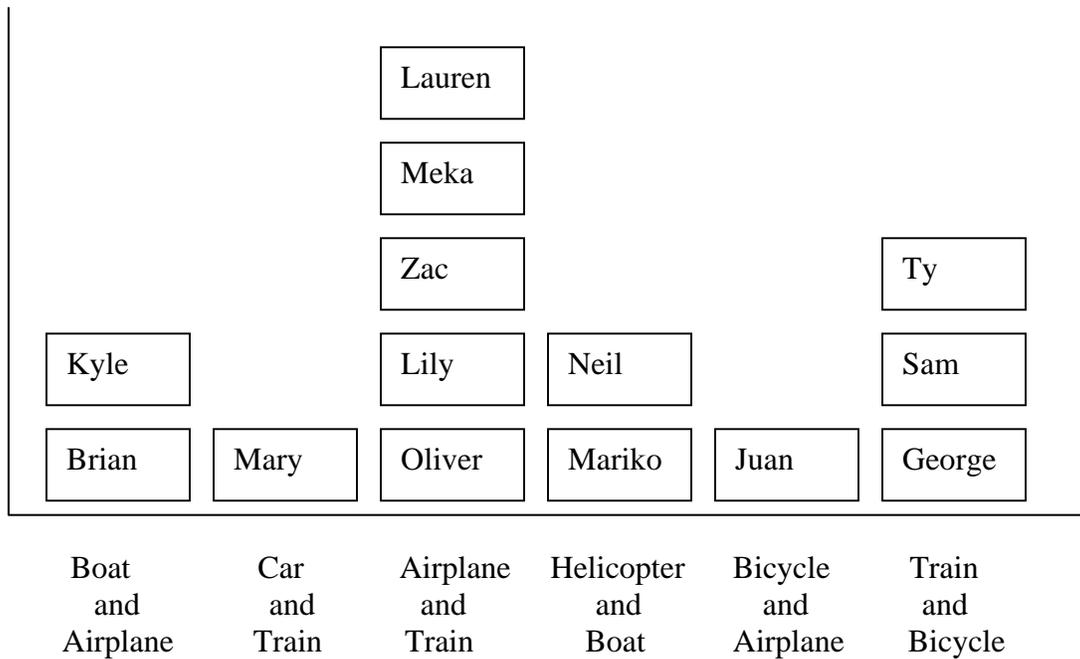
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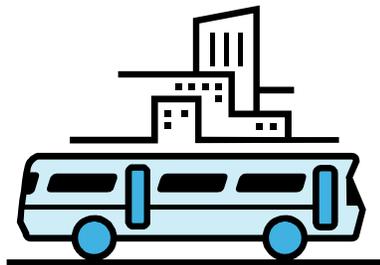
Favorite Transportation Toy Survey

Favorite Transportation Toys



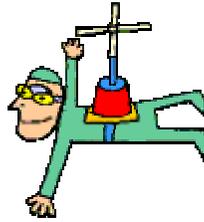
Favorite Transportation Toy Survey

Kyle and Brian like boats and airplanes. Mary likes riding in cars and trains. Lauren, Meka, Zac, Lily, and Oliver all like airplanes and trains. Neil and Mariko like boats and helicopters. Juan is the only person that likes bicycles and airplanes. Ty, Sam, and George all prefer trains and bicycles.



High Flying Ads Unit

Set Up Guide For Teacher



Prepare in advance 5 different stations or centers. Students should not spend more than 25 to 30 minutes at a station collecting data.

Materials:

For each station

- ❑ Graph Paper : 2 pages per group
- ❑ Board, to display instructions
- ❑ Folder to hold graph paper and worksheets

For specific stations

- ❑ Meter stick or measuring tape
- ❑ Masking tape
- ❑ Stop watch
- ❑ Centimeter ruler
- ❑ Scissors
- ❑ Flyer materials, 3 sets per group*

For each Group

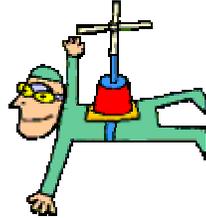
- ❑ Poster board
- ❑ Scissors
- ❑ Masking tape
- ❑ High Flying Ads Assignment, Resource Sheet 8
- ❑ Data collection chart, Resource Sheet 9
- ❑ Flyer Toy Assembly Instructions, Resource Sheet 10
- ❑ Pencil
- ❑ Markers, crayons, coloring pencils

