WORKSHOP SEVEN

Understanding Data

Tally of Number of Letters



Collecting and Analyzing Data

Outcomes

- To explore key concepts related to data analysis.
- Collecting and organizing data.
- Interpreting and predicting from graphs.
- To experience activities designed to reach diverse learners.

Overview

In <u>Understanding Data</u>, participants explore organizing and explaining data. As participants enter they make a graph that displays the number of pets each family has. Discussion follows on what the data shows, how the data is distributed, and on predictions or conclusions which can be made.

Participants then share the history of their names. They discuss details of the names in their families, pronunciations that might have changed over the years, and their origin. Then they use their names as the basis of an exploration of data analysis.

The participants build a human bar graph by lining up according to the number of letters in their first names. Next they create a bar graph on a chart using post-it notes which show the number of letters in their names. Through discussion, the participants title and label the graph. Then they informally discuss this visual representation of the data. Conclusions and predictions are made from the graph.

In order to gain a better understanding of the terms used with data analysis, the participants discuss concepts of range, mean, median and mode. Each of these measures is applied to the list of family names generated at the beginning of the session.

Information from local, state or national standards is shared. Connections are made between the concepts of the module and the district curriculum. At this point, facilitators share activities from their textbooks and explain the main concepts that are learned at the different grade levels in their schools.

The workshop ends with parents being provided with activities to use at home with their children.

Mathematics Background

The mathematical concepts in this module include:

- a) Data: Factual information used as a basis for reasoning, discussion or calculation; The word, data, is in plural form, thus stating ,"The data are analyzed." is correct while stating, "The data is analyzed" is incorrect.
- b) Measures of central tendency are:
 - Mean: an equal sharing of the total number of items in a set of data; an even redistribution of a set of data; found by adding the numbers, then dividing by the number of items in the set of data; commonly called average.
 - Median: the middle value when the numbers are arranged in increasing order.
 - Mode: the most frequently occurring number in a set of values; a data set can have more than one mode.
 - **Range**: the difference between the largest and smallest numbers in a set of values. Mathematically, mean, median, and mode are all averages. Since the common use of average is the mean, this workshop will refer to the mean as the average.
- c) Creating bar graphs by:
 - Labeling each axis.
 - Giving the graph a title.
 - Adding numerical information.

Literary connection

If everyone speaks the same language, selections from <u>Chrysanthemum</u>, by Kevin Henkes can serve as a good introduction to this module.

Mode, median, and mean

The question as to why and when one would use mean, median, or mode often arises. There are many reasons, but it is helpful to think about some different uses. Let's look at a piece of information and how it could be used differently. Seven new houses were sold last week. The prices are listed below:

- 1. \$100,000 2. \$100,000 3. \$100,000 4. \$300,000 5. \$600,000 6. \$900,000 7. \$1,400,000
 - a) **Mode = \$100,000:** A contractor would want to know what the mode is so that he can sell his houses easily when he finishes building them. Most people are paying \$100,000 for a house, so he will build more for \$100,000. Many sales people want to know what is most common.
 - b) **Mean = \$500,000:** The mean is handy for approximating amounts. A city accountant wanted to know what the approximate taxes would be for the new houses that were sold last week, He could multiply \$500,000 times seven houses and know that the city will be getting taxes from \$3,500,000 in new housing.
 - c) **Median = \$300,000:** The same city planner was trying to project out what the revenues from new housing would be for the year. He knew that the \$1,400,000 house was a rare one in this area, so was concerned about using \$500,000 as an average. Instead he used the median. When one item is especially high or low, the median is a more accurate look at the average.

Finding the mean using manipulatives

The mean can be found by an equal sharing process.



amount of balls.



After Sharing: Each has the same amount of balls.

