

Background:

This research was conducted at Evanston Township High School (ETHS) in Evanston, Illinois. Science education is trending towards a cyclical, non-rigid, open-inquiry model. Despite this shift, many science teachers still rely on lengthy, formal lab reports to summarize a lab that do not support meaningful data analysis or synthesis.

The purpose of my research was to find an alternative to the traditional lab report that allows students to summarize their learning from the lab in a more authentic, productive, and enjoyable way.

Methodology:

- The study was conducted on 25 Advanced Placement Physics 1 students
- There were four treatment phases, one for each lab report and one final lab where students selected their lab report method
- Students completed a pre-test and post-test for each lab and completed the Post Lab Opinion Survey after each lab summary was due

Primary Question:

How does the method of lab summarization impact student ability to learn the content and skills from the lab?

Secondary Questions:

How does the method of summarizing the lab have an impact on student perception of their learning from the lab?

How does the method of summarizing the lab have an impact on student enjoyment of the lab process?

Research Questions	Data Collection Instruments		
	1	2	3
Primary Question	Unit Pre-Tests Unit Post-Tests	Unit Exam Focus Questions	Lab Report Rubric
Secondary Question 1	Post Lab Opinion Survey	Student Interviews	Student Choice Survey
Secondary Question 2	Post Lab Opinion Survey	Student Interviews	

Lab Summary Methods:

Video Lab Report

- Students record a 2-4-minute video discussing their findings from the lab
- Video recordings of the lab being done are included
- Students connect the lab to an online video of a related phenomenon

Claim Evidence Reasoning Paragraph

- Students answer a scientific question by writing a claim, evidence, reasoning paragraph
- The evidence could be pictures, graphs, or mathematical relationships discovered in the lab

Email Home

- Students write an email explaining the lab to a family member or friend who does not know physics
- Students must meet the level of their reader and provide relatable examples from everyday life

Data and Analysis:

- The post tests showed a medium average normalized gain for the Video Lab Report, CER, and Email Home Lab Report. (Figure 1).
- Students in the treatment group scored higher on the Unit Test focus questions than the non-treatment group. (Figure 2).
- Students who chose the Email Home Lab Report had a high average normalized gain on the final post test and had the highest average on the Unit Test focus question (Figure 3).
- A majority of students agreed that they enjoyed the Video Lab Report and the Email Home Lab Report. (Figure 4).