** See Student Resource Sheet 5*

Name _____

Date _____

High Flying Ads Assignment



Your mission: To advertise the new flying toy with hoops

For this assignment, you will:

- ❖ Be assigned one or two coworkers
- ❖ Assemble the toy
- ❖ Collect data about its abilities
- ❖ Make at least three different graphs about your toy
- ❖ Create a name for the toy
- ❖ Write slogans to advertise the product
- ❖ Make a poster with your toy's name, graphs, & slogans
- ❖ Present your information to the class on the due date

Collect the following information about your flying toy:

(Further information will be provided after assembly)

- Flying distance
- Distance landed away from target (precision)
- Time required for assembly
- Type of toy preferred by kids
- Popularity of the flying toy over time

Instructions:

The Teacher Resource Sheets 1-5 are all for the stations. Feel free to cut out the boxed information on these and paste up at centers. Copies of the Student Resource Sheets should be made per group, NOT for each student. Use Student Resource Sheet 5b, "Flying Man", graphics to decorate!

For each station have ample graph paper available for at least two trials.

Station 2: Place three cut strips of masking tape in a convenient place of the room, in the form of a 'Y'. Student should have ample room to fly the flyer without disturbing other groups. They may even go put into the hall.

Stations 1, 3, and 5 can be done as seatwork. If you decide to do station 1 in this way, you can make copies of Resource sheet 1 for each group.

Station 4: Place two pieces of masking tape in the form of an 'X' on the floor. About 6 feet away from this place tape down the target resource sheet. There should be space for the student to fly the flyer to the target. You might want students do this in the hallway.

Note: Space should be made to store the fliers throughout the unit.

Station One

Our Favorite Things

To Do: In this activity you will research some given data. A survey was taken at your school last year on the students' favorite toys. The results are collected below. Use this data to make a graph of your choice.

To Show: You want to show your customer that flyers are truly a crowd pleaser!

Type of Toy	Number of Kids who Love it
Kites	25
Trains	25
Race cars	50
Flying planes	80
Balls	20
Yo-yo's	25
Board games	25

Station Two

How Far Can You Go?

To Do: *Whoosh! Boy, can your flyer fly! In this activity you will see how far the flyer actually flies.*

To Show: *You want to show your customer that your toy flies far indeed! You will take several measurements and record your results. Then you will make an appropriate graph to represent your data.*

Steps

1. One person will take the flyer and stand on the 'Y' marker.
2. Fly your flyer.
3. Another person will measure the distance the flyer flew from the marker. This can be done by measuring the distance (in meters) from the nose of the flyer to the 'Y' marker. The nose is the end of the flyer with the smaller hoop.
4. Repeat this at least 5-10 times.
5. Record your data on the table.
6. Choose a graph to represent your data in the best way.

Station Three

Flying Toys Sales History

To Do: Over the years, sales of flying toys have changed. In this activity you will use a given set of data to make a graph. Below is a list of years and corresponding number of sales for the toy.

To Show: You want to show your customers that flyers have done well in sales in the past and you think they will go up this year again.

Note: As seen from the data the sales went down towards the end. This just means that you will have to really advertise the best qualities of your product to attract more sales this year!

Use the data to make the most appropriate graph to show your information.

Consider: Why do you think the sales were highest in 1945? What historic event occurred at that time?

Station Four

Target Practice

To Do: Kids love to be able to have control over their flyers. In this activity, you will see how closely you can aim your flying toy to land on or near the target. This is called the precision of your flyer.

To Show: You want to show your customers your flyer is easy to control and can land on any target!

Steps

1. With your flyer stand 6 feet away from the target, on the 'X' marker.
2. Fly your flyer towards the target marker.
3. After your flyer lands, measure the distance in centimeters from the nose of your flyer to the center of the target. (The nose is the end with the smaller hoop).
4. Repeat this at least 5-10 times.
5. Record your data on the table.
6. Choose a graph to represent your data in the best way.

