Numbers and Social Problems: Survey Says! 1st Graders Look at the Numbers

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Introduction

"Survey says!" Richard Dawkins spoke those lines on television as we tuned in to see what answers people gave to questions both esoteric and mundane. People have a natural curiosity about what others think and like. We have numbers everywhere; we see surveys in the Wilmington News Journal: "Delaware by the Numbers". We know which summer movies are "blockbusters" and which are "bombs" all based on numbers - how many "Rotten Tomatoes" did a film get? Kids (and adults) are susceptible to all sorts of suggestions based on numbers we see. For example, I wouldn't go see *Guardians of the Galaxy* until I saw how many stars it received. In the media, we see charts and "infographics" detailing all kinds of information. Do the numbers add up? Is what they say actually important and relevant to our lives or are they just for entertainment value? Educationally, numbers are used to justify academic goals and achievement. Numbers are important. What do the kids think about this? The unit I have written involves teaching data analysis and critical thinking skills to 1st graders. This 11-day unit will tie in with our Math unit on Data Collection in the Investigations curriculum. I want students to take a closer look at numbers and how they are presented to us and see what exactly they are telling us, if anything. In order to do this, students will create a survey to administer to their peers. After collecting the data, students will "crunch the numbers" and then analyze their findings.

1st graders are still learning basic math skills. Numbers beyond 20 (fingers and toes) mean very little to them. At the beginning of the school year, many students still have difficulty counting into the teens, writing numbers correctly (91 meaning nineteen and 1001 meaning one hundred one), and writing them in the proper order. With that being said, students know that numbers are important and that many decisions that affect their lives are based on numbers. Students are also very curious and love to answer surveys to see whether their own choices are popular. We give surveys as part of our curriculum but I want to dig deeper into how to ask good questions and then what the answers we collect mean.

Students need to think critically about the numbers. Do they add up correctly? Using error analysis, we will look to find and correct any mistakes that are made. Is the difference between two numbers as much as we think it is or as much as we are led to believe? Do the numbers even matter? Is what we are being told even important to our choice? How can we give a survey and have accurate data? How can we (and should we) skew the data to fit our purposes? Does how we present the data change the meaning? Does how we ask the question and the choices we give change the meaning? How can we use the data to help us make informed decisions? Students will work cooperatively in pairs and groups to look at either data from appropriate resources or teacher-created data and analyze it to see what it is saying. Students will also work together to compose and then give a survey to their peers and then to the faculty or the school community at large. Again, we will see what the data tell us and, depending on the topic of the survey, may make an action plan based on that information.

Background

The elementary school where I teach is comprised of many different kinds of students. Our school has approximately 1200 students from Kindergarten through 5th grade. There are nine 1st grade classrooms grouped together in three clusters of three rooms. This year I have 22 students from Hispanic, African, Caribbean, Asian and Middle Eastern cultures as well as students whose families are from the United States. Socio-economically, my class is also diverse with all economic classes represented. I have 14 boys and 8 girls. The numbers we look at may mean different things to different students based on their tastes, opinions and experiences. How do these classroom characteristics of gender, race, culture, and class affect the questions that are asked, and the data that are collected, represented and then interpreted?

In our school we teach Math for one hour and then have a Math Intervention period for a half hour later in the day. Our Math curriculum is divided into nine units which take varying numbers of days to complete. Our unit on data investigations is the fourth unit that we teach sequentially and comes after units on number sense, geometry and story problems. Most students have an understanding of number order, greater than and less than, addition within 20, and different combinations of two addends that can equal a particular number (1+9=10 and 2+8=10 etc.). Students have had only a basic introduction to subtraction. Students are encouraged to use efficient strategies to solve addition and subtraction problems such as “counting on” using a number line or hundred chart instead of drawing pictures to represent the numbers and counting every one. Students have also sorted items by attributes (color, size, number of sides, etc.). Our Math curriculum stresses cooperative learning where students play many games. One game students play as an introduction to data collection is “Guess My Rule”. In this game, students must figure out how things, people, or words, etc. have been placed into categories and where they should place other items based on the current rule.

