Data Station A Recording Sheet

Data Source	http://www1.mms.com/us Link to the "About M&M's®" webpage by using the pop-down menu located under "About M&M's®" and clicking on Products.
How would you describe this set of data? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Data Station B Recording Sheet

Data Source	http://faculty.washington.edu/chudler/java/dottime.html
How would you describe this set of data? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

You will need to delete the cookie for this website to record data for each participant.

Data Station C Recording Sheet

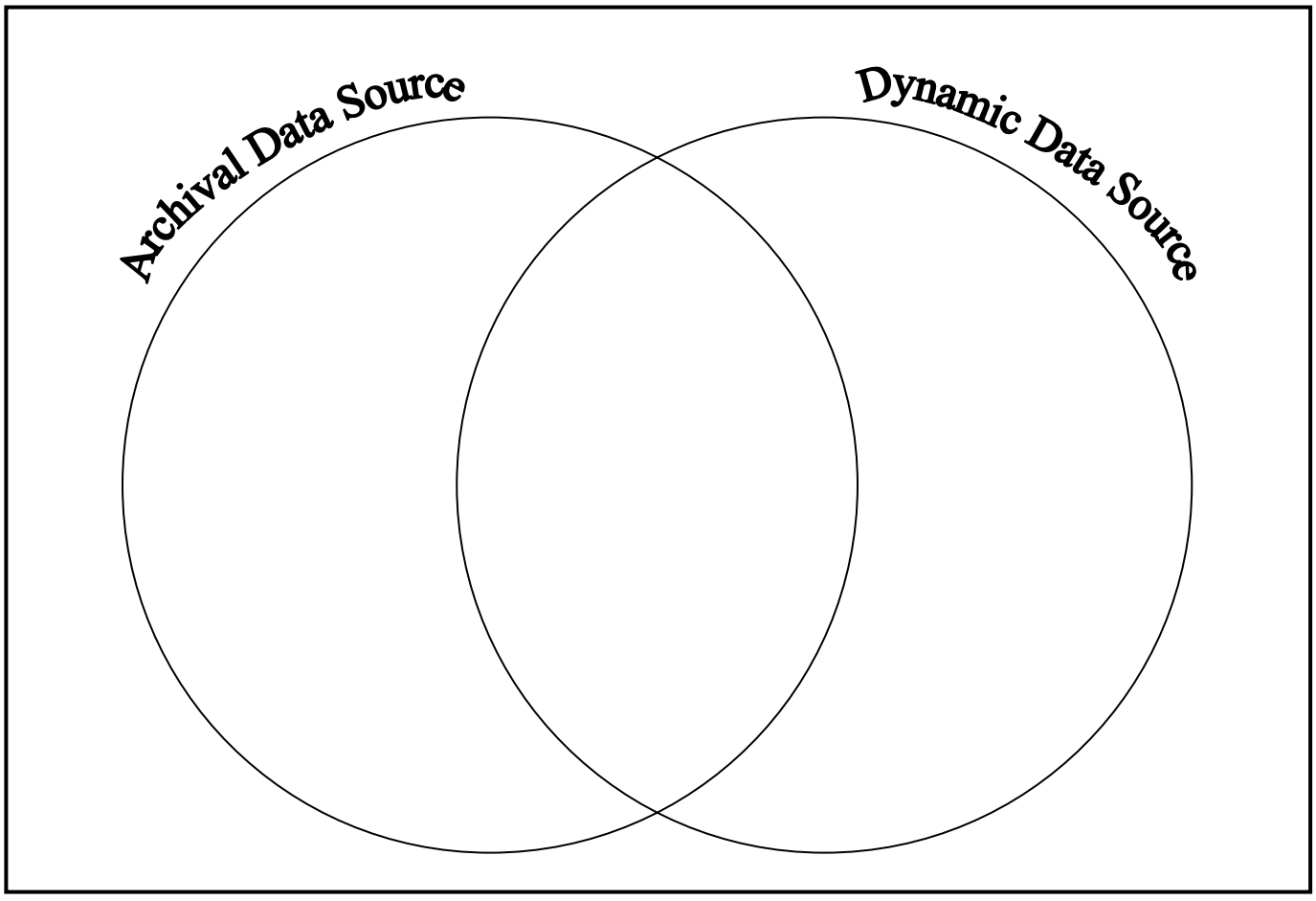
Data Source	CBR and graphing calculator
How would you describe the data generated by these tools? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Data Station D Recording Sheet

Data Source	Color tiles, one-inch cubes, one-inch paper squares, yard sticks
How would you describe the data generated by these tools? Why?	
What relationships occur within this set of data? Why?	
How would you represent this data? Why?	
What question(s) can we pose to students that this set of data helps to answer?	
How might this data be used to extend what students already understand about our course content?	