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Room Setup

- Desks or tables arranged in groups of 4-6
- Tables for sign-in, supplies, estimations, and snacks
- Overhead projector and screen
- · Chart paper on easel
- Poster of the agenda
- · Large area to hang butcher paper to create a graph
- Space for participants to line up

Materials

Facilitator	Transparencies
 Overhead projector Overhead pen Overhead square tiles Transparencies, write-on Chart paper Chart markers Butcher paper Masking tape Scissors Book: <u>Chrysanthemum</u> (optional) Timer (optional) 	BLM 1: Welcome BLM 82: Post-it Note Bar Graph BLM 83: Describing a Set of Data BLM 84: NCTM Data Analysis and Probability Standard
Participant	Handouts
Participant Individuals: • Pencil • Paper • Marker, black • Scissors • Name Strips (cut from BLM 80) • Calculator (optional) • Reflection	HandoutsPrepare before class:BLM 80: Name Strips (cut into strips)One per participant for classBLM 81: Family NamesBLM 83: Describing a Set of DataOne per participant for homeBLM 85: Creating Graphs at HomeBLM 87: List of TermsThree per participant for home

Timing

2 hours and 25 minutes

Preparation and Timing (2 hours)

Part 1: Preparing Classroom and Getting Started (10 minutes) - with children

Make transparency of:

BLM 1: Welcome

Prepare before class for Part 4:

BLM 80: Name Strips (cut into strips)

Distribute to each participant:

BLM 81: Family Names Paper, pencils, markers, and scissors Name Strips and Post-it® Notes (1 pad per group)

Part 2: Setting the Stage (10 minutes)

No transparencies or handouts

Part 3: Family Names (15 minutes)

BLM 81: Family Names (handed out at beginning of session)

Part 4: Name Strips (10 minutes)

No transparencies or handouts Materials should already be on tables

Part 5: Building a "Human" Bar Graph (20 minutes)

No transparencies or handouts

Part 6: Building a "Post-it Note" Bar Graph (20 minutes)

Make transparency of: BLM 82: Post-it Note Bar Graph

Part 7: Describing a Set of Data (20 minutes) - without children

Make transparency of: BLM 83: Describing a Set of Data

Make copies for each participant: BLM 83: Describing a Set of Data Distribute to each participant: Calculators (optional)

Part 8: Connections (10 minutes)

Make transparency of: BLM 84: NCTM Data Analysis and Probability Standard

Part 9: Take Home Applications (5 minutes)

Make copies for each participant:

BLM 85: Creating Graphs at Home BLM 86: One-Inch Graph Paper (three copies per participant) *BLM 87: List of Terms*

Part 10: Closing (10 minutes)

No transparencies or handouts

Distribute reflections or evaluations and estimation prizes

Articles from NTCM

Investigations Levels 3 and 4, "*Name Dropping*", Teaching Children Mathematics, Vol. 2, No. 1, September 1995, P. 32.

Investigations Levels 5 and 6, "What's in a Name", Teaching Children Mathematics, Vol. 2, No. 1, September 1995, P. 34.

Litton, Nancy, "Graphing from A to Z", Teaching Children Mathematics, Vol. 2, No. 4, December 1995, P. 220.

Data Explorations Focus Issue, Teaching Children Mathematics, Vol. 2, No. 6, February 1996, All Articles.

Botula, Mary Jean and Ford, Margaret I., "*All About Us: Connecting Statistics with Real Life*", Teaching Children Mathematics, Vol. 4, No. 1, September 1997, P. 14.

Scavo, Thomas R. and Petraroja, Byron, "*Adventure's in Statistics*", Teaching Children Mathematics, Vol. 4, No. 7, March 1998, P. 394.

Basile, Carole G., "*Collecting Data Outdoors*", Teaching Children Mathematics, Vol. 6, No. 1, September 1999, P. 8.

Kilman, Marlene, "Beyond Helping with Homework: Parents and Children Doing Mathematics at Home", Teaching Children Mathematics, Vol.. 6, No. 3, November 1999, P. 140.

Books

Standards 2000 Project, *Principles and Standards for School Mathematics*, The National Council of Teachers of Mathematics, Inc. (NCTM), 2000, p. 108, ISBN 0-87353-480-8, <u>www.nctm.org</u>

Henkes, Kevin, Chrysanthemum, The Trumpet Club, 1991

Instructional Programs

Investigations in Number, Data, and Space, Grade 4: The Shape of Data, TERC, Dale Seymour Publications

Newsletter

Math Solutions, "Growing Mathematical Ideas in Kindergarten". No. 26, Fall/Winter 1999-2000. For more information call 1-800-868-9092.

