


CAPSTONE ACTION/LEARNING LOG

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MY ESSENTIAL QUESTION: How can movement be used to generate electricity?

DATE: Nov. 27, 2020	HOURS SPENT RESEARCHING/PROTOTYPING: 7 hours	MY PROCESS: Create/ Build
QUESTION(S) OR GOALS I HAVE T PS C	RESOURCES I HAVE USED TO ANSWER THE QUESTION(S) T PS C	
<p>Does having the copper wire inside of the PVC pipe create more electricity?</p> <ul style="list-style-type: none"> • Since I was not able to find much information for this specific question, I created 2 separate designs one with the copper wire inside (figure 1.) of the tube and one on the outside to compare the results. • I tested both out and found that although the two made a similar amount of energy (around 8 millivolts), the one with the copper inside of the tube made it more difficult for the magnet inside to move.  <p><i>Figure 1. Photo of tube with copper wire loops inside</i></p> <p>Does the number of loops increase the amount of electricity generated?</p> <ul style="list-style-type: none"> • When I researched this, I found that many articles said that when you create more loops you also make you more resistance. This means that more energy is used up = less electricity created. 	<p><i>Must be properly cited. Sources could include: books, news articles, podcasts, artwork, people, songs/poetry, recorded conversations, films/documentaries, academic articles, stories, data...</i></p> <p>Capacitors Explained - The basics how capacitors work ... (n.d.). Retrieved from https://www.youtube.com/watch?v=X4EUwTwZ110</p> <p>Capacitors, DC and AC Current - YouTube. (n.d.). Retrieved from https://www.youtube.com/watch?v=NInt1Ss3vQ4</p> <p>Perkins, S. (2020, June 03). Explainer: How batteries and capacitors differ. Retrieved from https://www.sciencenewsforstudents.org/article/explainer-batteries-capacitors</p> <p>Storage of Electric Power. (n.d.). Retrieved from https://www.school-for-champions.com/science/electric_storage.htm#.X8ICDc1KjD4</p> <p>Wagner, D. (n.d.). Retrieved from https://www.rpi.edu/dept/phys/ScIT/InformationStorage/faraday/magnetism_a.html#:~:text=The induced current depends on,of loops in a coil.</p>	

- I later asked my family friend who is an electrical engineer if this were true and if more loops meant I would be making less electricity. He told me that yes this would have a greater an effect if I were using thinner wire, but since my wire is thicker it would be alright.
- Following this, I made 2 different prototypes. One with 1 layer of loops, and a second with 2 layers (figure 2.). I compared the energy generation of the two by moving a magnet inside and using a multimeter to measure the voltage. I found that my mentor was correct the resistance did not influence my prototype and that 2 layered loops generated double the electricity of the single layered one.



Figure 2. Process of adding 2nd layer of loops

Electricity Generation results:

1 layer of loops: 6-12 mV (millivolts)
 2 layers of loops: 15-20 mV

List individuals that have helped you with your project and explain who they are and why you are consulting with them.

Ali: He is a family friend, who is an electrical engineer. I contact him if I am ever stuck on something related to my capstone project.

My dad: Although he isn't in an engineering profession, he knows a lot about electricity, and he helps me solder when I need an extra pair of hands.

WHAT HAVE I LEARNED SO FAR?



WHAT HAVE I LEARNED SO FAR?



Reflecting on my LEARNING: *What have I learned since my last learning log (if this isn't the first) that helps me answer my essential questions?*

I am changing my essential question from "How can movement be used to generate electricity?" to "How can body movement and electromagnetic induction be used together to generate electricity?", as I feel that the research that I am doing is more specific than my previous essential question.

I have learned that soldering does provide a better connection for electrical components. I discovered that making more loops generates more electricity. After noticing that the size of my PVC pipe may be too small to generate sufficient energy, I doubled the size of the tube and tripled the number of loops (Figure 3.). I found that in comparison to the 2 layers of loops the energy production increased to 30-35 mV.