Reflections on Data

Complete the following Venn Diagram to compare and contrast the uses of archival and dynamic data found on the Internet.



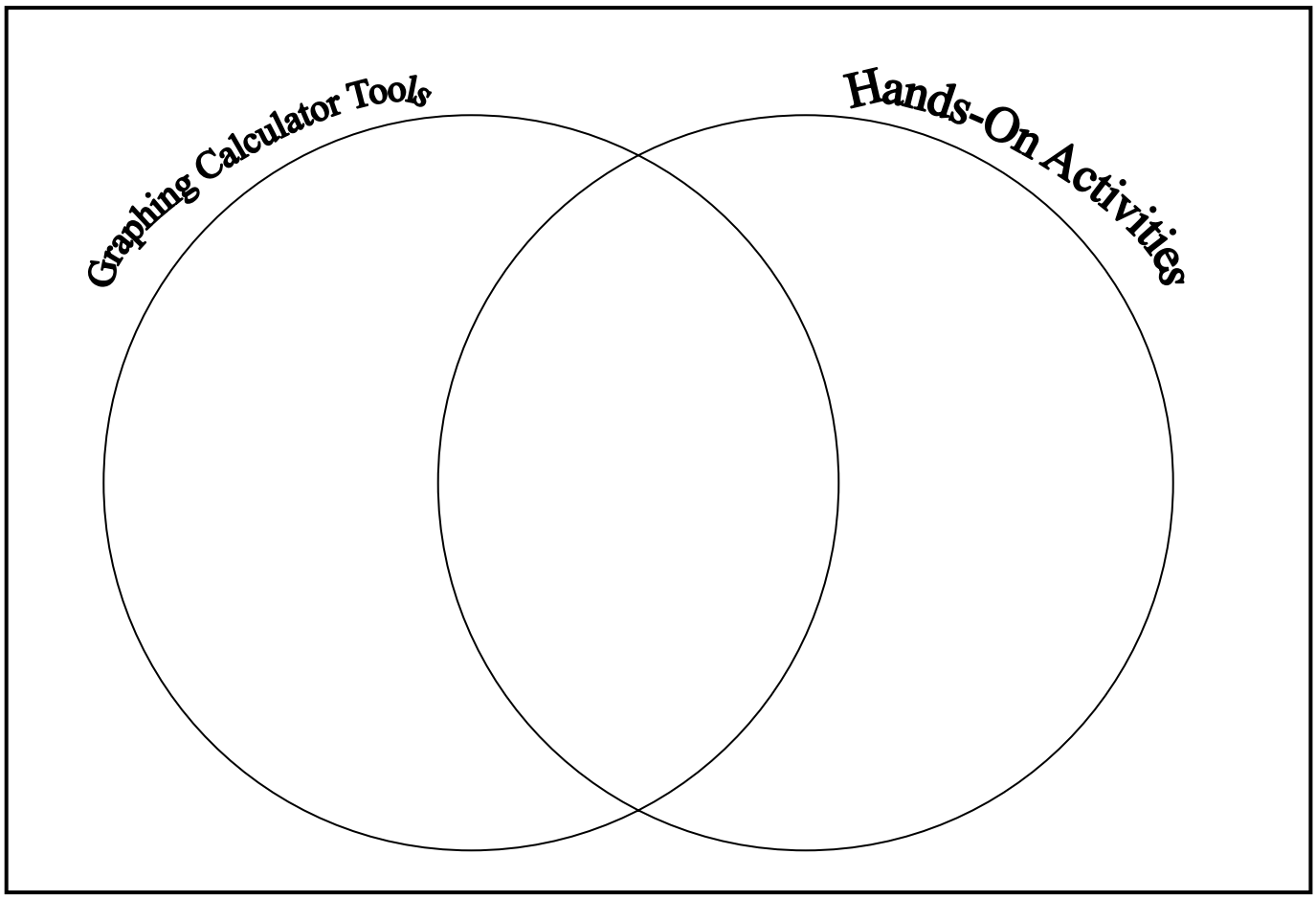
What are the benefits of using archival data found on the Internet?

What are the benefits of using a dynamic data source, such as an applet on the Internet?

How might teachers use these data sources in a middle school mathematics classroom?

Reflections on Data

Complete the following Venn Diagram to compare and contrast the uses of the graphing calculator tools and hands-on activities as data sources.



What are the benefits of using data resulting from graphing calculator tools?

What are the benefits of using data derived from hands-on activities?

How might teachers use these data sources in a middle school mathematics classroom?