Activities		
Preparation of Classroom	Notes	
 Before class begins, cut-up grid paper strips using BLM 80: Name Strips. Set up a table with a sign-in sheet, name tags, and snacks. On another table set up estimation activities. Arrange desks or tables in groups of 4-6. Display the transparency of BLM 1: Welcome!. On the participant tables, have pencils, paper, markers, scissors, post-it note pad, name strips, and copies of BLM- 81: Family Names. Have participants start listing their family names as the session begins. Prepare and display a poster with the agenda and purpose of the session. Post the shoe colors chart. Record your shoe color information and that of other adults as a sample. As participants arrive ask them to use tally marks to record their shoe color. See note A. 	BLM 1: Transparency BLM 80: Handon BLM 80: Handon BLM 80: Handon BLM 80: Handon Comparison BLM 81: Handon BLM 81: Handon Comparison Frendy Frent Near BLM 81: Handon Comparison Frendy Frent Near BLM 81: Handon Comparison Frendy Frent Near Comparison Frendy Frent Near Comparison Compariso	lout
Part 1: Getting Started (10 minutes) - with children		
 Introductions Introduce yourselves and then have the participants introduce themselves. Briefly explain the MAPPS program. Have participants who are involved in the program share their experiences. Go over the agenda and purpose for the session. Tell the participants that they will be looking at different ways to collect and organize information and make sense of the data. 		
Part 2: Setting the Stage (5 minutes) - with children		
1. Ask participants to look at the chart that shows their shoe colors. Say: Talk with your child or with others at your table about anything you notice about the chart.		

Part 2: Setting the Stage (5 minutes) - with children	Notes
 2. Ask for volunteers to make a statement about the shoes being worn today. Statements should be similar to: a) Most of us have shoes on. b) people are wearing white shoes. c) No one is wearing shoes. d) There are more people wearing brown shoes than black shoes. e) There are people here. 	
3. If the ideas below are not presented, ask: Is there anything else we can tell from this graph? (total number of people)	
4 . Ask : If someone else walked in this room, what color of shoe do you think they will be wearing? Why do you think so?	
5. Let participants know that we will be collecting more data and using different methods to display the data.	
Part 3: Family Names (15 minutes) - with children	
 Ask participants to list their family names on BLM 81: Family Names. Encourage conversation among themselves about the names. If children are not present, have this discussion in small groups. What is the origin of the names? What is the origin of the names? What are common and uncommon names in your family? What are some of the nicknames in your family? Have any of the names or pronunciations changed slightly or altogether? Why? 	BLM 81: Handout
2. Ask a few participants to share something about the family names with the whole group. This provides a real life opportunity to discuss diversity as it relates to names, their pronunciation, their origin, and culture.	
3. Have a short discussion about how our classrooms today can be very diverse. Accepting and celebrating diversity is important. Textbooks reflect this in their choice of names, pictures and word-problems. In the past, names used in textbooks were from the dominant culture. Today you should see more of a multi-cultural approach in all text- books used in your child's class. Say: Now that we have explored the variety and origin of names, we are going to use names as the basis for our mathematics exploration.	

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Part 4: Name Strips (10 minutes)	Notes
1. Have participants write their first name on the name strips, writing one letter in each square. Show an example of this. Instruct them to cut off the unused squares of their strip. See note B .	B. NOTE: Participants may use their given first name or a nickname. Allow them to make the choice. See example of the name strip below.
 Have participants count the letters in their first names. Then have them write their name and the number of letters (using a dark marker) on a post-it note. Show them an example that illustrates that the number should be written large enough to see from a distance. See note C. Have small groups of participants (4-6) place their name strips on the table. Ask them to arrange them from smallest to largest. Ask participants to discuss anything they notice about the length of their names. 	N O R A Cut this part off C. NOTE: Example of the post-it note. Nora 4
Part 5: Building a "Human" Bar Graph (20 minutes) - with children	
 Ask participants: What do you think is the fewest number of letters that some one here has in their name? What do you think is the greatest number of letters that some one here has? 	
2. Have participants write down their guesses on a sheet of paper. Then start questioning them. Who has fewer than 5 letters in their first name? 4 letters?	
 3. Continue with this questioning until you find the person in the room with the fewest number of letters in their name. Have that person come to the front of the room and stand to the far left side of the room. See note D. Ask: Did anyone guess that our shortest name would have these many numbers? What did you base your guess on? 	D. NOTE: Participants should position themselves as if they were on a number line with the numbers increasing from left to right.
4. Now look for the person in the room who has the most letters in their name. Say: Who has 5 or more letters in their name? 6 letters? 7 letters?	***
5. Continue with this questioning until you find the person in the room with the greatest number of letters in their name. Have that person come to the front of the room and	3 4 5 6 7 8 Number of letters in name