In “Tracking PA Announcements”, Robert Berkman observes that his tracking of the number of interruptions to the classroom got his students interested in something that was a common occurrence during the school day. As students started collecting data, it “got them involved in thinking about why things were the way they were, and as they answered one question, others sprang up, which ultimately led them to the realization that things didn't have to be this way."[1] By having my students think critically about the numbers we see, I hope that they will eventually be able to have a similar epiphany.

Concepts

When I signed on for this seminar I knew that it would be difficult to find age appropriate information to share with my first graders. "Numbers and Social Problems" is just not an appropriate topic for my class. Students at this age have a hard time seeing past their own limited experiences. My thought is that if I can get my students to look critically at data we collect, I can lay the groundwork for them to think critically about all sorts of information they will encounter about society in later years.

How can I get them to "do" data analysis? Some are weak on number sense, many have a hard time seeing beyond the surface of a problem, and most can hardly sit still for five minutes. The first task is to make the data relevant. If they are interested in what the numbers are saying maybe they will be able to look more closely at them. Okay, so we analyze the data: we look at the data, see that the numbers add up, and we're done, or are we? According to Joel Levine and Thomas Roos of Dartmouth College,

> The numerical results provided by a data analysis are usually simple: It finds the number that describes a typical value and it finds differences among numbers. Data analysis finds averages, like the average income or the average temperature, and it finds differences like the difference in income from group to group or the differences in average temperature from year to year. Fundamentally, the numerical answers provided by data analysis are that simple.
> But data analysis is not about numbers — it uses them. Data analysis is about the world, asking, always asking, "How does it work?"[2]

This is exactly what my first graders want to know: "How does it work?"

If we are going to analyze data, we need some data to analyze. In "Steps to Designing a Survey", David Walonick gives some steps that we can adapt for our purposes. First is "Define the goals of the research" or, in other words, decide what we want to know. Then take those goals and convert them to questions. He says that a testable research question starts with one of two phrases: "Is there a significant difference between…?" or "Is there a significant relationship between…?" For our purposes in 1st grade, we will be looking for a "significant difference between" preferences. We will then formulate a hypothesis: There is a significant difference…. and then invert it to say there is not a significant difference. We test the inverted or "null" hypothesis. We do this by writing our questions for the survey. After we write the questions we need someone, not a respondent, to check over the items to make sure that what is being asked is clear. Respondents may not be able to ask questions or survey givers may not be able to answer them unless we make sure the items are unambiguous. This process helps assure that the survey is valid. Walonick says that:

> Validity refers to the accuracy or truthfulness of a measurement. Are we measuring what we think we are? This is a simple concept, but in reality, it is extremely difficult to determine if a measure is valid. Generally, validity is based solely on the judgment of the researcher. When an instrument is developed, each question is scrutinized and modified until the researcher is satisfied that it is an accurate measure of the desired construct, and that there is adequate coverage of each area to be investigated.[3]

After we have our valid survey, we should make sure it is reliable. Reliability can come from administering the same survey to the same group at two different times. It can also come from making two surveys that will measure the same preferences or by asking different questions within the same survey that target the same information.[4] For our purposes in 1st grade, the reliability of our surveys will not be confirmed but in older grades, this is something to keep in mind.

We will begin our unit by looking at data already collected by someone else. I will ask another 1st grade teacher to have three students her class collect data on the whole class' favorite ice cream flavor. We will look at the data and see what it says. We will compare the data from these surveys and, as it is 1st grade, each student's collected data will most likely be different from their peers' collection. Will my class catch the differences between each student's collected data or will I need to point them out? This is our first step in thinking about what the numbers say. Are all data sets the same? If not, why not? Do all the graphs look the same? If not, why not? How can we decide which ones are correct? Can we know for certain? After a few days, I will ask her to survey her students again with the same question and we will compare our first data set with the second. What changed? Why did it change? As Joel Best says in ***Stat-Spotting: A Field Guide to Identifying Dubious Data***, "most errors that we see are not done on purpose but are innocent mistakes made by those preparing and presenting the data."[5] The 1st graders in the other class have no agenda that they are trying to forward, they are just six and seven year olds learning how to collect and interpret their data. The mistakes we find, such as marking the wrong answer, miscounting the answers, or a particular student changing his or her answer when asked by different students, will be due to innocent error but, they are mistakes just the same and that is something students, and everyone, should understand happens in the data we see every day.