Debriefing the Exploration of Data

1. What questions can we ask as reflective practitioners to determine the appropriateness of a data source for promoting mathematical learning?

2. How does the technology-based data offer an opportunity to strengthen mathematical learning?

3. How might hands-on activities complement the judicious use of technology?

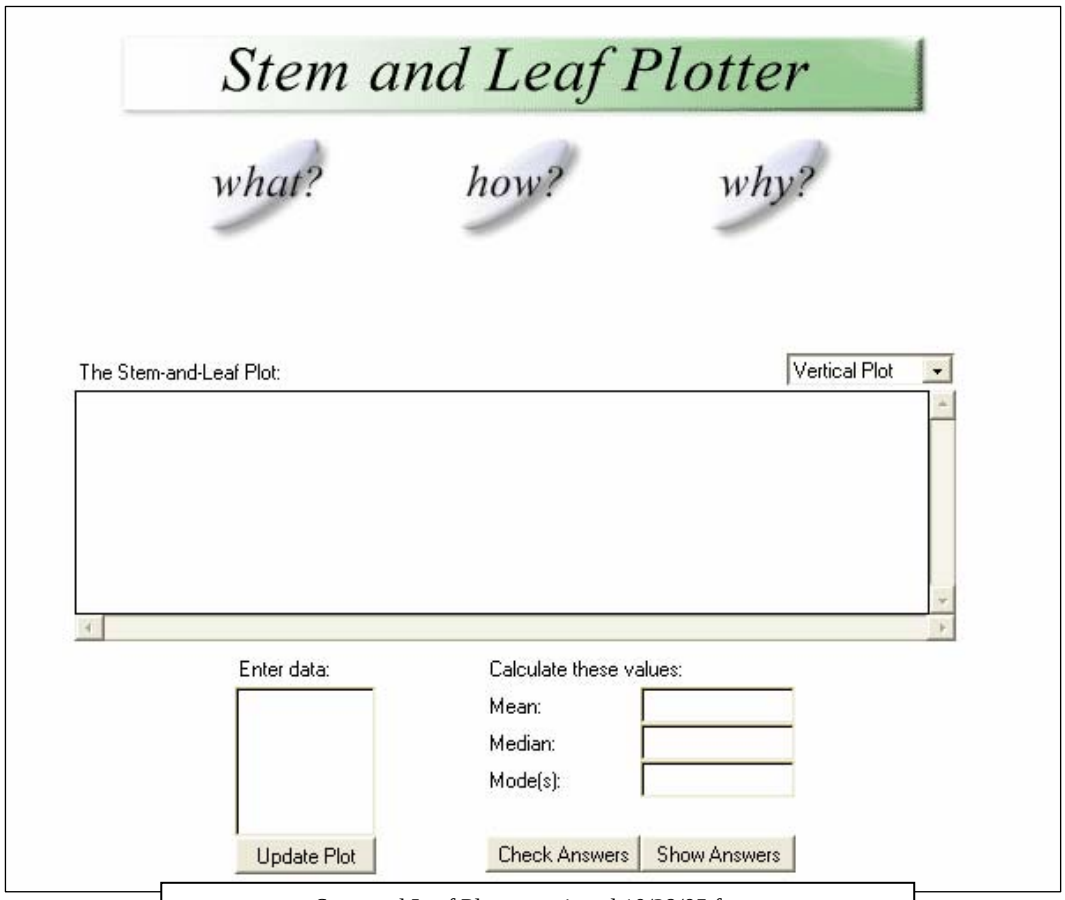
4. What paper-and-pencil methods do students need to know to make sense of the data we explored?

Planning for Intentional Use of Data in the Classroom

TEKS	Math		
	Tech Apps		
Question(s) to Pose to Students	Math		
	Tech Apps		
Cognitive Rigor		Knowledge	
		Understanding	
		Application	
		Analysis	
		Evaluation	
		Creation	
Data Source(s)		Real-Time	
		Archival	
		Categorical	
		Numerical	
Setting		Computer Lab	
		Mini-Lab	
		One Computer	
		Graphing Calculator	
		Measurement Based Data	
Bridge to the Classroom			

Stem and Leaf – Computer Participant Page

1. Open the Stem and Leaf Plotter on the computer.
   http://www.shodor.org/interactivate/activities/stemleaf/index.html
2. Enter the data as the presenter calls it out in the box titled: "Enter data:" Then select "Update Plot."
3. Sketch your stem and leaf plot below.



