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How is the Calculator Good at Comparing Data?

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Grade level(s)/Subject taught: Mathematics 7–8

Objectives: Students will use the graphing calculator to:

- engage in the process of statistical investigation, make conjectures, predictions, and conclusions based on statistical analysis.
- construct numerous plots in a relatively short amount of time.
- compare data using box-and-whiskers plots.
- compare data using statistical measures such as minimum, maximum, lower and upper quartiles, median, and range.
- consider the influence of extreme values in a set of data.

Mathematical Concept or "key idea" that TI Technologies will be used to teach:

Students use:

- concepts of uncertainty such as random sampling and measures of central tendencies to describe and compare samples.
- concepts of modeling and multiple representation to display the data, make conjectures, make predictions, and draw conclusions.
- mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.
- technology to apply the mathematics to real world situations.

Essential question: How is a graphing calculator useful in comparing different sets of data?

The lesson will begin with a warm-up activity, in which students review how to construct a box and whiskers plot. Namely, students will find the five number summary consisting of the minimum, lower quartile, median, upper quartile, and maximum values of the data.

Then, I will teach students how to make a box and whiskers plot on the graphing calculator. I will demonstrate this by entering a set of data into List L1, then turning Plot 1 on, and selecting the correct plot. We will discuss the role of the WINDOW for this type of plot, namely that while the x-values must be consistent with the data, the y-values are irrelevant. Finally, we will review the Trace function, in order to obtain the five number summary from the calculator.

The work time will proceed with students working in pairs to complete the problem below. As students work, I will monitor their progress by listening to their discussions, asking questions, and addressing misconceptions. At the end of class, students will present their findings to the rest of the class and explain how they came to their conclusion.

This activity would take several class periods if students had to calculate the five number summary and construct the box and whiskers plots by hand for the numerous sets of data. The calculator allows us to focus on the statistical analysis and apply concepts of uncertainty without focusing on computation or graphing skills. Students are able to make conjectures and within minutes test the validity of their arguments.

Problem:

Archeologists discovered the remains of two Native American settlements in Montana and Wyoming. The attached tables list the lengths and widths for each arrowhead that was found. The archeologist hoped to use the arrowhead data to estimate the time period during which each site was inhabited. To help them, they used arrowhead data from four other known sites. The archaeologists knew that two of the sites (Laddie Creek/Dead Indian Creek and Kabold/Buffalo Creek) were settles between 4000 BC and 500 AD. The other two sites (Big Goose Creek and Wortham Shelter) were settled between 500 AD and 1600 AD.

Using the graphing calculator, make box and whiskers plots for the lengths and the widths of all 6 sites. Use what you know about statistics and data representations to analyze the two new sites. During which time period was each of the unknown sites settled? How certain are you of your conclusion? Provide evidence to support your conclusions. Do you have any doubts? If the archaeologists had collected only a few arrowheads from each new site, might they have reached a different conclusion? Explain your answer.

Arrowheads Samples:

Big Goose Creek

Length	30	21	24	18	30	27	39	33	22	26	23	20	21	26	16	30	23	34	27	22
Width	14	11	14	13	15	13	18	13	13	11	13	11	12	14	13	14	14	15	13	13

Wortham Shelter

Length	22	42	28	31	25	20	20	25	19	28	29	29	18	27	32	24	31	26	19	30
Width	14	18	14	13	15	13	14	15	12	13	13	14	11	15	15	13	14	13	14	14

Laddie Creek

Length	29	25	32	52	29	35	27	37	44	38	27	39	41	30	40	32	31	42
Width	20	18	16	21	14	20	20	17	18	17	20	18	15	23	18	19	18	22

Kubold Buffalo Creek

Length	38	39	50	42	37	32	44	40	40	56	52	43	32	35	46	38	40	46	44	40
Width	24	21	23	22	21	23	20	20	20	19	17	23	22	22	20	18	21	17	23	22

New Site #1

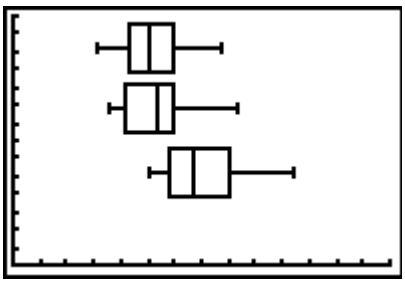
Length	62	31	40	63	37	24	29	38	29	45	27	31	38	45
Width	26	32	25	29	23	19	22	22	19	22	19	16	26	28

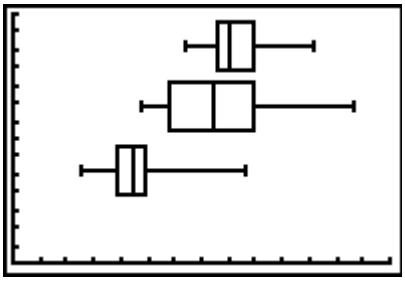
New Site #2

Length	16	13	22	19	24	20	26	19	25	17	22	22	27	23	15	25	43	22	24	21
Width	13	10	14	12	11	12	15	13	15	15	13	13	14	14	11	13	14	13	13	11

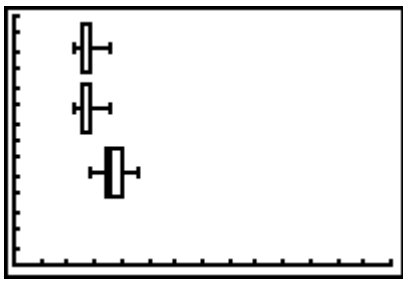
Screenshots of Expected Student Work:

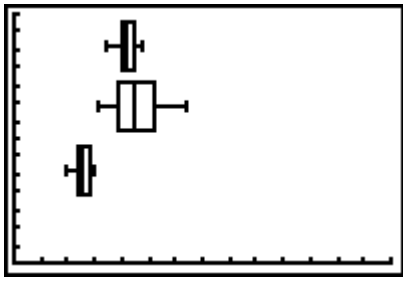
Arrowhead Lengths:





Arrowhead Widths:





Rubric:

Category	1	2	3
Use of graphing calculator	Did not use the graphing calculator effectively to display and compare the data.	Used the graphing calculator sparingly or some of the plots were not constructed.	Used the graphing calculator to effectively display and compare the data samples.
Ability to construct a valid argument	Conclusions are not consistent with the data and the evidence provided is irrelevant.	Conclusions may be inconsistent with the data due to errors in the plots created.	Conclusions are consistent with the data and evidence gathered supports conjectures.
Accuracy of results	Many flaws in calculations, data are not organized, or shows no understanding of the task.	Some calculations are inaccurate; data could be better organized, or shows partial understanding of the task.	Calculations are accurate, well organized, and demonstrates full understanding of the task.
Presentation	Presentation is missing or exhibits many flaws.	Presentation is confusing or final product shows a lack of effort.	Presentation is informative and final product shows commendable effort.