You can find my lesson plan in the pages below.

1. I will cause some disequilibrium because estimating a line of best fit is not perfect math, it's an estimate. I feel like this may cause disequilibrium in some students because they may only know how to rely on the formulas and making an estimate requires deep thought and finding relationships and patterns in the graphs.
2. I hope to help my students assimilate by connecting their basic knowledge of analyzing patterns to analyzing relationships within a graph. I think it would also be very useful to show silly examples of why correlation doesn't mean causation. My favorite example is that drownings increase when ice cream sales increase. I will help my students realize that that doesn't mean ice cream causes drownings, and hopefully that will help them make a connection with relationships in the context of the activity.
3. Information process model:
    a. Sensory Memory: My voice describing the assignment and directions, the hand motions described in Fischer's Three Tiers, Visual Aids of graphs as examples, and a video of a rollercoaster to get them in the right frame of mind (hearing the rollercoaster, people screaming, etc.). This will allow my students to focus their attention on the activity
    b. Working Memory: For working memory, the activity is put into two parts so my students can focus on only parts of the information at once. This will help to not overwhelm them to a point where they cannot participate. This also encourages rehearsal because they are introduced to the idea of relating lines to the scatterplot three times in the activity.
    c. Long-Term Memory: I plan to ensure Long-Term Memory by using these ideas throughout the semester so that my students can retrieve the information later.
4. I am choosing to include Fischer's Three Tiers:
    a. Something that I don't have in the lesson plan is actions or hands on experiments. To change this, I would love to use hand signals to show the difference between a positive relationship, negative relationship, strong relationship, weak relationship, etc.
    b. The visual representation is the examples of how my 'past' students chose to draw the line of best fit within the graphs.
    c. The abstract part is to allow my students to think of and show how they would estimate their own line of best fit.

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UVU Lesson Planning Guide

Name(s): Alison Willits	**Lesson length:** 30 min
Grade Level: 9	**Subject:** Secondary Math 1

I. Standards	
Utah State Core Curriculum Strand(s) and Standard(s):	**Standard S.ID.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. **a**. Fit a linear function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions, or choose a function suggested by the context. Emphasize linear and exponential models. **b**. Informally assess the fit of a function by plotting and analyzing residuals. Focus on situations for which linear models are appropriate. **c**. Fit a linear function for scatter plots that suggest a linear association.
Utah Core Literacy or Math Standard (secondary only):	**Standard SI.MP.4-** Model with mathematics. Apply mathematics to solve problems arising in everyday life, society, and the workplace. Make assumptions and approximations, identifying important quantities to construct a mathematical model. Routinely interpret mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
Summative (Unit) Assessment:	
Central Focus:	Support students in developing conceptual understanding of statistical data, analysis, and interpretation using real life data.

II. Intended Learning Outcomes	
Learning Objective/Target/Indicator: (Know and Do)	Students will be able to identify relationships between attributes in data sets, they will be able to estimate the line of best fit (the linear regression line). They will be able to determine if the regression line is a good predictor of the data.

III. Academic Language

Language Function:	Learning Statistical language and its meaning and use in the context	
Language Demand		
	Vocabulary:	line of best fit, linear regression line, attributes, relationships, scatterplot, bivariate, data, analyze, evaluate, outliers, mean, median, expectation, x-axis, y-axis
	Syntax:	
	Discourse:	
	Mathematical Precision (math only):	Reading graphs, labels of axis, being precise in using attributes and definitions in explanation of hypothesis and in defending the relationships found
Language Support:	Put definitions on board, visual demonstration while going through and explaining definitions, using appropriate and correct language when talking with the class or small groups	

IV. Assessment of Student Progress	
Pre-assessment:	
Formative assessments:	Observe, talk to small groups, question and answer format, students will be accountable for individual summaries and generalizations
Final formative assessment:	Worksheet

V. Preparation	
Students' prior knowledge, skills and assets:	Know how to work in CODAP, read graphs, y=mx+b form, how to plot data
Student preparation (if applicable):	Have the CODAP roller coaster activity up from previous lesson and notes
Teacher preparation:	Anticipate Student answers: Create graphs in CODAP to use as examples Reserve mobile computer lab/ computer lab
Technology integration (as applicable):	CODAP Rollercoaster Data

VI. Addressing Learners' Needs	
Differentiation/Individualization:	Modify content for interest by using codap and the rollercoaster data. Modify process for profile and readiness by using partners/groups.