Stem and Leaf Plotter retrieved 10/29/05 from
http://www.shodor.org/interactivate/activities/stemleaf/index.html

4. Estimate the values of the mean, median, and mode(s). Enter your estimates in the boxes. Then select "Check answers."

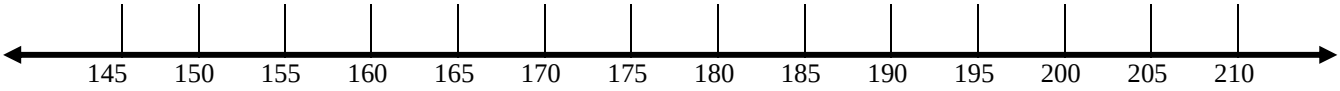
5. The stems are the values found to the left of the vertical line on the stem and leaf plot. Where do these values come from?

6. The leaves are the values found to the right of the vertical line on the stem and leaf plot. Where do these values come from?

7. If you turned the stem and leaf plot horizontally, what type of graph would it resemble? Use the drop down menu to select Horizontal Plot. Does this verify your prediction?

Box and Whisker Plot – Participant Page

I. Create a box and whisker plot that represents the flat-footed heights of the participants. Fill in the appropriate values in the table for the flat-footed heights.



		Flat-footed height	Tiptoe height
minX	**Minimum**		
Q_1	**Lower Quartile**		
Med	**Median**		
Q_3	**Upper Quartile**		
maxX	**Maximum**		
$\bar{x}$	**Mean**		
maxX-minX	**Range**		

II. Using the number line above, create a box and whisker plot that represents the tiptoe heights of the participants. Create the plot above the flat-footed plot. Then fill in the appropriate values in the table for the tiptoe heights.

Box and Whisker Plot – Computer Participant Page

1. Open the Virtual Manipulatives website. **http://nlvm.usu.edu/en/nav/vlibrary.html**
   - Click on Data Analysis and Probability Grades 6-8.
   - Click on Box Plot.
   - Click on Clear in the lower left corner to clear the list of data.
2. Using your Stem and Leaf Activity Page, enter the shortest height first.
3. Using your Stem and Leaf Activity Page, enter the tallest height second.
4. Continue by entering heights from the lower 50% of the data. Why does the "box" shift as more values are entered? _____
5. Predict what will happen to the graph as the remainders of the class heights are entered.

   _____
6. Verify your prediction by entering the upper 50% of the data. More cells will automatically be created as you need them. Was your prediction correct? _____
7. What is the minimum value of data? _____ Where do you see this on the graph?

   _____
8. What is the maximum value of data? _____Where do you see this on the graph?

   _____
9. About 75% of the class is taller than what height? _____
10. About 50% of the class is shorter than what height? _____
11. What is the median height? _____Where do you see this on the graph? _____

    _____

Box and Whisker Plot – Computer Participant Page

Experiment with the data on the computer to answer the following questions. Record your solutions below.

12. Add some data that will change the minimum value. What data did you add? Why did this data change the minimum value?

13. Add some data that will change the maximum value. What data did you add? Why did this data change the maximum value?

14. Add some data that will shift the median to the left. What data did you add? Why did this data shift the median to the left?

15. Add some data that will shift the median to the right. What data did you add? Why did this data shift the median to the right?

