

SIXTH GRADE SCIENCE FAIR PREPARATION

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OUTLINE OF GOALS FOR THE UNIT

The students will use the following tools to help them do an investigation.

I. Data Collection

- A. Table/Chart
- B. Tally Sheet
- C. Line Plot
- D. Stem-and-Leaf Plot

II. Graphical Representation

- A. Bar Graph
- B. Pictograph
- C. Line Graph
- D. Circle Graph
- E. Box and Whisker Plot

III. Measure of Center

- A. Range
- B. Mode
- C. Median
- D. Mean

IV. Model Controlled Experiment Scientific Method

OUTLINE OF ACTIVITIES FOR THE UNIT

1. "To Graph or not to Graph that is the question"
2. Name Game
3. Hoop Shoot
4. Water Relay
5. Crane Activity (AKA standing on one foot)
6. Cool It
7. Traits
8. Peanut Butter Comparisons
9. Project: Individual Class Investigation

Lesson Plans

DAY 1 “To Graph or not to Graph that is the question”

Goals:

1. Students will understand the importance of organizing data

Materials:

15 copies of results in paragraph form

15 copies of results in graph form

Procedure:

1. hand out results **face down** to the class. One side of the class gets the paragraph form and the other side gets the graph form.
2. Explain that each side will be competing against each other. They need to blurt out the answer as soon as they can find the information.
3. After the side with graphs wins by a large margin have the students show each other the information they were using and discuss how a graph makes it easier to quickly “see” the results.

DAY 2 Name Game

Goals:

1. Make a Line Plot
2. Introduce concepts of range, mode, mean, and median
3. Students find range and mode
4. Construct a bar graph
5. Introduce idea of sample size & accuracy of conclusion

Materials:

8 post it notes for each person two colors one for boys and one for girls
Adding machine paper
Overhead transparency for graph

Investigation Question: What do we want to find out?

Who has more letters in their first names boys or girls?

Hypothesis: What do you think will happen?

Estimate or guess the answer the question.?

Procedure: How will we do the experiment?

1. Students will write one letter of their name on each post it note, and the number of letter on a final note.
2. Students place the post it notes horizontally on the whiteboard by rows.
keep notes equal distance to make it easier to read results
3. Teacher uses # post it notes to make a vertical line plot. Discuss how organizing the information makes “reading” the results easier.

Results: What actually happened?

1. Find the range - What is the least number of letters for boys? What is the most number of letters for boys? etc....
Distance from least to greatest
2. Find the mode - Most girls have ____ number of letters in their names?
3. Show the concept of mean by evening out the data. Make sure to keep the same number of columns
4. Show the concept of median by placing the post it notes on adding machine paper and fold it in half.
5. Construct a bar graph on an overhead transparency to display the data.
Parts to include
 1. horizontal base line
 2. vertical side line
 3. number lines (find range before)
 4. label lines

Conclusion: General statement about what we learned?

We learned that boys have less letters in their names than girls.

Discuss the idea of sample size & accuracy of conclusion. We do not have enough data to make a general statement above. A person would need to collect more data.

DAY 3

Individual work:

1. Teacher surveys the number of people in each brother and sisters of each student and write it on the whiteboard in a random order.
2. Students construct a line plot with the information on one side of grid paper
3. Students find the range, and mode of the data and record it above the line plot.
4. Student make a bar graph on the back side of the grid paper. **MUST** use color pencils

DAY 4 Hoop Shoot

Goals:

1. Construct own Line Plot
2. Construct own pictograph
3. Review concept of range and mode
4. Students find median and mean of shots made left handed
5. Introduce criteria of a good question.
6. Introduce concept of variables.

Materials:

- 4 basketballs
- 4 baskets
- 1 post it note for each student a different color for each section

Investigation Question: What do we want to find out?

Which class can shoot better?

Hypothesis: What do you think will happen?

Estimate or guess the answer the question.

Which class will make the most shots right handed?

Which class will make the most shots left handed?

How many free throws will most of the kids make?

Procedure: How will we do the experiment?