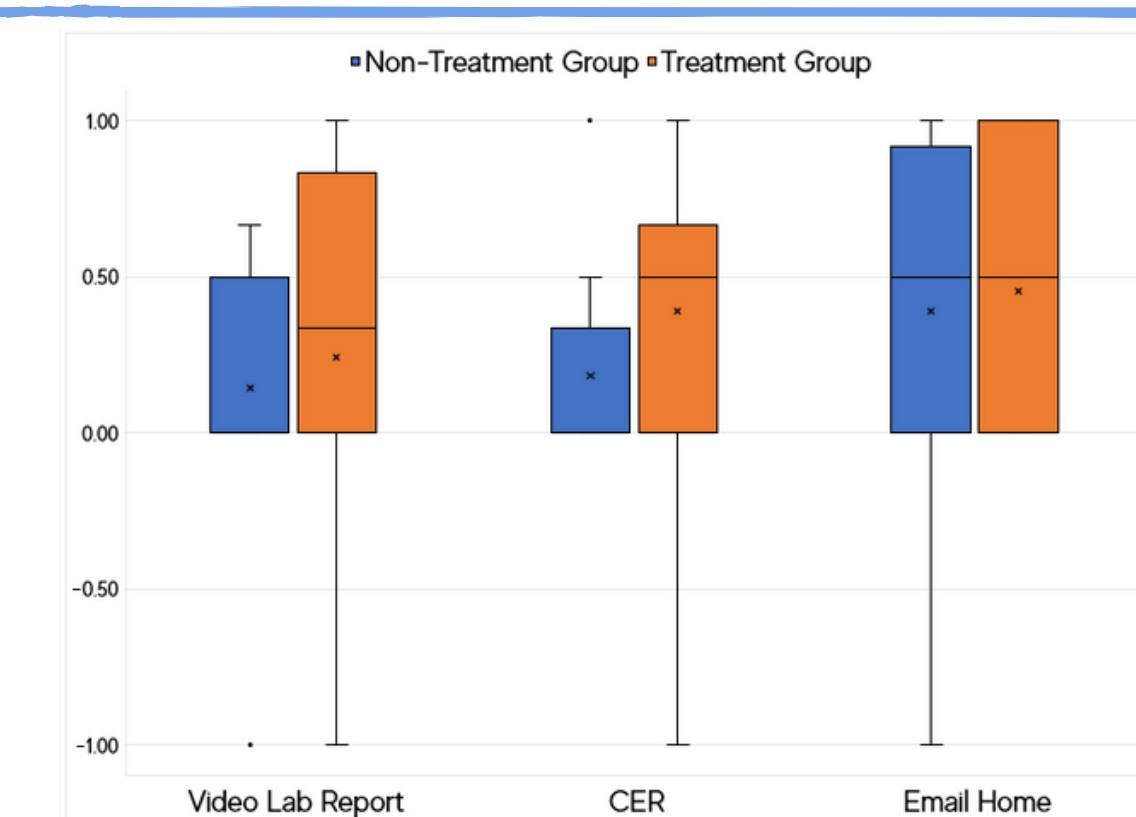


Figure 1. Average normalized gain between pre-test and post-test for each lab summary (N = 21).

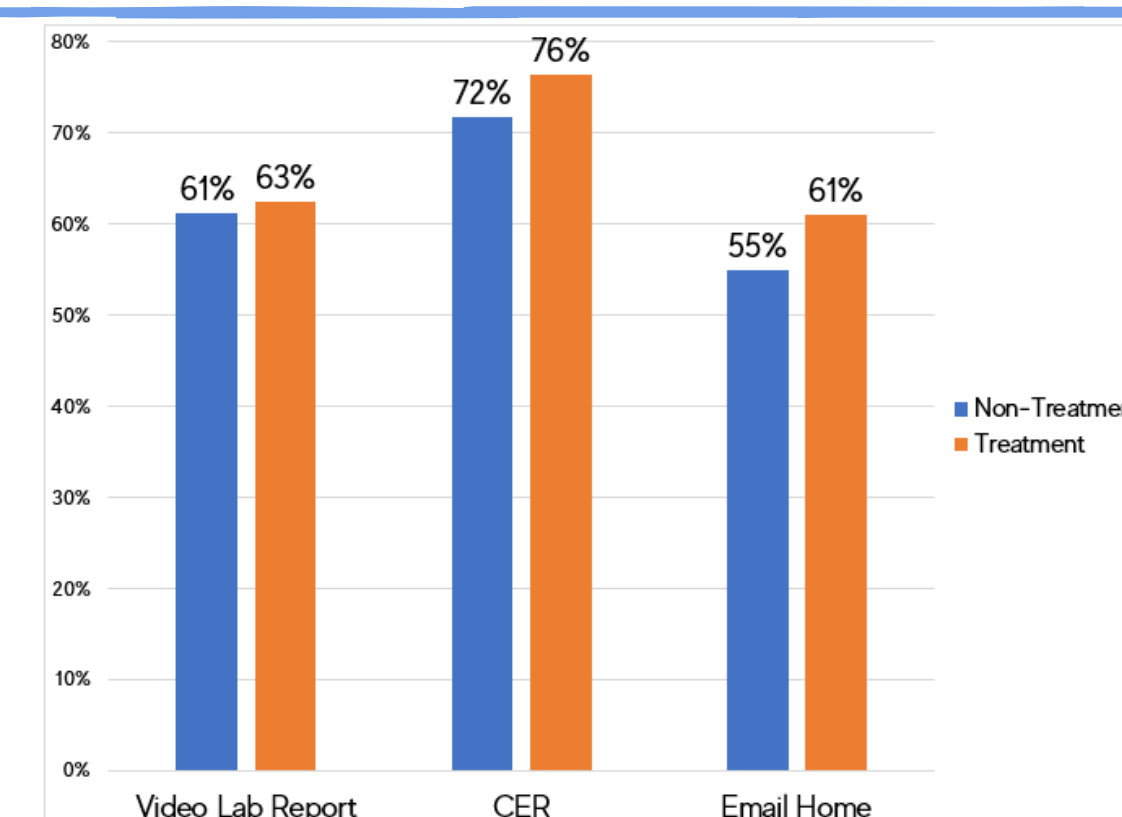


Figure 2. Average score on Unit Test focus questions for each lab summary (N = 24).