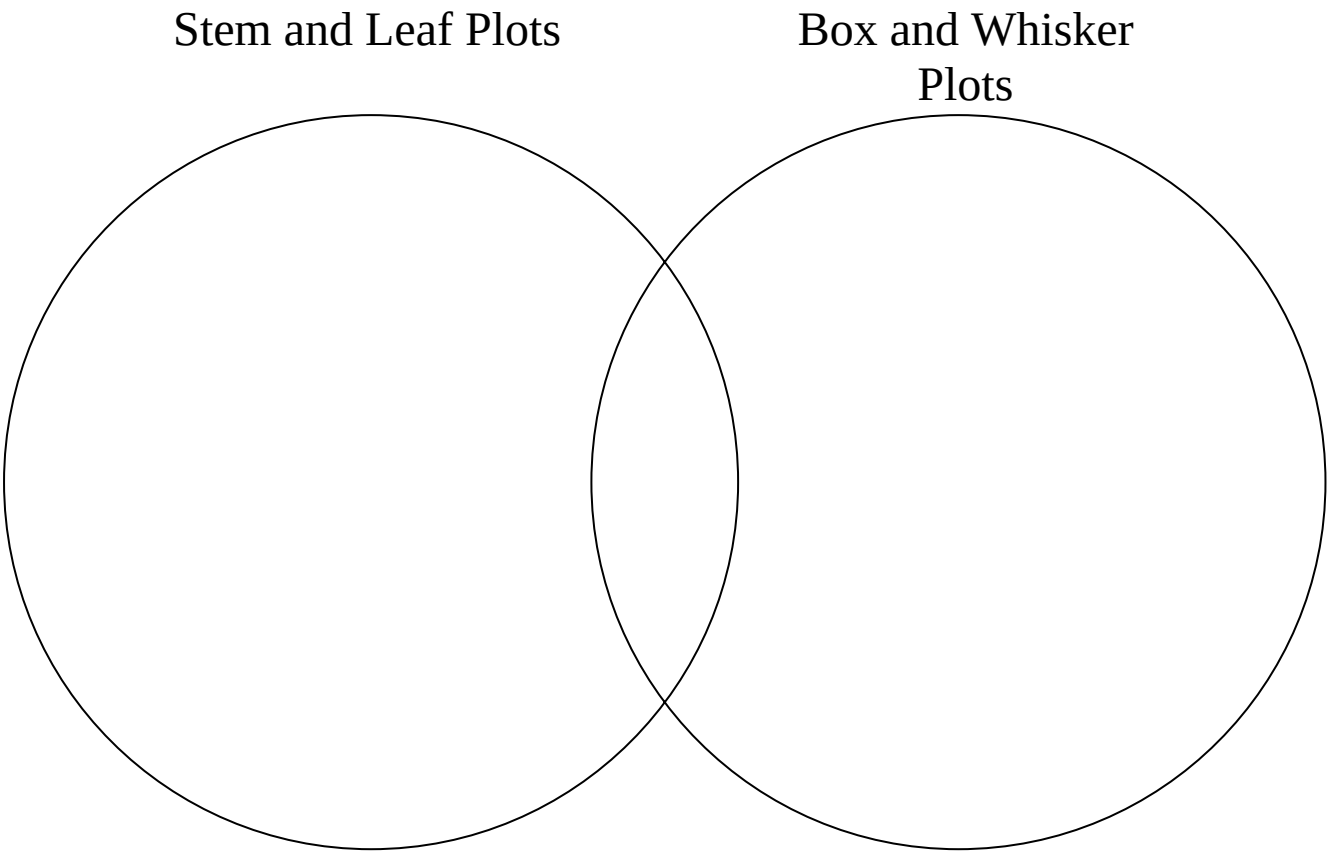
16. Add some data that will cause the whiskers to be equal in length. What data did you add? Why did this data create whiskers of equal length?

17. Add some data that will cause the box sections to be equal in length. What data did you add? Why did this data create box sections of equal length?

18. Add some data that will cause the right whisker to be about twice the length of the left whisker. What data did you add? Why did this happen?

19. Generate a list of new data that will allow the average to fall in the whiskers. Why did the average fall in the whiskers?

Venn Diagram – Participant Page



Explore/Explain 1 - Intentional Use of Data

TEKS	Math		
	Tech Apps		
Question(s) to Pose to Students	Math		
	Tech Apps		
Cognitive Rigor		Knowledge	
		Understanding	
		Application	
		Analysis	
		Evaluation	
		Creation	
Data Source(s)		Real-Time	
		Archival	
		Categorical	
		Numerical	
Setting		Computer Lab	
		Mini-Lab	
		One Computer	
		Graphing Calculator	
		Measurement Based Data	
Bridge to the Classroom			

Participant Page: Generating Data

Part 1:

- Input formulas for all cells containing a red hint flag:
  Total Number of People Surveyed,
  Total Percent of People Surveyed,
  and Percent of People Surveyed for each interval.

Part 2:

- Complete Grams of Fat table by entering data into the Number of People Surveyed using the Data Statement Cards. Manipulate data until all cards have been satisfied.
- Save as: JDoe_Grams_of_Fat_Spreadsheet

1. What approach did your group take to complete the table?

2. What type of manipulation did it take to make your data set fit the Data Statement Cards you were given?

3. How would you manipulate the data when you have half or a third of a person represented in your data set? Is it okay to have half a person? Why, or why not?

4. What is the smallest meaningful value you can have for the total number of people surveyed for your data?

5. How does using a dynamic spreadsheet encourage student learning and thinking?

6. How could you combine what you just did on the spreadsheet with what you do in the classroom?

Participant Page: Time to Play

Part I. Collecting Data!

1. Sort and place data cards into the brown-paper bags by the defined intervals. Label each bag.

2. Based on the information in your table, draw data cards out one at a time with replacement.
   Example: You have 5 people that stated they ate between 0 and 9 grams of fat each day. Then you would make 5 pulls from the bag labeled 0-9 grams of fat.

3. Record results as you draw data from the bags into the Data Pieces table found on sheet 2 of the Middle School-Explore Explain 2 Spreadsheet spreadsheet.