	Modify the environment for profile by creating a worksheet with directions and questions in larger font size than provided in CODAP. Modify the environment for profile by showing ELL students how to change the language in CODAP
Support for ELLs:	Codap can be used in a variety of languages Using pictures and words so they can find a connection.
Accommodations/Modifications for IEPs/504s:	As required

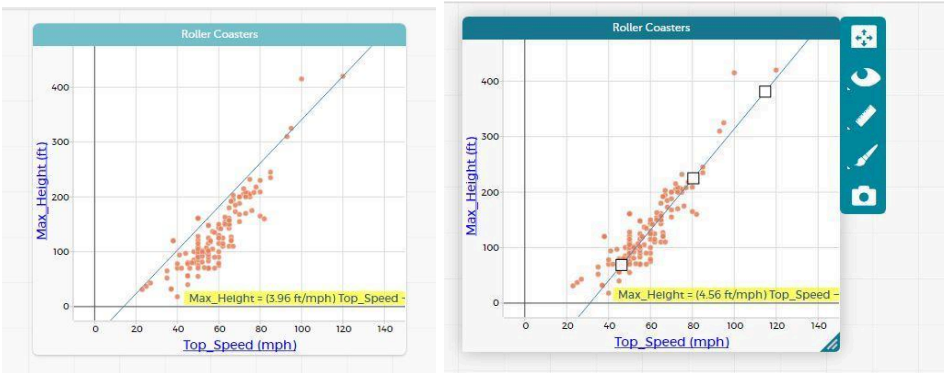
VII. Instructional Procedures (including models of instruction, strategies, assessments, differentiation, transitions, etc.)	
Model of Instruction	Integrative Model- Data coming from CODAP
Step 1:Plan for the Integrative model. Topic and target generalization	Least squares line and how it pertains to data relationships Data Set: CODAP Rollercoaster Data Teacher implementation: make sure everyone can access the link and have it open
Differentiation:	Modify content for interest by using codap and the rollercoaster data. Modify process for profile and readiness by using partners/groups. Modify the environment for profile by showing ELL students how to change the language in CODAP
Step 2: Describe, compare, and search for patterns in the data set	Activity 1: try out methods for placing “line of best fit” and analyze line vs. pattern of scatterplot. Does the line represent the data relationship well? Teacher Implementation: walk around, observe, ask guiding questions, ensure students are on task.
Formal Assessment:	The CODAP activity questions
Step 3:Explain the identified similarities and differences	Group discussion Write a brief summary using statistical language on your worksheet Teacher implementation: Guide group discussion
Informal Assessment:	Ask guiding questions
Differentiation:	Modify the environment for profile by creating a worksheet with directions and questions in larger font size than provided in CODAP.
Step 4:Hypothesize what would happen under different	Activity 2: explore a predicted relationship and its line of best fit. Teacher implementation: observe students, walk around, ensure students are on task

conditions:	
Teacher implementation	Lead discussion about Activity 2
Step 5: Make broad generalizations about the topic and the discussion	Make broad generalizations about what the purpose of the line of best fit is useful for, use statistical language.
Formal Assessment	Worksheet will be turned in on their way out of class Teacher implementation: collect worksheets

Q5: Describe your strategy for placing your line of best fit. If it is the same or different as the strategy of the person you studied in part A, tell me why or why not.