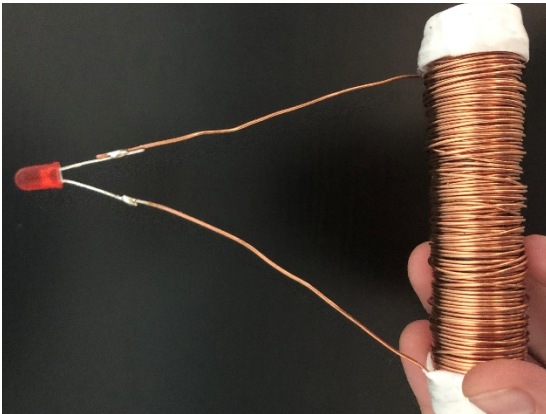


Figure 3. The latest prototype I have made

I also discovered that I may be able to use capacitors to temporarily store some of the energy be generated. But since the electricity that is being made by induction is alternating current (which is not collectable, because the current jumps from + to - therefore nulling out any charge that is collected), I will have to somehow find a way to change it to direct current before collecting it all in a capacitor.

Reflecting on the PROCESS → *What's working? What's not?*

I have found that electricity is being generated, but it is far too little to charge a battery or even light up an LED. I thought maybe instead of charging a battery, I could make a flashlight for runners and bikers to use, but I have not been able to find LED's that require a small amount of

Reflecting on SELF à *What am I learning about myself?*
(learning style, personality, skills, feelings, work ethic...)

I learned that I retain more information if it has more visuals.

- As I was doing research, a lot of the articles I read were not very engaging, but after watching YouTube videos on the same topic I noticed that I found it more enjoyable and the graphics made it easier for me to remember.

I learned that I find it frustrating and stressful when the project does not work the way I would like it to, but as a determined person I try to find alternative paths and solutions.

energy to light up, therefore I am planning on implementing a capacitor in my design so that it can store the electricity and release it continuously.

FURTHER QUESTIONS I THOUGHT OF AS A RESULT OF MY RESEARCH...

Which size capacitor would I need to use/ Will the size of the capacitor make a difference?

How can I convert alternating current into direct current?

Will the capacitor be able to store voltage long enough to keep the LED lit for long periods of time?

Can the heat from soldering damage an LED, or a capacitor (I am worried that this might be another reason the LED does not light up)?

If I use the prototype as a flashlight, what is the best possible way to design it so that it is both comfortable and appealing.

NEXT STEPS:

- Incorporate a capacitor
- Make a more appealing and comfortable design plan
- Answer questions listed above

WHEN WILL I COMPLETE THIS WORK:

- I will complete it under 10 hours and by the next learning log.

CAPSTONE LOG HOLISTIC RUBRIC

LEARNING LOG #: 4

Date: Nov. 27, 2020

EXTENDING

Thinking is METACOGNITIVE

- Student Learning Log is mindfully completed.
- Demonstrates examination of the learning process, showing what learning occurred
- Includes properly documented evidence/sources
- Demonstrates that student has reconsidered what they already knew
- Provides thorough and meaningful examples of critical thinking
- Creates clear, meaningful and manageable objectives as well as a timeline for learning
- Communication is clear and coherent

PROFICIENT

Thinking is ANALYTIC

- Student Learning Log is complete.
- Demonstrates that student has applied learning to a broader context of personal and professional life.

- Includes evidence/sources
- Provides examples of critical thinking
- Creates clear and meaningful objectives as well as a timeline for learning
- Communication is clear and coherent

DEVELOPING

Thinking is DESCRIPTIVE

- Student Learning Log is simple yet complete
- Shows an understanding of how learning could be used
- Shows evidence of research; may not include documentation
- Provides some limited examples of critical thinking
- Creates simple objectives and may not have a clear timeline for learning
- Communication although flawed at times, does not impact meaning

EMERGING

Thinking is SUPERFICIAL

- Student Learning Log is incomplete
- Demonstrates acquisition of minimal new content and is limited to a description of general unfounded opinions and behaviors
- Shows no evidence to support thinking and is limited to personal, prior knowledge
- Student has not set any learning objectives and has no clear timeline for learning
- Communication is flawed and often impacts meaning

DID NOT SUBMIT

- Student did not submit this assignment for assessment.