Station Five

Flyer Toy Assembly Line

To Do: *How long does it take to assemble the flyer? In this activity you will time how long it takes for 1 person to put the flyer together and graph this information. Then you will see how long it takes an assembly line to put it together.*

To Show: *You have assembled your flyer, but when your customers buy your product, you want to show them that it is so easy and fast to do! Take your readings, record your results, and make an appropriate graph to represent your data!*

Steps

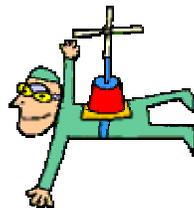
1. Assign roles to each group member: a Recorder, an Assembler, and a Timer.
2. The assembler will take a paper template.
3. The timer will time the assembler.
4. Following the directions for making a flyer, the assembler will make a flyer as quickly as possible.
5. The recorder will write the results.
6. Repeat this 2-3 more times, switching roles.
7. Now, for an assembly line, each person doing a different part of the assembly.
8. Time how long it takes to assemble the flier.
9. Repeat two more times.

High Flying Ads Data Collection

*Below is a table that will help you decide what graphs to use for each activity.
Remember to:*

- ❖ Review carefully the characteristics of each graph that you have learned.
- ❖ Look at all the data you have collected before you begin making your graphs.
- ❖ See which graphs would be most appropriate in showing what you want your customers to notice.

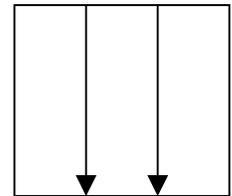
Type of Graph	Activity/Station Number (s)
Line Plot	
Stem and Leaf	
Bar Graph	
Line graph.	



Flyer Toy Assembly Instructions

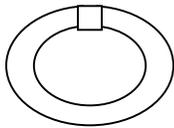
Step 1: Gather materials:

- Scissors
- 4X6 index card
- Scotch Tape
- Plastic Straw (not bendable)

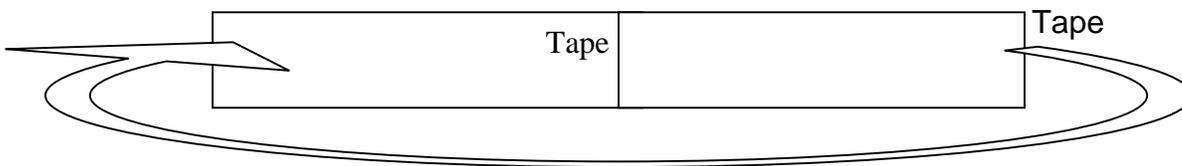


Step 2: Cut stiff paper template into three equal long strips. You can fold the paper into 3 parts first.

Step 3: Take one of the three strips and tape the ends together to form a small hoop.

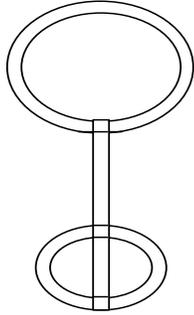


Step 4: Take the remaining two strips and tape them together.

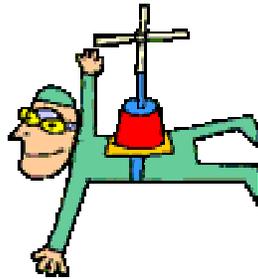


Step 5: Connect the other two ends of the long strip with tape.

Step 6: Tape the straw underneath the two hoops as shown below:



