

ESTEEM Webinar for Teacher Educators: Reflecting on Preservice Teachers' Work in the ESTEEM Modules & Assignments

Rick Hudson University of Southern Indiana Heather Barker NC State University Christina Azmy Catawba College

March 3, 2020 4:00-5:45 p.m. EST



Webinar Goals

- Learn the context and purpose of the Screencast Assignment and Task Design Assignment
- Examine *PSTs* work in an *investigation* of roller coasters in Foundation Module
- Share examples of Student Screencasts and discuss how PSTs use CODAP
- Discuss Task Design Assignment and what we have noticed in PST submissions
- Listen to a fielder tester's experience with implementing Screencast Assignment
- Questions/Discussion



To access and share ESTEEM modules

. . .

Open the following link:

https://place.fi.ncsu.edu

Direct link to ESTEEM page

https://place.fi.ncsu.edu/local/catalog/course.php?id=22&ref=3



ESTEEM Modular Approach



Context of Screencast Assignment

Go to <u>https://tinyurl.com/ESTEEMscreencast</u>

- Purpose of this assignment is for PSTs to demonstrate their ability to conduct a statistics investigation using CODAP
- Opportunity to show how they can utilize the tools of CODAP to conduct an investigation



Context of Task Design Assignment

Go to <u>https://tinyurl.com/ESTEEMtaskdesign</u>

<u>**Purpose</u>** - this assignment provides an opportunity for PSTs to design a task that develops students' statistical thinking utilizing CODAP as a tool.</u>

- Implemented after the Association and/or Inference Modules
- Six Parts:
 - Part 1: Introductory Information
 - Part 2: Task Launch
 - Part 3: Student Guide/Handout of the Task
 - Part 4: Anticipating Students' Work
 - Part 5: Notes for Implementation of the Task
 - Part 6: Reflection



Roller Coaster Investigation Assignment



Getting to Know CODAP & Dotplots

Name the coaster with the tallest maximum height.

What is the maximum height of this coaster?

Sample of Older US Roller Coasters								Cases									
Cases (31 cases)																	
index	Coaster	Park	Year Oper	Type	Max Heigl	Track Len											
-10	ocurrent	minuere	1505	nooden	,	LOTO		e									
14	Swamp	Family	1963	Wooden	75	2400	1	he									
15	Blue Str	Cedar P	1964	Wooden	78	2558		Ite									
16	Cannon	Lake Wi	1967	Wooden	70	2272		9									
17	River Ki	Six Flag	1971	Steel	32	2500		att									
18	Big Bend	Six Flag	1971	Steel	81	2876		an a									
19	Creat A	Six Flag	1973	Wooden	105	3450		ag									
20	Demon	Six Flag	1976	Steel	102	2130		d									
21	Demon	Paramo	1976	Steel	102	2130		0					-				
22	Whizzer	Six Flag	1976	Steel	70	3100		ere									
23	Screami	Six Flag	1976	Wooden	110	3872		×					š				
24	Texas C	Six Flag	1976	Wooden	93	3180		000									
25	Cemini	Cedar P	1978	Steel	125	3935		0			00						
26	Loch Ne	Busch G	1978	Steel	130	3240							0000				
27	Montez	Knotts	1978	Steel	148	800			0	20	40	60	80	100	120	140	160
28	Colossus	Six Flag	1978	Wooden	125	4325						Max	Heigh	<u>t (ft.)</u>			
29	Revoluti	Libertyl	1979	Steel	70	1565											
30	Silver B	Frontier	1979	Steel	83	1942											
31	Beast	Paramo	1979	Wooden	110	7359											
							¥										



Supporting New Users in CODAP

Are there differences or similarities between the track lengths for older coasters that are made of different material (Wood or Steel)? Explain.



The steal coasters are generally shorter in length than the wood coasters. Wood coasters are generally the same length. They are distributed across the graph in a way that reflects these answers. [sic]



The coaster with the longest track length is wooden. While the shortest track length is steel. While the average wooden coaster length is 3063 and the average steel coaster length is 2138.