4. Continue until all data has been generated.

5. Format the Measures of central tendency using the red flag hints.

6. Record the mean, median and mode. Which of the measures of central tendencies best describes your original data set, and why?

   Mean: _____

   Median: _____

   Mode: _____

7. Save your work as **JDoe_Grams_of_Fat_Spreadsheet** on your desktop.

Part II. What If?

In the following What If's: Manipulate the data elements in a way that keeps the Data Statements Cards **TRUE**. Open your spreadsheet and begin.

1. **What if**, you create a data set in which the mean is the same as the mode:

   What type of changes did you make to your data set? Were you able to make the changes to satisfy these parameters?

   _____

   _____

(Part 2 continued)

2. **What if**, you create a data set in which the mode would be the best measure of central tendency to use to describe the data set:

   What type of changes did you make to your data set? Were you able to make the changes to satisfy these parameters?

   _____

   _____

3. **What if**, you create a data set in which the median would be the best measure of central tendency to use to describe the data set:

   What type of changes did you make to your data set? Were you able to make the changes to satisfy these parameters?

   _____

   _____

Participant Page: Comparison

How does using the spreadsheet software compare to manipulating data and graphing data by hand?

Software Justification:

By Hand Method Justification:

Student Value:

Student Value:

Explore/Explain 2: Intentional Use of Data

TEKS		
Question(s) to Pose to Students		
Cognitive Rigor	Knowledge	
	Understanding	
	Application	
	Analysis	
	Evaluation	
	Creation	
Data	Real-Time	
	Archival	
	Categorical	
	Numerical	
Setting	Computer Lab	
	Mini-Lab	
	One Computer	
	Graphing Calculator	
	Measurement Based Data	
Data Source(s)		