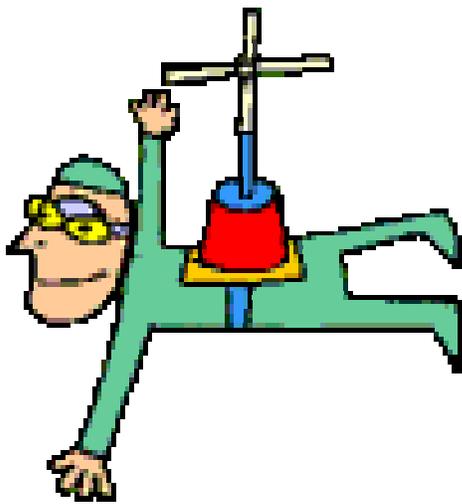
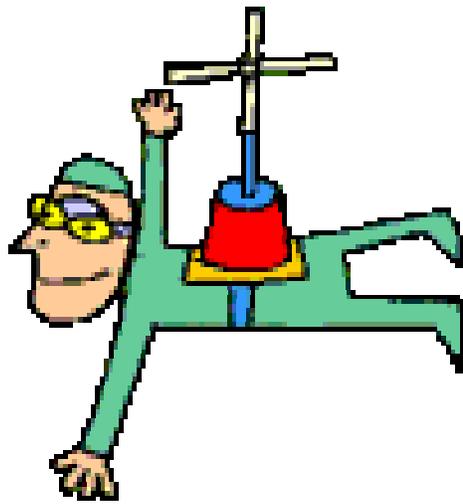
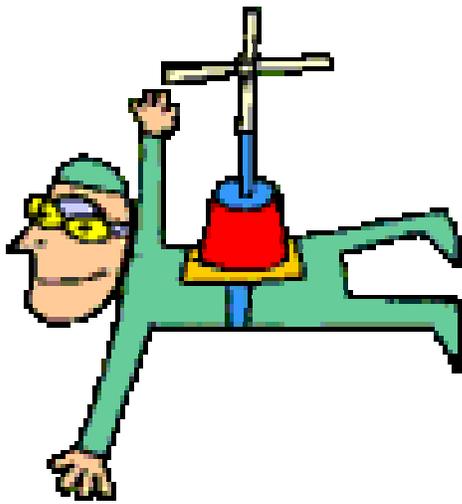
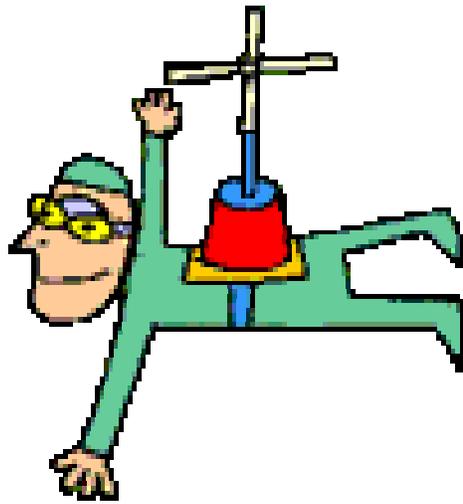
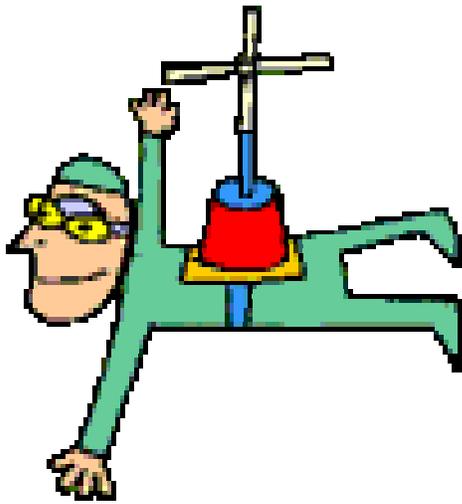
Step 7: Fly the toy by holding the straw, putting the small hoop (the nose) out in front, and throwing it like a spear.



Happy Flying!

Target Practice





Resource Sheet 6-- Student
Group_____

Date_____

How Far Can You Go?

Reading	Distance Flown in meters
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Flying Toys Sales History

Year	Number sold (in thousands)
1940	0
1945	36
1950	20
1955	14
1960	10
1965	10
1970	6
1975	5
1980	8
1985	10
1990	15
1995	14
2000	12

Target Practice

Record your readings on the table below.

Attempts	Distance from Center (cm)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Flyer Toy Assembly Line

Individual Times

<i>Attempts</i>	<i>Time in seconds (60 seconds=1 minute)</i>
<i>1</i>	
<i>2</i>	
<i>3</i>	
<i>4</i>	

Assembly Line Times

<i>Attempts</i>	<i>Time in seconds (60 seconds=1 minute)</i>
<i>1</i>	
<i>2</i>	
<i>3</i>	

Answer Key

Student Resource Sheets 1-10

RS 2a

Answers will vary

RS 4a

Answers will vary

RS 5a

Answers will vary

RS 6, 7

Students who have the RS7 will be confused and not able to answer the questions posed by the teacher. Students who have the RS 6 will be able to answer exactly the names of the people who prefer the different transportation toys.