The track lengths for older coasters don't go above 2800 feet. This is near the middle, but it's in the lower length of the track length. The lowest the track length goes is 2132 feet, and the lowest on the entire graph is 200feet. So mainly the older coasters have a smaller track length compared to the newer coasters.

Supporting New Users in CODAP Cont.



Most of the track lengths are below about 4500 feet with one wooden coaster that is an outlier on the graph. It has a track length above 7000.



The wooden coasters tend to be longer, their median it 2767 feet long while the steel coasters median is 2130 feet long. The wooden coasters have one outlier where it is much longer than the rest of them

Screencast Assignment



Why use the screencast assignment?

- In teacher preparation programs teachers should be given the opportunity to engage in statistics investigations, particularly engaging in investigations similar to the ones their students will engage in and sharing out with other teachers (Pfannkuch & Ben-Zvi, 2011).
- Pratt, Davies and Connor (2011) propose that the reason that the infusion of technology in the classroom may be stagnant is because teacher education programs aren't including it in the college curriculums.
- The *Statistical Education of Teachers* (SET) Report recommends that teachers engage in the statistical investigation cycle using dynamic statistical software (Franklin, et al., 2015).



Data sets for Screencast Assignment

- Choose one of three data sets
 - Birth Frequency Data:

https://tinyurl.com/ESTEEMbirthday

- State Education Data: <u>http://tinyurl.com/2015StateEducationData</u>
- U.S. Health and Nutrition Data: <u>https://tinyurl.com/nhanes2003</u>



Screencast Example 1

As you watch the screencast think about this:

 In what ways do the features and actions in CODAP support or hinder the PST's statistical thinking?







Screencast Example 2

As you watch the screencast think about this:

• Think about how the student here is interpreting the question and she uses CODAP to aid in her understanding?







Screencast Example 3

As you watch the screencast think about this:

• How can different representations help further PSTs experience while engaging in a statistical investigation?







Consider



What can these screencasts tell us about the readiness of these PSTs to teach their students to do statistical investigations with CODAP?



Task Design Assignment



Why use the task design assignment?

- Having preservice teachers engage in tasks that use technology as well reflecting on using those tasks from a teacher's perspective, prepares PSTs for similar opportunities in the classroom (Lee & Hollebrands, 2008).
- In contrast to typical formative summative assessments, preservice teachers should be able to create alternative assessments to further their understanding of students' statistical reasoning (Pfannkuch & Ben-Zvi, 2011).
- A recent <u>national survey</u> found that teachers on average spend 5 hours per week creating their own instructional materials and that most of the materials they use in their classroom are self-created (Gorman, 2017). Thus, teachers could benefit from guidance on how to create high-quality statistical tasks.

<u>**Purpose</u>** - this assignment provides an opportunity for PSTs to design a task that develops students' statistical thinking utilizing CODAP as a tool.</u>

- Implemented after the Association and/or Inference Modules
- Six Parts:
 - Part 1: Introductory Information
 - Part 2: Task Launch
 - Part 3: Student Guide/Handout of the Task
 - Part 4: Anticipating Students' Work
 - Part 5: Notes for Implementation of the Task
 - Part 6: Reflection



Task Design Assignment Research Project

Participants:

- 76 preservice secondary math teachers
- 5 universities

<u>Data:</u>

- 73 completed Task Design Assignments (one instructor permitted teachers to work in pairs)
- Focus on 3 key aspects
 - Analysis of large, multivariate, real datasets
 - Continual connection to context
 - Engagement in the statistical investigative cycle

<u>First Publication:</u> Casey, S., Hudson, R., Harrison, T., Barker, H. & Draper, J. (in press). Preservice teachers' design of technology-enhanced statistical tasks. Accepted for publication in *Contemporary Issues in Technology and Teacher Education.*

Task Design Assignment Research Project

Conclusions

- Three key aspects largely reflected in the tasks created by preservice math teachers who used the ESTEEM materials
- Stronger in Key aspect 1: use of large, multivariate, real datasets & Key aspect 2: continual connection to context
- More room for improvement for Key aspect 3: engagement in statistical investigation cycle
- Knowledgeable and comfortable using CODAP