Participant Page: Group Activity Sheet

Simulation #1

Outcomes	Tally	Frequency
1		
2		
3		
4		
5		
6		

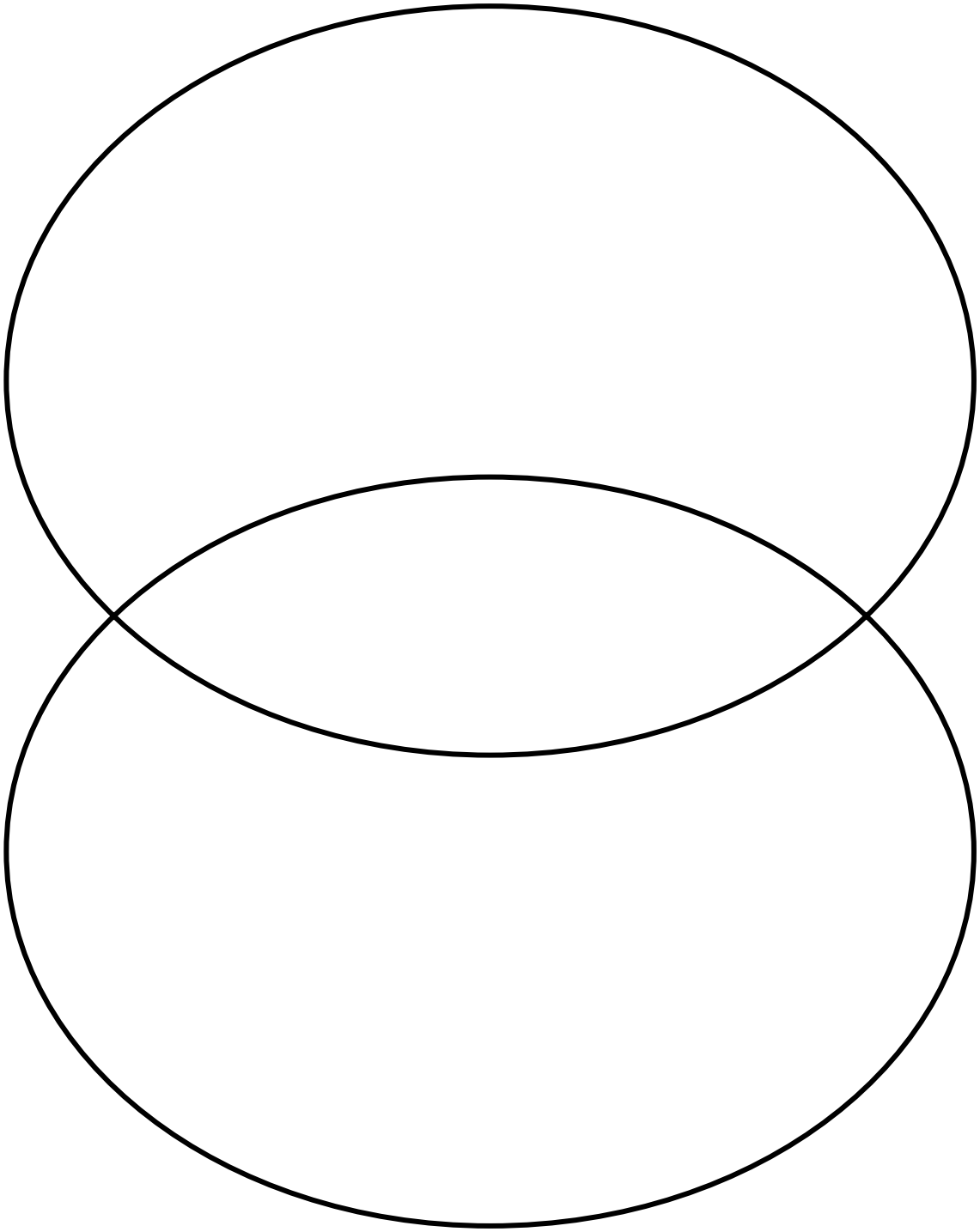
Data Table: Simulation #2

Participant's Name	Data List
#1:	
#2:	
#3:	
#4:	

Simulation #2

Outcomes	Tally	Experimental Outcomes	Theoretical Outcomes
1			
2			
3			
4			
5			
6			

Participant Page: Venn Diagram



Participant Page: My Best Graph Questionnaire

1. What type of graphical representation(s) do you think would represent your data in the best way?

⬭ Circle Graph ⬭ Histogram ⬭ Bar Graph ⬭ Line Plot

2. Why did you choose the type(s) of graph that you did? (Give details for each choice.)

3. Is there more than one graphical representation that will represent the data in a satisfactory way? Why?

4. When would you use one graphical representation over another?

5. What conjectures can you make from the graph that you decided to generate?

6. How does analyzing other graphical representations of the same data benefit your students?

Explore/Explain 3: Intentional Use of Data

TEKS	Math		
	Tech Apps		
Question(s) to Pose to Students	Math		
	Tech Apps		
Cognitive Rigor		Knowledge	
		Understanding	
		Application	
		Analysis	
		Evaluation	
		Creation	
Data Source(s)		Real-Time	
		Archival	
		Categorical	
		Numerical	
Setting		Computer Lab	
		Mini-Lab	
		One Computer	
		Graphing Calculator	
		Measurement Based Data	
Bridge to the Classroom			

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Understanding the Question

1. Have you answered a question or conducted an investigation similar to this one before? If yes, what was the problem or investigation? How did you answer the question?

2. How might you restate the question?

3. What is the unknown you are investigating?

4. What data might you gather to answer the question: When estimating elapsed time, does feedback help you become a better estimator? Why might this data be appropriate?

5. What data collection tools are available to help answer this question?

Making a Plan

1. How might you gather data?

2. What statistical concepts might you address after collecting data related to estimating elapsed time?

3. How might you use spreadsheet software to organize, represent, and analyze this data?

4. How might you use a graphing calculator to organize, represent, and analyze this data?

5. How might you create a summary document that explains and justifies our answer to the question?

6. After discussing your plan with another participant, use a word processor to open the **Making a Plan** document. Record your plan on this document. As you work, save this file.

Carrying Out the Plan and Answering the Question

1. Open a new spreadsheet document. Use this document to organize, represent, and analyze the data resulting from your plan. Save this document as **Gathering the Data**.

2. Open a new word-processing document. Use this document to hold imported screen shots from the graphing calculator. Save this file as **Gathering the Data with a Graphing Calculator**.

3. Open another new word-processing document. Use this document to summarize and explain your answer to the questions: *Does feedback on estimating elapsed time help you become a better estimator of elapsed time?* and *How does technology assist you in answering this question?* Save this file as **Answering the Question**.

4. How did you organize your data? Record your organized data in the **Answering the Question** document. Include text explanations of why you organized your data as you did. Use this word-processing document to record how you carried out your plan to answer the question: When estimating elapsed time, does feedback help you become a better estimator?

5. What representations of your data did you create? Record your representations in the **Answering the Question** document. Include text explanations of why you represented your data as you did.

6. What tools did you use to represent the data? Include text explanations of why you selected that tools that you used to represent the data.

7. What analyses of your data did you perform? Record your analyses in the **Answering the Question** document. Include text explanations of how you decided to analyze your data, including justification for the appropriateness of your analysis.