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Part 5: Building a "Human" Bar Graph (continued)	Notes
 position themselves on the far right side of the room where they think they would be once everyone has lined up. Ask: Did anyone guess that our longest name would have this amount of letters? What did you base your guess on? 	
6. Have the rest of the participants line up side by side based on the amount of letters in their name. If there is more than one person with the same number, have them line up in a single file line (one behind the other). They are creating a "Human Bar Graph."	
7. Once the "human graph" is completed ask: What do you notice?	
Some things participants might mention are: a) The number of letters that appears the most. b) The number of letters that appears the least. c) The range of numbers of letters.	
8. Ask participants to return to their seats.	
9. Say: We have just created a human bar graph.	
Record the words "bar graph" so all can see. Explain that they are now going to use the post-it notes to create another bar graph.	
Part 6: Building a "Post-it Note" Bar Graph (20 minutes) - with children	
Creating the Graph: 1. Have participants talk with each other about how they might use the post-it notes to make a graph.	BLM 82: Transparency
 Have them share some ideas with the large group. Follow this by displaying BLM 82: Post it Note Bar Graph so everyone understands what needs to be done. 	The second sec
3. Have the participant with the fewest letters in their name come to the front of the room and place their post-it on the chalkboard or a piece of butcher paper.	
4. Call up the rest of the participants (by number of letters) to place their post-it notes until all have been posted.	

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Activities	
Part 6: Building a "Post-it Note" Bar Graph (continued)	Notes
 Making sense of the graph: 1. Ask: How is this graph different than the human bar graph we made earlier? How is it the same? Why might we want to use a graph to display /record information? (It can be easily read, described, and compared.) 	E. NOTE: Example of "Post-it Note" Bar Graph. Each post-it represents a participant and each number represents the number of letters in their name. How Long are Our Names?
 2. Ask: If someone walked in, would they know what the post-its represented? How can we help others to better understand our graph? 	Sharon 6 Joga Aaron 4 5 6
 3. Ask questions that help participants think about labeling the graph, such as: What do these post-its represent? What would make it easier to count the number of post-its? How would someone know what this graph is all about? Answers should lead to the naming and labeling of a) A title b) The horizontal axis (it represents the number of letters in the names) c) The vertical axis (and placing numbers below the post-its; it represents the number of people) See Note E. 	Bob Deby Darcy Javier Jennifer 3 4 5 6 8 2 3 4 5 6 7 8 Number of Letters
 4. Ask participants to talk to each other about the graph. What can you say about the lengths of our names? What do you notice when you look at the graph? Below are some questions that will help reveal important data concepts. Answers in parenthesis refer to the graph in Note E. How long are most of our names? (Most are 4, 5 or 6 letters long) Are there numbers that do not have post-its? (2 and 7) Why? (2 letter names are not very common for us. Many 2 letter names are nicknames. Names with 7 letters could occur) The length of our names range fromto (3 to 8) What length of name occurs most often? 	

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Part 6: Building a "Post-it Note" Bar Graph (continued)	Notes
 5. Another important data concept is that of rare data. To discuss this, say: Look at your list of family names. Are there any names on the list that would not be on our graph? Can you think of a name that has more than 10 letters? Does anyone have a name with more than 11 letters? 12? 13? These names may be rare or unusual. 	
6. Have the participants take a few minutes to talk with their children about the graph.	
7. Dismiss the children.	
Part 7: Describing a set of Data (20 minutes) - without children	
 Tell participants that they just discussed some very important concepts related to Data Analysis. In schools today young children collect and organize data into charts and graphs. They also begin to describe parts of the data to decide what the data shows. As they progress in their education, their work with data analysis becomes more complex. 	
• Let's take a few minutes to look at how some of the concepts that we discussed earlier relate to concepts and terminology learned in the middle grades.	BLM 83: Transparency / Handout
Range 1. Distribute and display BLM 83: Describing a Set of Data. Say: We are going to focus on 4 ways to describe data. Let's look at our graph again. The length of names started at and ended at We said that our names ranged from to This difference is called the range.	Describing a Set of Data Family Names
2. Write the word "range" in one of the boxes on BLM 83 . Explain to the participants that range refers to the spread of the data. If the names vary from 3 letters long to 8 letters long, the spread of the names is from 3 to 8, or a range of 5. Range refers to how far apart the smallest and the largest pieces of the data are. Beside the word range, write "spread of data" or "how far apart". See Note F .	F. NOTE: Example chart of BLM 83 transparency to show the progressive use of the chart. This shows Range. Describing a Set of Data