1. Explain the info. needed on table and students will design their own chart/tally record sheet. record sheet must include gender, class, shots made right hand, shots made left handed
2. Students shoot and record number data on record sheet on basketball court. Teacher will change the one variable making it easier for some classes than others.

Results: What actually happened?

1. After students return to the classroom they write their shots made right handed on post it notes - put homeroom teachers name on the back of note.
2. Students place their results on a line plot on the whiteboard
note: post its should be stacked on top of each other with no space between them.
3. Find the range, mode, mean, & median of the number of shots made right handed.
4. Construct a pictograph on the whiteboard using circles that look like basketballs.

Individual work:

1. Have the students design their own pictograph using the classes actual data.
Must have key to communicate how many each symbol represents
Each "basketball" represents two people
Decide how to show partial symbols
(Show whole symbol and only shade in part)
1/2 of a basketball = 1 person

DAY 5

Individual work:

1. Teacher records on the whiteboard the number of shots made left handed.(in random order)
2. Students construct a line plot with the information on one side of grid paper
3. Students find the range, mode and median of the data and record it above the line plot.
4. Student make a pictograph on the back side of the grid paper. MUST use color pencils

Conclusion: General statement about what we learned?

1. Discuss the results with the class - range, & mode.

What was the maximum number of shots made right handed?

What was the minimum number of shots made right handed?

$$\text{Max} - \text{Min} = \text{Range}$$

What number did most people make?

$$\text{Most} = \text{Mode}$$

What is the middle number when lined up = Median

What makes a good question?

1. Is the question feasible?
2. Will all people understand the question in the same way?
“shoot better” - lay ups, 3 point shots??? must be more specific
3. How will you measure you data?

What was “not fair not equal” about the test?

1. Distance from basket.
2. Height of the basket (we have adjustable height hoops)

To keep an experiment “fair” for all people being tested we needed to keep the same except for the one thing we are testing. The one thing being tested is called the variable.

DAY 6 Water Relay

Goals:

1. Review the concept of mean

Materials:

- 4 tablespoons
- 4 graduated cylinders

Investigation Question: What do we want to find out?

Which class can get more water from a bucket of water into a graduated cylinder 15 feet away?

Critique the question using the criteria

1. Is the question feasible?
2. Will all people understand the question in the same way?
3. How will you measure you data?

“more water”???must be more specific how will we measure data

Modify question so all are clear about what is being compared.

Hypothesis: What do you think will happen?

Estimate or guess the answer the question.

How much will we be able to move in 3 minutes?

Procedure: How will we do the experiment?

1. Put the students into groups
 - have a different number of groups in each class 3, 4, 5, or 6 groups
2. A student scoops water with the spoon and pours it into the graduated cylinder.
3. they can run and hand off the spoon and the next student attempts to carry water.
4. students continue until 3 minutes is over

Results: What actually happened?

1. To find how well the class did the teacher will find the mean by pouring water from one graduated cylinder to another until they are all even.
2. Explain that the other classes may have a different number of groups so we can not simply pour all the water together because the group with more groups would have an advantage.
3. Could we do this a different way? Pour all the water into one large container and divide the total amount by the number of groups.

DAY 7 Crane Activity (AKA standing on one foot)

Goals:

1. Introduce stem and leaf plot
2. Calculate range, mode, median, and mean
3. Discuss the importance of controls and using specific language.

Materials:

- 2 post it notes for each student
- 1 stop watch per group
- 1 grid paper per person

Investigation Question: What do we want to find out?

Which class can stand on one foot longer?

Hypothesis: What do you think will happen?

Estimate or guess the answer the question.

What will be the range of our experiment?

What will be the mode of our experiment?

What will be the median of our experiment?

PART #1 Estimates

1. Have students estimate how long they will be able to stand on one foot with their eyes closed.
Estimate in seconds a multiple of 10 (eg 10,20,30 ... , maximum of 180 seconds
Students write their estimate on one post it note
2. Students place predictions on a stem and leaf plot on the whiteboard.
3. Discuss the range, mode, mean, and median using the estimated data.

Procedure: How will we do the experiment?

PART #2 Experiment

1. Students will do experiment with a partner.
 - A. The STANDER will stand on one foot.
 - B. The TIMER will time the stander, make sure the stander does not get hurt, and record the time.