The Data Sets



- <u>Multivariate</u>: approximately 15 attributes provided per case, half included 11 or more attributes. 79% of datasets included both quantitative and categorical attributes.
- <u>Real:</u> 61 of 73 (83.5%) used real data, 55 pre-collected and 6 collected by students in class; additional 5 used CODAP's sampler to generate simulated data



Launching Statistical Explorations

Launch A

Trailer for La La Land: <u>https://youtu.be/VDMf9m7FXd4</u> Trailer for Moana: <u>https://youtu.be/yfCOEGyHMwc</u> Trailer for Rogue One: <u>https://youtu.be/T_Mr2XfpADo</u>

To introduce the topic of movies, I will show the above **trailers**. This will engage the students in thinking about movies. By **activating this background knowledge**, it will be easier for the students to engage in making the connections needed to carry out this task. Following the movie trailers, the teacher will lead a class discussion about movies and their attributes. The teacher will use the following questions to guide the students' thinking:

What goes into making a movie?

What determines a movie's success?

What are some attributes that might contribute to how much money a movie makes?

Students will then be **introduced to the data set** composed of data pertaining to movies that came out in 2016. **Definitions will be given for certain attributes,** namely gross referring to the amount of money a movie makes and runtime referring to the number of minutes long a particular movie is. Any other attributes that students are unclear on will be addressed at this time as well. Students will be given the handout and instructed to begin exploring the data.

Launch B

The 2020 Olympics in Japan is coming soon! The Olympics is a sporting event among the nations of the world where athletes compete in a variety of events for honorable competition. We will be looking at some data from the years of the Olympics and analyzing it using CODAP. We will particularly want to look at the gender makeup of the data, and see if we can ask questions about it.



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables



Categorical and Quantitative Variables

Task simulated creating 10 bags of 15 M&Ms using CODAP's sampler.

Data resulted in colors (e.g., BL for blue or Y for yellow).

"Create a dotplot of our data" "What do you notice about the shape of the distributions?"



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs. Causation



Correlation vs. Causation

"Select two quantitative variables you think have a correlation, **one affecting the other**, and put them into the graph."

"If variables have a correlation: they have a relationship and **they directly impact the other**; If variables are no correlation: they do not have a relationship so they are not impacted by the other."

"Does the arm span of the student make a difference in height?"



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs.Causation
- Difference between Mathematics and Statistics



Difference between Math and Statistics

"Were those two qualitative variables associated or independent? How can you **prove** that?"

"Tomorrow the temperature is 90 degrees Fahrenheit and Dairy Queen wants to know how much money they will make from selling their ice cream. Write your guess for the amount that they will make and then **solve for what exactly they will make** for that day."



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs.Causation
- Difference between Mathematics and Statistics
- Analysis Issues



Analysis Issues

"a) Graph "Hanging Out With Friends Hours" versus "Paid Work Hours". What do you see? Write down some notes. Ask a question about what you see. b) Click on the ruler icon and click on Median. Why are so many medians zero?"





Analysis Issues Cont.

Not considering student choices...

Data about 400 graduate school applicants included 8 attributes. Students were asked to **choose two attributes** and analyze the bivariate data for

- form (linear, quadratic, exponential)
- strength (strong, moderate, weak, none)
- direction (positive correlation, negative correlation)





Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs. causation
- Difference between mathematics and statistics
- Analysis issues

Pedagogical Issues

- Clarity of questions
- Students underprepared to answer



Clarity of Questions & Students Unprepared

Contextual Support Needed

"What four teams have the greatest number of losses and least number of wins?"



"Create a graph of with the variable Rank in Region and Team" [sic] and "Now it's time to complete your bracket."

Content Support Needed

8. Fill in the table below that shows the joint relative frequencies and marginal relative frequencies. Use the ruler feature in order to find the joint and marginal relative frequencies.