As we move on to collecting our own data, we need to figure out what we want to know. The questions we ask need to be developmentally appropriate and relevant to the lives of a typical 1st grader. Students need to have the background knowledge to answer the questions. While which movie do you like better "Frozen" or the "Lego Movie", might seem like a perfect question for 1st graders, if students have not seen both films then we are not getting accurate data. We may have already run into this problem because a student who was questioned in the Ice Cream Survey may be lactose intolerant and not have experience with tasting many ice cream flavors. I will give the class a survey but the available answers to choose from would be ones that they may not normally choose: What is your favorite pizza? Is it anchovy, pineapple, or garlic and onion. We will look at our results and see if they truly reflect the opinions of the class. I am sure they truly prefer plain cheese or pepperoni. What could I have done differently to get accurate data? We will then brainstorm questions to ask and go through and find out what problems we may encounter with them. What happens if we give an open-ended question as compared to when we give choices that respondents can pick? If we give either/or questions like in the movie example, what does that tell us? Can we add another choice to help us get more accurate data? If we add another answer how does that change our data? In our reading assessments, students are just starting to see the answers "all of the above" and "none of the above". Does providing an answer like those help give us more accurate data?

Walonick in "Qualities of a Good Question" gives some helpful guidelines.[6] We can look at four of his guidelines to help us write our questions. He says that good questions evoke the truth, ask for an answer in only one dimension, can accommodate all possible answers and do not imply a desired answer. We can evoke the truth by not asking sensitive questions that may cause repercussions to the responder. In first grade, a question as simple as, "What is your favorite color?" could cause a problem for boys who choose a "girl color" such as pink. We could make the surveys anonymous but, since the questions will be given orally, it is very hard to make the responses totally secret. When we ask our question we should ask about one characteristic only, we should not ask which movie and music did you prefer: "The Lego Movie" or "Frozen." Some respondents may have enjoyed "The Lego Movie" more but love the song "Let It Go". It is best to ask the questions separately. We should make sure that we account for all answers. For our movie question, we should include "I did not see both movies". The questions should be written and delivered as neutrally as possible. I am sure that my students will have their own opinions on the questions we ask and we want to make sure we do not lead the respondents to make a choice based on making the survey administrator happy.

When we have our questions we will then work on giving our survey. First we will discuss what answers we think we will get. Why do we think that? Who will we give the survey to? There are two other 1st grade classrooms in our hallway who we will administer it to. How can we administer it so that we get accurate data? We will talk about not leading the respondents to pick a particular answer. Because many 1st graders cannot read beyond basic sight words and short vowel words, we will have to administer it orally. How can we offer choices and make sure that our own preferences are not influencing how we say the words? What if we wanted a particular answer to be picked? How could we administer a survey to get the answer we want? Should we do that? How do we know that someone responded? How do we mark the response or have the respondents mark their responses so they are accurate?

First graders will answer many questions based on how they perceive their peers answering. This is an example of response bias: "...a systematic tendency to respond to a questionnaire item on some basis other than the specific item content."[7] Surveys become popularity contests with students cheering when the item with the most responses gets another response. If the survey is not administered secretly or individually, many students will choose what their friends choose or alternatively pick the most extreme item on the survey to get a reaction from their peers - many boys who would not be caught dead in a pink shirt will choose pink as their favorite color because they think that it will be funny. For our purposes, the easiest way to combat this phenomenon is to administer the survey either secret ballot style, for simple choices students can read by themselves, or individually. While this may not eliminate bias completely this is the best that can be done in our situation.

After we have collected the data, what then? We will discuss different types of graphs and then create them with our data. With our Science unit on Weather, the students are used to seeing bar graphs. We graph how many sunny days, rainy, cloudy, partly cloudy and snowy days we have throughout the year. Even though students see a bar graph every day, that does not mean they understand what the graph represents. Why do we put the results in a graph? I hope that the students will see that it is easier to understand our results when we see a representation of the data. We will take our responses and graph them in a bar graph. How do we label the graph to show the results of our survey? Do students understand that each item on the graph represents one response? What happens if we survey students and we get more responses than can fit on our graph with a one to one correspondence? What interval should we use between numbers? What if we choose intervals of two and we have odd numbers, how do we show that? After we have answered all these questions (and the unforeseen ones, as well), we will then compare class one to class two. What do the results tell us? Is this what we thought would happen? I am sure that each student will think that the classes would choose the item that they themselves would choose. Why were there different responses? We will input the numbers into Excel and make a pie chart and compare the pie chart to the bar graph. Which is easier for us to read and understand? What happens to the graphs when we make a mistake? How can we tell whether there is a mistake?