Results: What actually happened?

1. Students will record the time on a post it note and place it on the other side of the stem and leaf plot.

Conclusion: General statement about what we learned?

1. Discuss as a class...
 1. how the estimates differ from the actual.
 4. Must be specific when writing the procedure.
 - A. starting procedure start with eyes open or closed
 - B. ending point - can you hop?

DAY 8 Cool It

Goals:

1. Find the range, mode, median, and mean of results
2. Construct a line graph and discuss when to use line graphs

Materials: (per group)

- 1 styrofoam cup
- 1 clean tin can
- 2 Celsius thermometers
- 1 stop watch
- Hot water at least 75 degrees C

USE “Cool It” activity from the AIMS Educational Foundation
Math + Science: A Solution c 1987

Investigation Question: What do we want to find out?

Hypothesis: What do you think will happen?

Procedure: How will we do the experiment?

Results: What actually happened?

Conclusion: General statement about what we learned?

Individual work:

Students will construct their own line plot.

DAY 9 Traits

Goals:

1. Construct Pie Graphs using a protractor
2. Introduce concept of sample size
3. Introduce concepts of heredity and traits
4. Introduce concept of how one question leads to another.
5. Have a concrete example on fractions

NOTE: students must be able to construct an angle to do this activity

Materials:

- 1 large piece of cardboard
- 30 ft of yarn
- 1 piece of construction paper for each person
- 1 sheet of 1cm grid paper per person
- Students bring color pencils, rulers, glue, and scissors

Investigation Question: What do we want to find out?

Does gender affect the tongue rolling trait?

Hypothesis: What do you think will happen?

Estimate or guess the answer the question.

Which gender will have larger fraction for the tongue rolling trait?

Procedure: How will we do the experiment?

Results: What actually happened?

1. Make a physical fraction bar of boys using each student as 1 unit by having the students line up against the wall. Use a large piece of cardboard to mark the division. Repeat with girls.
2. Discuss what fraction of the boys and girls have the trait for rolling their tongue and what fraction can't roll their tongue and record the number on the whiteboard.

EXAMPLE:

$\frac{2}{11}$	$\frac{9}{11}$
nonrollers	rollers

BOYS

$\frac{4}{12}$	$\frac{8}{12}$
nonrollers	rollers

GIRLS

3. Have the students form a circle and use a piece of yarn to make a pie graph using the students as each unit.
4. Construct a "poster display" as a group
 - A. Format the poster
 1. Write the Question at the top of the poster
 2. Label "boys" and "girls"
 3. Label Conclusion at the bottom of the poster
 - B. Construct a fraction bar using the classes data and glue it to the poster.

C. Construct a pie graph using the classes data

1. Review measuring angles
2. Given the fact there is 360 degrees in a circle have students attempt make a pie graph quietly on their own for 3 minutes.
3. Have students explain how they found the size of the slice on the whiteboard.
4. Discuss and develop the process below

360 number of degrees	23 number of students	15.65 round to 16 degrees per student
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BOYS

16 degrees per student	2 number of nonrollers	32 degrees in slice of nonrollers
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GIRLS

16 degrees per student	4 number of nonrollers	64 degrees in slice of nonrollers
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D. Write the conclusion at the bottom of the page

1. Example

“I learned that a larger fraction of boys have the trait for tongue rolling.”

2. Often times the experiment leads to a new question. How does Heredity affect a students ability to roll their tongue?
5. Students take heredity data sheet home and complete.

DAY 10

Individual work:

1. Teacher will record the heredity data on the whiteboard.
2. Students will construct a “poster display” to display the data about one of the traits.
 - A. Format the poster
 1. Write the Question at the top of the poster
 2. Label “boys” and “girls”
 3. Label Conclusion at the bottom of the poster
 - B. Construct a fraction bar using the classes data and glue it to the poster
Discuss what each part of the fraction means
 - C. Construct a pie graph using the classes data
Review measuring angles
Review how to determine the size of the slice of the pie graph
 - D. Write the conclusion at the bottom of the page
 - E. Based on the data how can you predict a person’s traits.