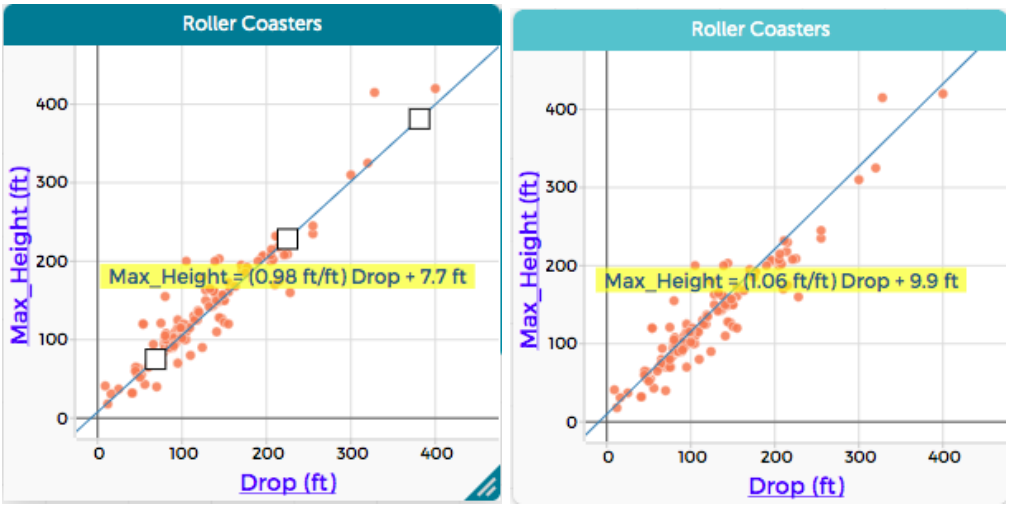
Student 1: Tried to get the line in the middle of the data from top to bottom. Different, Thomas had his go through the first and last point. I picked height vs top speed. The line would have been too high if I used Thomas's method and would have had almost all the points under the line. So it would underestimate the top speed if I used it.

Thomas



Student 1

Student 2: I compared Drop and Max Height. My strategy was to only look at the data that was bunched together because I assumed the rest would be considered outliers. I tried to fit the line in the middle of that part of the data. I chose not to do it the way Molly did it because it seemed unnecessary to do all the work when all I had to do was guess. If I had approached it the same way Molly did, we would get about the same equation of the line. (on the left is mine, on the right is Molly's)



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Exploration Day: Roller Coaster

Roller Coaster Activity part 1:

Group 1:
Thomas's approach

Group 2:
Molly's approach

1. Look at the line and determine if the slope/direction of the line looks similar to the data.
2. Click on the ruler icon and click "Squares of Residuals."

Q1: What is the "Sum of Squares" for your person's approach to creating a line of best fit?

3. Unclick the "Moveable Line" and the "Squares of Residuals."
4. Click the "Least Squares Line" to find the actual line of best fit.
5. Click the "Squares of Residuals" for the least squares line.

Q2: What is the "Sum of Squares" for the least squares line? How does it compare to the moveable line created by your person? Q3: What would you assume the "Squares of Residuals" tell us about the line? Q4: Do you agree with your person's approach to creating a line of best fit? Why or why not? Does it work for this dataset? Would it work for all datasets?

STOP Come Back to Class to Discuss
Roller Coaster Activity part 2:

Data Set

1. Find two attributes that you think will have a linear relationship.
2. Click on the ruler icon and click “Moveable Line.” Manipulate the line to be where you think the line of best fit would be.

Q5: Describe your strategy for placing your line of best fit. If it is the same or different as the strategy of the person you studied in part A, tell me why or why not.

3. Click on “Squares of Residuals” and begin moving the moveable line to see how the sum of squares changes. When you find a place for the line to stay, click the least squares line to see how close you were.

Q6: Were you successful in getting your line close to the least squares line? Why or why not? Q7: Was the “Sum of Squares” useful in determining the best place to put your line? Why or why not?

Brainstorm moment

Q8: What will the equation for the line of best fit tell us about the data? Why is it important to calculate?