8. Record your answer to the following questions, using imported graphics from spreadsheet software and graphing calculators as needed, to justify your solution.
   Does feedback on estimating elapsed time help you become a better estimator of elapsed time? and *How does technology assist you in answering this question?*

Evaluating the Answer and the Plan

1. Is your answer reasonable? Why?

2. Did you alter your plan while carrying it out? Why?

3. What other representations might you have used to communicate your solution to the question?

4. If you did this again, which technology tool(s) would you select to carry out your plan? Why?

5. Summarize your responses to these questions in your **Answering the Question** document.

Extending the Question

1. Based on the data that you have collected, organized, represented, and analyzed, answer the questions:
    a. What do you predict the average time for estimating one minute of elapsed time without feedback will be?
    b. What do you predict the average time for estimating one minute of elapsed time with feedback will be?
    c. How might you test your predictions?

2. How might you connect this question to everyday experiences, investigations in other disciplines, and activities in and outside of school?

3. How might answering this question provide opportunities for communication through informal and formal mathematical language, representations, and models?

4. How might answering this question provide opportunities for you to use logical reasoning to make conjectures and verify conclusions?

5. Summarize your responses to these questions in your **Answering the Question** document.

Rubric for Answering the Question		Proficient	Developing	Emerging
Making a Plan	Content	Fully addresses the statistical concepts and representations to be found in the data.	Partially addresses the statistical concepts and representations to be found in the data.	Barely addresses the statistical concepts and representations found in the data.
	Technology	Includes strategies to address the spreadsheet and the graphing calculator.	Includes strategies to address the spreadsheet or the graphing calculator.	Includes one strategy to address the spreadsheet or the graphing calculator.
Carrying out the Plan - Spreadsheet	Organize Data	The data are organized and labeled.	The data are organized.	The data are not organized.
	Represent Data	The data are represented in multiple ways and labeled appropriately.	The data are represented in one way and labeled appropriately.	The data are not represented appropriately.
	Analyze Data	The data are analyzed.	The data are partially analyzed.	The data are analyzed inappropriately.
Carrying out the Plan – Graphing Calculator	Organize Data	The data are organized and labeled.	The data are organized.	The data are not organized.
	Represent Data	The data are represented in multiple ways and labeled appropriately.	The data are represented in one way and labeled appropriately.	The data are not represented appropriately.
	Analyze Data	The data are analyzed.	The data are partially analyzed.	The data are analyzed inappropriately.
Answering the Question		The answer to the question includes full justification of the answer.	The answer to the question includes partial justification of the answer.	The answer to the question does not address the question.
Evaluating the Answer and the Plan	Reasonableness	The answer to the question includes full justification of the reasonableness of the answer.	The answer to the question includes partial justification of the reasonableness of the answer.	The answer to the question does not address reasonableness.

Rubric for Answering the Question		Proficient	Developing	Emerging
	Reflection	The summary addresses reflections about the mathematics and the technology used to answer the question.	The summary partially addresses reflections about the mathematics and the technology used to answer the question.	The summary lacks reflections about the mathematics and the technology used to answer the question.
Extending the Question	Mathematics	The prediction is reasonable and fully justified based on the data gathered to answer the original question.	The prediction is reasonable and partially justified based on the data gathered to answer the original question.	The prediction is unreasonable.
	Connections	Connections are made to everyday experiences, investigations in other disciplines, and activities in and outside of school.	Connections are made to everyday experiences, investigations in other disciplines, or activities in and outside of school.	Connections are made to everyday experiences.
	Communication	Informal and formal mathematical language is used to describe how the data has been organized, represented, and analyzed.	Informal mathematical language is used to describe how the data has been organized, represented, and analyzed.	Lacks descriptions of how the data has been organized, represented, and analyzed.
	Reasoning	The conjectures and conclusions are logical.	The conjectures and conclusions are partially logical.	Lacks conjectures and conclusions.

Gallery Walk Observations

Man in the Box Explore/Explain I	How did the activity promote careful decision making about the use of technology? How did the activity integrate technology into the learning of mathematics? Was technology use ever restricted for the purpose of enhancing learning? Why? How did the technology facilitate discussion about "statistical sense"?

Grams of Fat Explore/Explain II	How did the activity promote careful decision making about the use of technology? How did the activity integrate technology into the learning of mathematics? Was technology use ever restricted for the purpose of enhancing learning? Why? How did the technology facilitate discussion about "statistical sense"?

Trials! Trials! Trials! Explore/Explain III	How did the activity promote careful decision making about the use of technology? How did the activity integrate technology into the learning of mathematics? Was technology use ever restricted for the purpose of enhancing learning? Why? How did the technology facilitate discussion about "statistical sense"?

How Much Longer? Elaborate	How did the activity promote careful decision making about the use of technology? How did the activity integrate technology into the learning of mathematics? Was technology use ever restricted for the purpose of enhancing learning? Why? How did the technology facilitate discussion about "statistical sense"?