3. Ask participants to look at their list of family names and record the range of their family names on their chart.

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Range (how far apart)

Part 7: Describing a set of Data (continued)

Mode

1. Say:

Let's look at another way to describe the data. The most common length of name we had on our graph was _____. This most common data is called the mode.

2. If the data did not have more than one mode, explain that more than one mode often exists.

3. Write the word "mode" in the second box on **BLM 83**. **See Note G**.

4. Ask:

What should we write to remind us about the meaning of mode? Record "most common" or "most often".

5. Ask participants to look at the length of their family names and record.

Median

1. Say:

- Another way to describe the data is to use the median. Talk to each other about what the median could mean.
- What do you think the median is?

2. Ask a few participants to share their thinking. Lead them to definition of the median as the middle number. It is important to stress that the numbers must be put in order first and then the middle number is found.

3. Write the word "median" in the second box on **BLM 83** and write "middle number" next to it. **See Note H**.

4. Say:

What does the median tell us?

(The middle number after all the items are put in order. This number is greater than half of the numbers in the set of numbers and less than the other half. The median is exactly in the middle.) **See Note I**.

5. Ask participants to find the median for the length of their family names. Remind them to place the numbers in order before finding the median.

G. NOTE: This shows Mode as the next progression.



I. NOTE: The example of a "Post-it Note" bar graph in note E show the following numbers: 3, 4, 4, 5, 5, 6, 6, 6, and 8. In that example, the middle number is between 5 and 6 so 5 1/2 is the median.

Part 7: Describing a set of Data (continued)	Notes
 Mean/Average: 1. Say: The most commonly known data analysis concept is the mean. It is commonly referred to as the average. Write the word "mean" in the next box on BLM 83. Beside it write "average". See Note J. 	J. NOTE: This shows Mean as the next progression. Describing a Set of Data
 2. Ask participants to think about what average means to them. Then ask them to do one of the following: a) Give a formal definition of average. b) Explain it in their own words. c) Write an example or draw a picture that explains average. 	Range (how far apart) Mode (most common) Median (middle) Mean (arithmetic average)
3. Have participants share their thoughts with others at their tables. Ask for volunteers to share with the whole group.	
4. In most cases, someone will share that to find the mean or average you add the numbers of a set and divide by the number of items in the set. Acknowledge that this is a correct process of finding the mean.	
5. Have participants find the mean for the length of names on the post-it chart. Calculators can be made available for this.	
6 Tell them that the dictionary definition for average includes: usual, typical, not exceptional, arithmetic mean. Tell them that using that definition of typical and not exceptional, they may understand why mode and median are also called averages today. Write the word" average" next to both median and mode on BLM 83 .	
Part 8: Connections (10 minutes)	
1. Tell the participants that they have done a lot of mathematics in this session. Ask: Why is it important for students to know about graphing and analyzing data	
(People construct much of their knowledge of the world through informal analysis of data they encounter. Graphs and averages are often used as a means of convincing. They are used to support an argument.)	
2. Show examples of data analysis problems at different grade levels from the district's curriculum. This is important to participants because they like to know what their children are doing in school.	

Part 8: Connections (continued)	Note
3. Connect the ideas of the workshop to either the national, state or local standards. BLM 84: NCTM Data Analysis and Probability Standard presents the national standards. Show the participants the progression through data analysis.	BLM 84: Transparency Next Class And Class
Part 9: Take Home Applications (5 minutes)	
 Distribute the following handouts for the participants to take home: BLM 85: Creating Graphs at Home BLM 86: One Inch Graph Paper (several sheets) BLM 87: List of Terms 	<section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header>
Part 10: Closing (5 minutes)	
 If your district does not have an evaluation form to use, have them answer one of the following questions: What did you learn tonight? What will you do with your child as a result of this session? What did you find interesting tonight? Distribute any prizes from estimations or drawings. Thank participants for coming during their busy schedules. 	

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