Learning Objectives

The goal of this unit is to have students think critically about data. In order to do this, students must be able to interpret the numbers and know what they mean. Students will use their prior knowledge from previous Math units, particularly number sense and addition, to think about what the data are actually telling them. Students will also learn how to take a valid survey and how to begin to spot when one is not valid. I will create surveys that, when students look into them, will give data that is suspect. Students will be asked to think about what the data seem to say and then what they actually say. Students will use addition and subtraction skills to look at the data. Do the numbers actually add up or was there an error in the tabulation? What happens when we look at different kinds of graphs, does that change how we view the data? Students will plan and give a survey to two other 1st grade classes. We will look at the ways we asked the questions as well as the questions that we asked. Did the way we asked a question lead to a specific answer? Why? How could we ask a better question? We will work on figuring out the right questions to ask and then how to ask them correctly. At the end of the unit students will create and administer a survey to the whole school population and/or the school staff. An example would be, "Do you prefer recess after lunch or after math intervention?" Students will then look at the data and come to a conclusion. Depending on the topic of the survey, some action may be taken based upon those numbers.

This unit will be taught in conjunction with the 1st grade Investigations curriculum. Many of the learning objectives of that curriculum align with those of this unit specifically:

- Representing Data
  - Making a representation to communicate the results of a survey
  - Making sense of data representations including pictures, bar graphs, tallies
  - Using equations to show how the sum of the responses in each category equals the total responses collected
- Data Analysis
  - Describing and comparing the number of pieces in each category or at each value and interpreting what the data tell you about the group
  - Understanding the sum of the pieces of data in all the categories equals the number of people surveyed
  - Using data to compare how to groups are similar or different [8]

As all subjects are taught in the 1st grade classroom, this will allow me to target other standards besides the Common Core State Standards in Math. I will also be targeting the Common Core State Standards in ELA for Reading, and Speaking and Listening.

Classroom Activities

Unit Introduction: One Day
Standards: CCSS ELA RI 1.1, 1.2, 1.4, 1.6, 1.7, 1.8 SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3
Content Objectives: Students will understand the data can be collected, represented and interpreted.
Day One: I will present a hypothetical situation, we are going on a field trip but we have to decide where we are going. How do we this? I will read The Best Vacation Ever by Stuart J. Murphy and Nadine Bernard Westcott. In this story, a child surveys her family

about what they would like on a family vacation. Do they prefer a warm or cool place, near or far, with their pet or without their pet? The child collects the data and analyzes it and discovers that camping in their backyard while cover the majority of the preferences. We will discuss how the child came to this conclusion. Can we give a survey in the classroom? What else can we decide? Students will share with partners their ideas and I will call upon random students to share out.
Assessment: Informal based upon student responses.

Lesson 1 – Looking at Surveys: One day
Standards: CCSS ELA SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3 CCSS Math 1.MD.C.4, 1.OA.B.3, 1.OA.D.7
Content Objectives: Students will understand that answers to questions can be used as data. Students will understand that graphs can be used to represent data and that each answer is shown as a value of plus one on the graph. Students will think critically about the administration of the survey and what could have been done differently to get the most accurate data.
Day One: I will ask the 1st grade teacher across the hall to choose three students to administer a survey to her whole class. The students will ask their peers, “What is your favorite ice cream flavor?’ and give them three choices, chocolate, vanilla, and strawberry. The administrators will record the answers. One student will administer the survey first thing in the morning, another student, before lunch and the third before dismissal. Each administrator will ask every student so each student will be asked the same question three times. When the surveys are completed my class will evaluate them. First, each student will predict what they believe the favorite ice cream flavor will be. How did they come up with the answer? Did they guess? Did they choose the flavor that they liked best? We will then look at one survey and graph it using a bar graph. Each answer to that survey will be represented on the graph by filling in one space on the graph. What does the graph tell us? We will then look at a second survey and graph that one. Are the answers the same? Why do they think so or why not? We will the compare the third survey with the other two. Are all three the same? Are two out of three the same or are all three different? Did everyone answer the survey? How can we figure that out? We will discuss the reasons for the answers we got. If answers were different we will discuss why they were. Were their enough choices on the survey? Students will be tasked with thinking of ways to make a better survey and we will share them tomorrow.
Assessment: Informal based upon student responses.