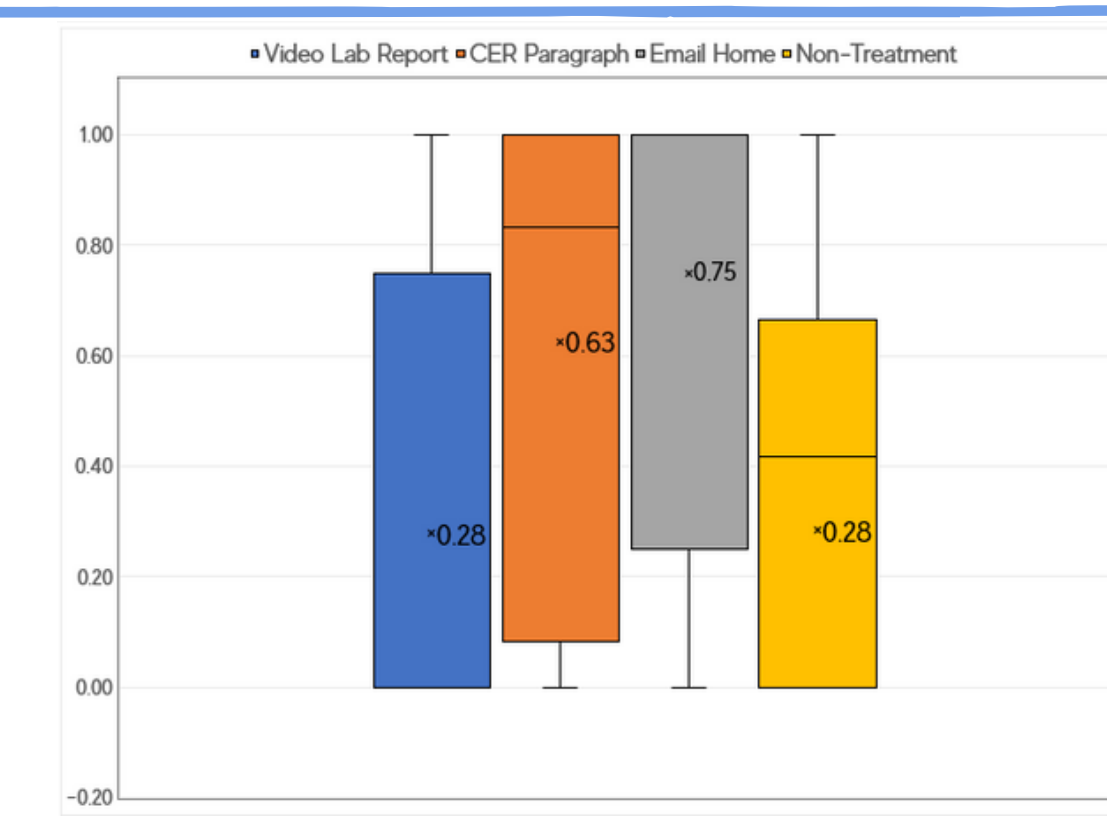


Figure 3. Average normalized gain between Unit 5 pre-test and post-test based on student choice (N=24).