RS 9

Type of Graph	Activity/Station Number (s)
Line Plot	Target Practice/ 4 How Far Can You Go/ 2
Stem and Leaf	Assembly Line/ 5 Target Practice/ 4 How far can you/ 2
Bar Graph	Favorite Things/ 1
Line graph.	<i>Sales history/ 3</i>

These are suggested graphs for each activity. Accept all reasonable answers.

Sample Answer key for “Flyer Toy Assembly Line” (Station 5)
(Data will vary)

Assembly Time in Seconds
(Individual or Assembly Line)

5	8
6	4 6 6
7	2
8	
9	4

Key: $5|8 = 58$ seconds

Choosing Appropriate Graphs Summative Assessment

1. Maria collected data on the number of people living in a house for her neighborhood.

Number of people in the house	Frequency
2	1
3	1
4	5
5	4
6	0
7	2
8	3
9	0
10	1

Which type of graph would best display the data?

- a. Circle graph
 - b. Line plot
 - c. Bar graph
 - d. Stem-and-leaf plot
2. Give an example situation in which a set of data would be best displayed in a stem-and-leaf plot. Explain why this graph would be the most appropriate.

3. The type of graph that is best to show the change over time is a _____.

Resource Sheet 11--Teacher

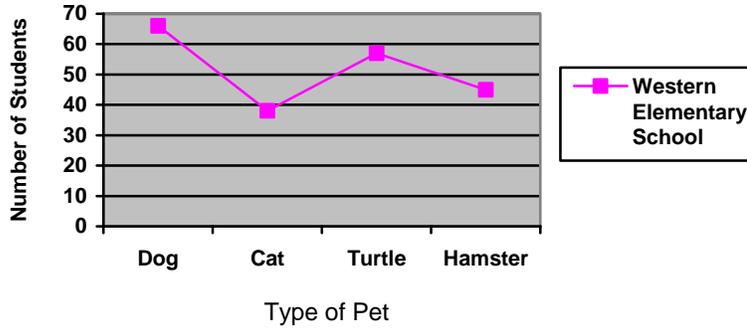
Summative Assessment
Choosing Appropriate Graphs

Answer Key

1. b
2. Answers will vary, but should include a set of data that has a wide and large range.
3. The type of graph that is best to show the change over time is a line graph.

Brief Constructed Response

Table 1: Type of Pet Owned by Students



Part A

What is wrong with this graph?

Part B

Use what you know about mathematical concepts to explain why your answer is correct. Use numbers and/or words in your explanation.

MSA Mathematics BCR Rubric Grades 3 through 8

Part A

1 This data should be represented in a bar graph.

Or

A line graph shows change over time.

0 The response is completely incorrect, irrelevant to the problem, or missing.

Part B

1 The response demonstrates a complete understanding and analysis of a problem.

- The data given in this graph should be represented with a bar graph because it is
- categorical data. Also, if the data were appropriate for a line graph, the x-axis
- should have some form of time: dates, months, years, etc.
- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation¹ of and/or justification² for the mathematical process(es) used to solve
- a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics
- are clear.
- Supportive information and/or numbers are provided as appropriate.³

1 The response demonstrates a minimal understanding and analysis of a problem.

- The student explains that a bar graph is more appropriate because it has categories OR that the line graph is not appropriate because it should show change over time.
- Partial application of a strategy in the context of the problem is indicated.
- Explanation¹ of and/or justification² for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.³

0 The response is completely incorrect, irrelevant to the problem, or missing.⁴

Notes:

¹ **Explanation** refers to students' ability to communicate **how** they arrived at the solution for an item using the language of mathematics.

² **Justification** refers to students' ability to support the reasoning used to solve a problem, or to demonstrate **why** the solution is correct using mathematical concepts and principles.

³ Students need to complete rubric criteria for *explanation*, *justification*, *connections* and/or *extensions* as cued for in a given problem.

⁴ Merely an exact copy or paraphrase of the problem will receive a score of "0".