Lesson 2 – Coming Up with Questions: Three days
Standards: CCSS ELA SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3 CCSS Math 1.MD.C.4, 1.OA.B.3, 1.OA.D.7
Day One: We will continue our discussion of yesterday’s survey. We will discuss ways that we could change that survey to get better results. The students were assigned to come up with ways to make a better survey. What did the students come up with? Assign students to small groups; groups should have students at various ability levels. Students

will discuss their ideas in their groups and come to a consensus on which ideas they would like to share with the whole group. Some ideas to direct the conversation are: What if your favorite flavor was mint chocolate chip or cookies and cream? What if you don't like ice cream? Did asking the same question at three different times cause a problem? What could we do differently? Students, in their small groups, will rewrite the ice cream survey using their new ideas.

Day Two: I will administer a survey to the students. I will ask them is their favorite pizza: anchovy, pineapple, or garlic and onion? I will then tabulate the data and create a bar graph showing that the class prefers one of them. I will make mistakes in my tabulations. Students will critique with a partner my survey, my data and my conclusions. We will then share out what they have discovered. How could I have made a better, more accurate survey? What mistakes did I make when tabulating the results? Are my conclusions valid?

Day Three: Students, in their small groups, will formulate questions that they would like to ask the class. Each group will decide on one question to ask and will construct their survey according to David Walonick's instructions from "Qualities of a Good Question." Students will come up with questions that they would like to know the answer for. Ideas for topics can include favorite foods, sports, movies or books. Students will create a question such as: "Do you prefer chicken patties or chicken nuggets for lunch." We do not know which students prefer or, if in fact, they prefer either one. We can ask the question and give the two food items as answers as well as the choice of "no preference". This inclusion of "no preference" is important because it will allow students who like both and those who like neither or never buy lunch to answer the survey truthfully and not be forced to make a choice that does not represent their actual opinion. After groups have chosen their questions and answer choices, they will write them out and prepare to administer them to the class. One idea to incorporate technology is to have students create a "Google form" where classmates can answer the question via computer. Another is to use the free "Plickers" app on a tablet or iPad (www.plickers.com).

Assessment: Does the survey ask an appropriate question? Does it ask only one? Are there answers that will cover all responses?

Lesson 3 – Administering the Survey: One day

Standards: CCSS ELA RI 1.1, 1.2, 1.4, 1.6, 1.7, 1.8 SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3
CCSS Math 1.MD.C.4

Content Objectives: Students will administer a survey and accurately record the responses.

Day One: Today we will administer our surveys. We will discuss why it is important to keep track of our responses and how we might do this. I will read Talley O'Malley by Stuart J. Murphy and Cynthia Jabar to help illustrate the point. In the story, a family is on a trip and the kids are bored in the car. They devise a game counting the different color cars on the road. In order to keep score and know who wins, they use tally marks. We will discuss this and other ways of collecting data. Students, in their groups will discuss the best way to give their survey. How will they know that everyone gave an answer?

How important is it that answers are confidential? We will return as a whole group and discuss how we will give the surveys. Students will then give their surveys to their classmates. In 1st grade, it is important that everyone have a job. I might have someone from each group read the question and someone keep track of the responses. A third person might add up the tallies (or other ways that data was collected) and the fourth would check to make sure all students responded. In order to have less chaos, students will administer the survey as part of a center activity. Each group will have a turn at the center where they will collect data from students who are working on other tasks.
Assessment: Did students give their assessment? Did they record student data? How did they record the data? Did they ask all their classmates? Did the students work cooperatively?