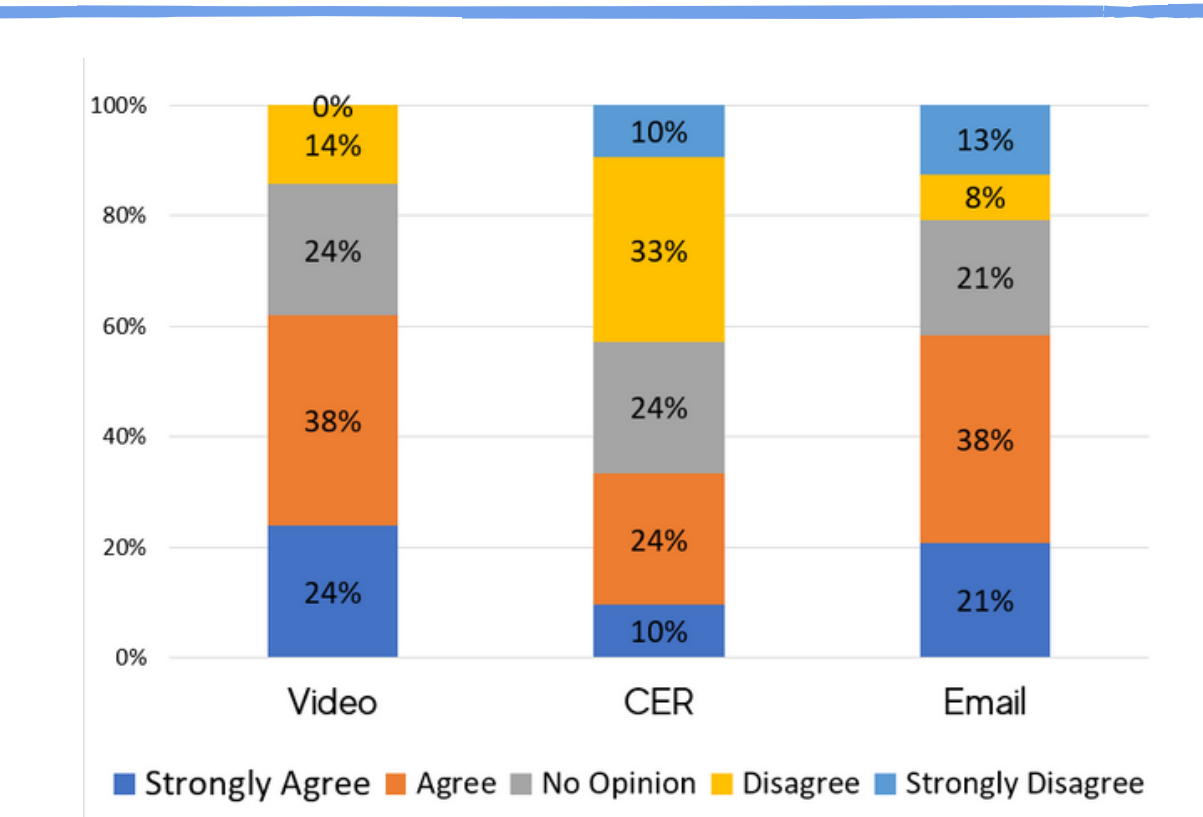


Figure 4. Response to Likert question, "I enjoyed using this lab summary method" (N = 24).

Conclusion:

The results of the study showed that students learned more from the labs while using the Email Home Lab Report when compared to students who chose other lab summary methods and students in the non-treatment group. Students also enjoyed the Email Home Lab Report the most due to the creative nature of the summary. One student said, "I enjoyed the email home lab report because I was able to put in some creativity instead of just explaining what I did and why."

Procedure for lab two (radius vs period)

For this lab we evaluated the relationship between radius and period. We did this by using tape to mark certain radius lengths, from there we used the same method from lab one, spinning the stopper 20 times then dividing the time it took by 20 to get the average speed for a rotation. We did this for each radius length. 0.05m, 0.1m, 0.15m, 0.2m, 0.25m, 0.3m, 0.35m and 0.4m. After we gathered the data we graphed and linearized.

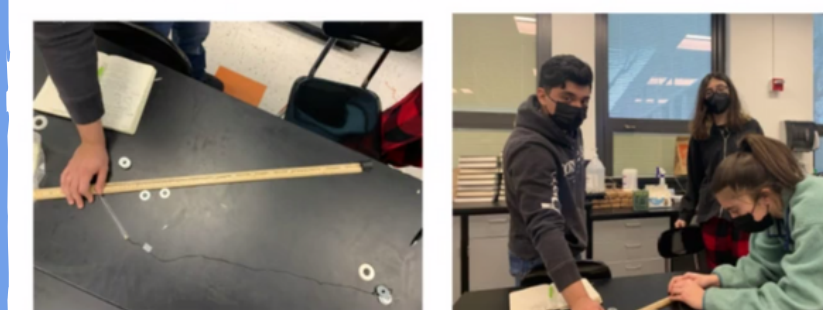


Figure 5. Example of student Video Lab Report slide.

Claim: Black holes are a space phenomenon whereas extreme gravitational forces prevent anything from escaping. They have a large mass and exert stronger gravitational forces with objects closer in range.

Evidence: According to experiment #1 of the gravitational force lab, as distance increases, the force decreases in an inverse ² relationship. We recorded a range of (radius, force) points, including the following: (1, 0.000 000 166 852), (5, 0.000 000 006 674) and (10, 0.000 000 001 669). This is represented by the mathematical model of $F = (1.6685 \times 10^{-5}) / r^2$ and the graph of:

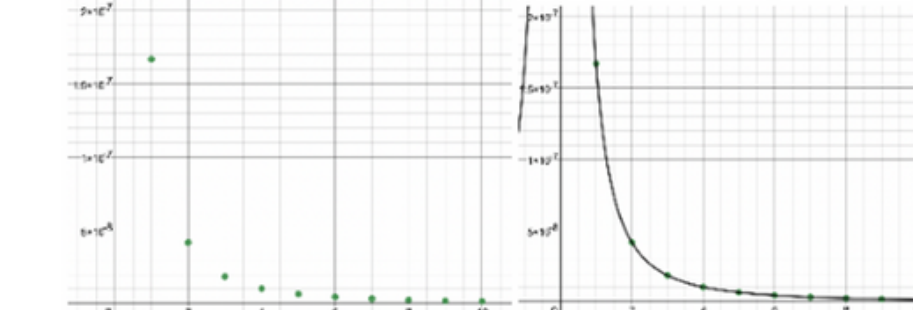


Figure 6. Example of student CER.

Hi Dad,

Remember a couple of months ago when we went sledding in Park City Utah and were wondering how the different heights of each hill related to the final speed of the sled? Today in physics class we did a lab that helped me figure out why! In our lab today we tested how energy is conserved. The principle of the conservation of energy says that energy within an isolated system is not taken or made, it is simply transferred from one type of energy to another.



Figure 7. Example of student Email Home Lab Report.