DAY 11 Peanut Butter Comparisons

Goals:

1. Construct a box and whiskers plot as a way of comparing two groups
2. Discuss the use of quality rating to measure results

Materials: (per group)

- 1 sheet of construction paper
- 1 sheet of grid paper
- 1 Lab sheet 1.1 Peanut Butter Comparisons

Investigation Question: What do we want to find out?

Which has a higher quality rating - natural or regular?

Hypothesis: What do you think will happen?

Estimate or guess the answer to the question.?

Procedure: How will we do the experiment?

1. Consumer Reports

Results: What actually happened?

1. Find the range - these numbers will be the whiskers
2. Find the median by placing the data in order and finding the middle number.
May want to use small pieces of paper so the students can rearrange the data if necessary.
3. Find the median of the lower half and upper half. These numbers make the ends of the box.

Conclusion: General statement about what we learned?

We learned that natural peanut butter had a higher quality rating than regular peanut butter.

DAY 12

Individual work:

1. choose two things you wish to compare in the peanut butter table
2. list the data in order and find the median
3. find the median of the lower half and upper half
4. construct a box and whisker plot
 1. title
 2. label each box and whisker

DAY 13 Individual Class Investigation

Goals:

1. Students will formulate a comparison question appropriate for investigation.
2. Students will form a hypothesis
3. Students will organize raw data on a record sheet.
4. Students will use measures of center to analyze data
5. Students will construct a visual representation (graph) of data
6. Students will construct a general statement based upon the data collected

Product:

The student will construct a poster display of investigation.

Group Display

1. Question: Do boys or girls own more dogs?
1. Review concepts of questioning, data organizing, measures of center and graphing covered during the unit.
2. Explain the students will be constructing a classroom display about the 6th grade class.
3. Each student must formulate a question whose answer might provide interesting information about the class.
4. The student must design a record sheet to record raw data
5. Student will stay in their desks and they will pass their record sheets around the room. Give about 15-30 seconds each turn.
6. When record sheet returns to the owner students will begin working on poster display.
7. Students will present their data to the class in a short presentation.
8. Display finished posters in the hall outside the classroom or in the library.

Display will include

1. Question
2. Hypothesis
3. Organized raw data
4. Visual representation of data
5. Conclusion
6. Prediction based on data

Oral Presentation Form

1. The question which I gathered data on is

2. My hypothesis is

3. To collect the data I

4. I used _____ to organize my data

5. I used a _____ to visually represent the data.

6. I learned

Getting to know you

CLASS INVESTIGATION

Content Standard: **Chance and Data Handling;** Level: middle

Specific Statement(s) from the Standard:

A student shall:

- 1.calculate basic measures of center and variability, to demonstrate understanding of basic concepts of probability and calculate simple probabilities;
- 2.formulate a question and design an appropriate data investigation;
- 3.organize raw data and represent it in more than one way;
- 4.analyze data by selecting and applying appropriate data measurement concepts;
- 5.critique various representations of data;
- 6.devise and conduct a simulated probability situation; and
- 7.predict future results based on experimental results.

Product(s):

The students will construct a poster display and present its data to the class.

Task Description:

1. Students will formulate a question whose answer might provide interesting information about the class.
2. Students will clearly state a hypothesis to the question
3. Students will collect raw data and organize it by designing a record sheet.
4. Students will use a visual representation (graph) to clearly communicate the data they collected.
5. Students will form a logical conclusion about the data they collected and clearly state it in written form

Special Notes:

This project is designed to help students practice gathering organizing, and analyzing data in preparation for a larger science fair project.

PERFORMANCE PACKAGE TASK 1
(Class Investigation)

FEEDBACK CHECKLIST FOR TASK 1

The purpose of the checklist is to provide feedback to the student about his/her work relative to the content standard. Have the standard available for reference.

Y=Yes

N=Needs Improvement

<u>Student</u>		<u>Teacher</u>
_____	question appropriate for investigation	_____
_____	hypothesis stated clearly	_____
_____	raw data organized on record sheet	_____
_____	data correctly analyzed using appropriate measures of center	_____
_____	visual representation (graph) of data clearly communicates results	_____
_____	logical conclusion based on results	_____