			Class		7		
		Crew	First	Second	Third	Total	
Survived	Survived	9.6%	9.2%	5.4%	8.1%	32.3%	
	Did not survive	31%	5.5%	7.6%	24%	68.1%	
	Total	40.6%	14.7%	13%	32.1%	100.4%	

9.Write three statements describing a joint relative frequency, a conditional relative frequency, a marginal relative frequency.

Joint Frequency: 31% of the crew members did not survive. Marginal Frequency: 14.7% of the people on the Titanic belong to first class Conditional Frequency: 76% of the crew members did not survive



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs. causation
- Difference between mathematics and statistics
- Analysis issues

Pedagogical Issues

- Clarity of questions
- Students underprepared to answer
- Focus on computation/CODAP use



Focus on Computation/CODAP Use

- 1. Describe how you chose to create a graph using the class data.
- 2. What graph tools did you use in CODAP?



Problematic Aspects

Content Issues

- No driving statistical questions (51%)
- Distinguishing between categorical and quantitative variables
- Correlation vs. causation
- Difference between mathematics and statistics
- Analysis issues

Pedagogical Issues

- Clarity of questions
- Students underprepared to answer
- Focus on computation/CODAP use



Reflection on Implementation

Christina Azmy



Sharing Screencast Experience

- Dr. Christina Azmy, Catawba College, Assistant Professor of Education
 - Implemented screencast before the final version was made







Scoring Rubric

Category	Point
Mathematical Content Standards ; provide the following on the webpage: • Identify A FEW NC Standards or Common Core mathematical standards (depending on the requirements in your state) that could be addressed by using the chosen task.	2
Technology use : • The ways technology is used should illustrate best practices, and advanced skills as learned through different course tasks and resources. (e.g., creating more than one graph, linking between multiple representations, using appropriate graphs and adding measures to a graph, computing measures in a table, creating new attributes based on a formula, arranging data hierarchically, viewing a map if appropriate)	10
Problem solving and language • The language you use during the video should be statistically accurate and you should be modelling enacting statistical habits of mind, such as considering variation, understanding measurement, connecting to the context, using multiple representations and measures to display data, and being uncertain in your claims	10
Quality and length of video • Video should be high quality (practice a few times), and under 10 minutes. • Video should be posted on YouTube or other videohosting service provided by a screencast recorder website so that it can be embedded on your website and a direct URL link provided.	3



Total

Questions?



References

- Gorman, N. (2017, February 7). Survey finds teachers spend 7 hours per week searching for instructional materials. *Education World*. Retrieved from <u>www.educationworld.com</u>.
- Franklin, C., Bargagliotti, A. E., Case, C. A., Kader, G. D., Scheaffer, R., & Spangler, D. (2015). The statistical education of teachers. Alexandria, VA: *American Statistical Association*.
- Lee H.S. and Hollebrands K.F. (2011). Preparing to teach mathematics with technology: An integrated approach to developing technological pedagogical content knowledge. *Contemporary Issues in Technology and Education, 8*, 326 - 341.
- Pfannkuch, M., & Ben-zvi, D. (2011). Developing teachers' statistical thinking. In C. Batanero, G. Burrill, and C. Reading (eds.), *Teaching Statistics in School Mathematics-Challenges for Teaching and Teacher Education: A Joint ICMI/IASE Study* (pp. 323–333).
- Pratt, D., Davies, N., Connor, D. (2011). The role of technology in teaching and learning statistics. *International Journal of Technology in Teaching and Learnin, 10*(2), 97 107.





Principal Investigators:

Hollylynne Lee, North Carolina State University William Finzer, The Concord Consortium Stephanie Casey, Eastern Michigan University Rick Hudson, University of Southern Indiana

Research Associate:

Gemma Mojica, North Carolina State University

This project is supported by the National Science Foundation under Grant No. DUE 1625713 awarded to North Carolina State University. Any opinions, findings, and conclusions or recommendations expressed herein are those of the principal investigators and do not necessarily reflect the views of the National Science Foundation.

hirise.fi.ncsu.edu/projects/esteem/