Lesson 4 – Looking at the Data: Two or Three days
Standards: CCSS ELA SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3 CCSS Math 1.MD.C.4, 1.OA.B.3, 1.OA.D.7
Content Objectives: Students will analyze and graph the data and share what they show with the class.
Day One: Today we will look at our data. Students, in their groups, will create a bar graph showing the data they have collected. If available, students can graph their data on a spreadsheet program such as Microsoft Excel or Google Sheets. This class period may be needed to instruct students on how to use these programs, if so, then the following becomes Day Two. Students, individually, will write down any conclusions they can draw from their data. What does the graph show? Were all students questioned? How do we know? How many more or how many fewer students preferred choice A to choice B? How about choice C? Students will write an equation showing that the number of responses is equal to the number of students that took the survey. Students will also write equations showing the difference between the most popular choice and the two other choices. Was there a significant difference between the answers? Are you surprised? Why or why not?
Day Two: Students will share their graphs with the class either using a document camera or the spreadsheet program via the SmartBoard. As a class, we will look at their graph and analyze the data asking the same questions that were asked when they looked at the data individually.
Assessment: Are the equations correct? Does the graph correlate to the answers? If not, can students explain where the problem is?

Lesson 5 – Constructing, Administering and Analyzing a Question to Ask the School or the Faculty. Three Days
Standards: CCSS ELA SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3 CCSS Math 1.MD.C.4, 1.OA.B.3, 1.OA.D.7
Content Objectives: Students will devise, administer and analyze a survey to either the entire school body or to the entire faculty.

Day One: Using what was learned in Lesson 2, students, in groups of five or six, will decide who they will give a survey to and then devise an appropriate survey to administer. An appropriate survey for the student body could be one about choices for a whole school reward, games at field day, or the type of music the principal plays in the morning.
Day Two: Students will decide how best to administer their survey and collect their data. Will data be collected and recorded in each classroom, in the lunch room or some other way? Students will discuss the different scenarios and decide which way is best. After clearing it with the principal, students, in groups of two or three, will fan out in the building and, using what was learned in Lesson 3, will administer their survey. Students need to be reminded about proper behavior in the hallway and other classrooms.
Day Three" Using what was learned in Lesson 4, students will analyze the data and come to a conclusion. Students will write equations showing the responses given equal the number of respondents. As this will be a large number, students will add them up by classroom: B1 had eight for choice A, nine for choice B, and three for no preference, 8+9+3=20. When adding up the classroom totals as a whole school, a calculator will be used and a running total kept on the board.
Assessment: Did the students use what was taught in previous lessons to come up with, administer, and analyze an appropriate survey for their intended audience? Did the students behave appropriately when in the hallway and in other classrooms? Did the students work cooperatively?

Lesson 6 – What Can We Do with the Information? One Day
Standards: CCSS ELA SL 1.1, 1.1A, 1.1B, 1.1C, 1.2, 1.3 CCSS Math 1.MD.C.4,
Day One: Students will break into their small groups and decide what we can do with these data, if anything. If there is a significant difference between our answers, how can we show the principal that our data is valid? If there is not a significant difference between the answers, can we make a recommendation? Why or why not? One student will write down the recommendation of their group. Students will reassemble into a whole and groups will present their recommendation to the class. Students, as a class, will decide which recommendation will be presented to the principal and that group will present it.
Assessment: Were recommendations reasonable and appropriate for the data collected? How did the class decide which recommendation was chosen?

Appendix A

Common Core State Standards
Math
- Represent and interpret data.

CCSS.MATH.CONTENT.1.MD.C.4
Organize, represent, and interpret data with up to three categories; ask and answer

questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.[9]

The above standard will be addressed when students plan, give and then analyze surveys.

- Add and subtract within 20.

  CCSS.MATH.CONTENT.1.OA.B.3

  Apply properties of operations as strategies to add and subtract.2 *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)*

- Work with addition and subtraction equations.

  CCSS.MATH.CONTENT.1.OA.D.7

  Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 - 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*[10]

The above standards will be addressed when the students analyze and manipulate the numbers. Number lines, hundreds charts, graphic organizers and manipulatives may be used to facilitate the calculations.

English Language Arts Standards » Reading: Informational Text

- Key Ideas and Details:

  CCSS.ELA-LITERACY.RI.1.1

  Ask and answer questions about key details in a text.

  CCSS.ELA-LITERACY.RI.1.2

  Identify the main topic and retell key details of a text.
- Craft and Structure:

  CCSS.ELA-LITERACY.RI.1.4

  Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.

  CCSS.ELA-LITERACY.RI.1.6

  Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.
- Integration of Knowledge and Ideas:

  CCSS.ELA-LITERACY.RI.1.7

  Use the illustrations and details in a text to describe its key ideas.

  CCSS.ELA-LITERACY.RI.1.8

  Identify the reasons an author gives to support points in a text.

  CCSS.ELA-LITERACY.RI.1.9

Identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures). [11]

The above standards will be targeted as students to listen to Math Start stories that illustrate ideas in the collection and representation of data. Graphic organizers will be used to help students to express their ideas.

English Language Arts Standards » Speaking & Listening

- Comprehension and Collaboration:

CCSS.ELA-LITERACY.SL.1.1

Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.

CCSS.ELA-LITERACY.SL.1.1.A

Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).

CCSS.ELA-LITERACY.SL.1.1.B

Build on others' talk in conversations by responding to the comments of others through multiple exchanges.

CCSS.ELA-LITERACY.SL.1.1.C

Ask questions to clear up any confusion about the topics and texts under discussion.

CCSS.ELA-LITERACY.SL.1.2

Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

CCSS.ELA-LITERACY.SL.1.3

Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.[12]

The above standards will be targeted during class time discussions.

The following are some resources that I found helpful:

Bahr, Damon L., and Lisa Ann de. Garcia. *Elementary mathematics is anything but elementary: content and methods from a developmental perspective*. Australia: Wadsworth Cengage Learning, 2010.

College level textbook with many ideas for teaching Mathematics in the primary grades.

Best, Joel. *Stat-spotting: a field guide to identifying dubious data*. Berkeley: University of California Press, 2008.

Information about how to look critically at statistics.

Byrnes, T. "CRITICAL THINKING." CRITICAL THINKING.

http://faculty.valenciacollege.edu/tbyrnes/poscritical.htm (accessed August 5, 2014).
The article gives information on critical thinking skills.

"Elementary School Resources." Elementary School Resources. http://www.nctm.org/profdev/content.aspx?id=11426 (accessed August 5, 2014).
Website with activities pertaining to data collection and analysis.

Garcia, D.E.. "Data Analysis." Strategies for Teaching Elementary Mathematics. http://mathteachingstrategies.wordpress.com/2008/11/24/data-analysis/ (accessed August 5, 2014).
A website that provides definitions, examples and activities for data analysis in mathematics.

Gutstein, Eric, Bob Peterson, and Robert Berkman. "Tracking PA Announcements Collecting and Analyzing Data in the Classroom ." In *Rethinking mathematics: teaching social justice by the numbers*. Milwaukee, WI: Rethinking Schools, 2006. 130.
A compendium of articles that shows how mathematics education can be used to highlight social issues.

"Unit 4 Data Analysis Investigation 3." In *Investigations in number, data, and space*. 2nd ed. Glenview, Ill.: Pearson Scott Foresman, 2008. 86-109.
1st grade Math curriculum.

"Unit 4 Data Analysis Investigation 2." In *Investigations in number, data, and space*. 2nd ed. Glenview, Ill.: Pearson Scott Foresman, 2008. 48-84.

Levine, Joel, and Thomas Roos. "Introduction to Data Analysis: The Rules of Evidence." http://www.dartmouth.edu/~mss/docs/Volumes_1-2.pdf (accessed October 27, 2014).
Information on Data Analysis for college students

Murphy, Stuart J., and Nadine Bernard Westcott. *The best vacation ever*. New York: HarperCollins, 1997.
A children's picture book in the Math Start series for primary school students that deals with collecting, organizing, and interpreting data.

Murphy, Stuart J., and Cynthia Jabar. *Tally O'Malley*. New York: HarperCollins, 2004.
Children's picture book in the Math Start series for primary school students that discusses the use of tally marks to keep track of information.

Paul, Richard. "Critical Thinking in Every Domain of Knowledge and Belief." Critical

Thinking in Every Domain of Knowledge and Belief. http://www.criticalthinking.org/pages/critical-thinking-in-every-domain-of-knowledge-and-belief/698 (accessed August 5, 2014).
Keynote address on critical thinking to The 27th Annual International Conference on Critical Thinking. Discusses importance of teaching critical thinking skills to our students.

Paulhus, Delroy, J.P. Robinson, P.R. Shaver, and L.S. Wrightsman. "Measurement and control of Response Bias." In *Measures of personality and social psychological attitudes*. San Diego: Academic Press, 1991. 17.
This resource defines bias as it pertains to surveys.

Walonick, David. "Qualities of a Good Question." Qualities of a Good Survey Question. https://www.statpac.com/surveys/question-qualities.htm (accessed October 27, 2014).
This resource provides twelve guidelines for constructing and asking a good question for a survey.

Walonick, David. "Survey Design Guidelines." Survey Design Guidelines. https://www.statpac.com/survey-design-guidelines.htm (accessed October 27, 2014).
This resource provides the steps in designing a survey.

Notes

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[1] Robert Berkman "Tracking PA Announcements Collecting and Analyzing Data in the Classroom" Rethinking Mathmatics Teaching Social Justice by the Numbers (Milwaukee, WI: Rethinking Schools, 2006) 130

[2] Joel Levine and Thomas Roos "Introduction to Data Analysis: The Rules of Evidence." (accessed 27 October 2014) http://www.dartmouth.edu/~mss/docs/Volumes_1-2.pdf.

[3] David Walonick "Survey Design Guidelines" (accessed 27 October 2014) https://www.statpac.com/survey-design-guidelines.htm

[4] Walonick "Survey Design Guidelines" (accessed 27 October 2014) https://www.statpac.com/survey-design-guidelines.htm

[5] Joel Best Stat-Spotting A Field Guide to Identifying Dubious Ideas. (Berkeley: University of California Press, 2008) 17

[6] David Walonick "Qualities of a Good Question" (accessed 27 October 2014) https://www.statpac.com/surveys/question-qualities.htm

[7] Delroy Paulhaus Measurement and Control of Response Bias (accessed 27 October 2014) http://gauss.unh.edu/~mas2/Chapter2-Paulhus.pdf

[8] "Unit 4 Data Analysis Investigation 3." In *Investigations in number, data, and space*. (2nd ed. Glenview, Ill.: Pearson Scott Foresman, 2008) 11

[9] http://www.corestandards.org/Math/Content/1/MD/ (accessed 6 December 2014)

[10] http://www.corestandards.org/Math/Content/1/OA/ (accessed 6 December 2014)

[11] http://www.corestandards.org/ELA-Literacy/RI/1/ (accessed 6 December 2014)

[12] http://www.corestandards.org/ELA-Literacy/SL/1/ (accessed 6 December 2014)

Curriculum Unit Title: Survey Says

Author: David Ostheimer

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

1st grade students can create, administer surveys and analyze the data they report.

ESSENTIAL QUESTION(S) for the UNIT

How can we create and administer a valid survey and how can we analyze the data.

CONCEPT A

Surveys contain valid questions.

CONCEPT B

Surveys must be administered without bias.

CONCEPT C

Data can be analyzed to provide answers for a hypothesis.

ESSENTIAL QUESTIONS A

How can we phrase questions to provide valid data?

ESSENTIAL QUESTIONS B

How can we be assured that our administering of the survey does not influence the survey?

ESSENTIAL QUESTIONS C

What do~~es~~ the data show us?

VOCABULARY A

survey, data, valid

VOCABULARY B

administering, bias

VOCABULARY C

Analyze, bar graph

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES

Murphy, Stuart J., and Nadine Bernard Westcott. *The Best vacation ever*. New York: HarperCollins, 1997.

Murphy, Stuart J., and Cynthia Jabar. *Tally O'Malley*. New York: HarperCollins, 2004.

Walonick, David. "Qualities of a Good Question." Qualities of a Good Survey Question. https://www.statpac.com/surveys/question-qualities.htm (accessed October 27, 2014).

Walonick, David. "Survey Design Guidelines." Survey Design Guidelines. https://www.statpac.com/survey-design-guidelines.htm (accessed October 27, 2014).