Inquiry-Based Learning and Higher-Order Thinking Skills in High School Science

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Research Question

The question that guided my research was: *How does the incorporation of inquiry-based learning and student choice increase student understanding in a high school science class?*

Project Summary

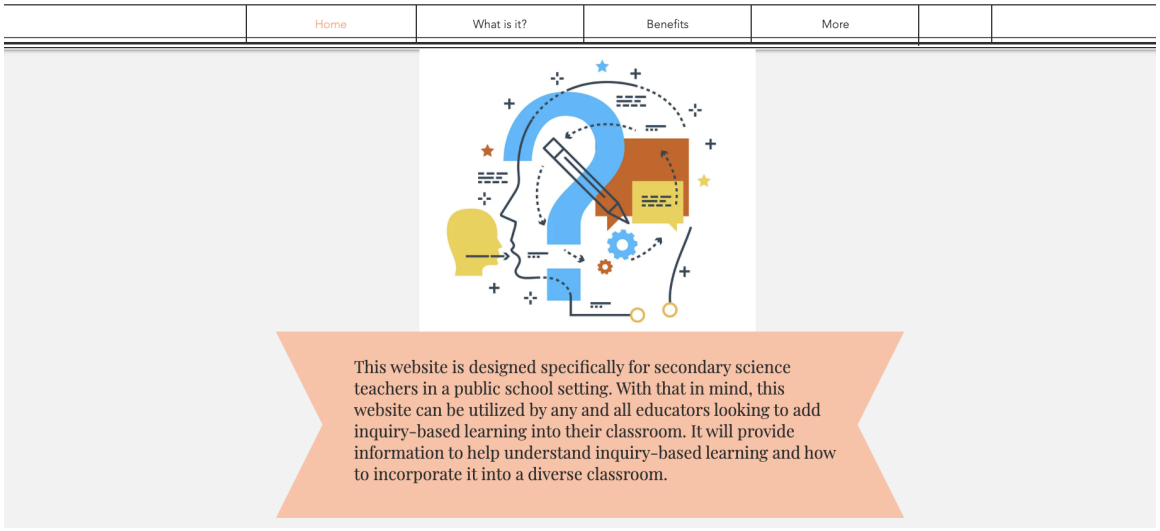
Every student is required to take a science course throughout their schooling and students fall on either one of two sides: they love science class or they hate science class. Often, students who are good at memorizing facts and regurgitating it on a test later tend to do well in science classes while other kids struggle. This usually happens because teachers will use a lecture based approach where they present information to students on slides while students are expected to learn by taking notes, then students practice by completing worksheets or practice problems, students complete a lab with all of the steps laid out for them, and finally students will take a test to see if they 'learned' the content. This teaching style does not set students up for success in science, or in any content area. Some students who struggle with this style might describe themselves by saying they 'learn best by doing' or 'learning with their hands'. Inquiry-based learning is actually a strategy where the classroom is flipper, giving the students the opportunity to explore topics, discover new things, and learn by using their hands and working together.

In order to answer my research question, I chose to design a website as my project. There were a couple different reasons that I decided a website was the best route for me, but the main one is because as a first year teacher myself, I have encountered many times where I was searching online for resources to use or learn from. Web resources are a powerful tool and are easily accessible to all types of educators. At first, I

wanted to create a professional development session, but chose against it because a website would be a resource that teachers could look back to multiple times and access it when it is most convenient to them. My website is specifically designed with secondary science teachers in mind, since that was the primary focus of my research, but all of the resources and tools on the website can be used and incorporated into any type of classroom. The main goal of the website is to educate the users on what inquiry-based learning is, how it is beneficial to the students and their learning, and also find resources and examples of it in a classroom setting.

The Project

The website can be found at https://rscheiller.wixsite.com/inquirybasedlearning Since the process of designing a website is very complex, I wanted a platform that would simplify the process, have helpful tips and tricks, provide templates, and be cost effective. Based on those considerations, I chose the platform Wix to design my website. When I first started the process of building my website, I focused on the layout and organization of it to make it accessible and easy for any user to navigate.



The first thing seen on the homepage is an explanation of the website. My website includes five main sections that can be accessed from the home page and navigation bar. The sections include: *About, What is it?, Benefits, Classroom Incorporation, and Resources*. On the home page, there is a short description of each section with a 'Learn More' button for users to click on. All of these pages are also accessible from the navigation bar, with the *What is it?* and *Benefits* sections shown as their own tab on the bar, and the remaining pages *Classroom Incorporation, Resources*, and *About* under the 'more' tab.

1

WHAT IS IT?

Inquiry is any process that has the aim of augmenting knowledge, resolving doubt, or solving a problem. Inquiry-based learning uses that idea and turns it into a teaching strategy that can deepen students' understanding of a topic.

LEARN MORE

2

BENEFITS

Using inquiry-based learning in a classroom comes with many advantages. It helps students with their problem solving skills, it reflects how scientists work in the real world, students can connect science to their life experiences, and it gets students more involved in the topics they are learning about.

LEARN MORE

3

CLASSROOM INCORPORATION

Why should I use inquiry-based learning instead of a traditional lecture style?

LEARN MORE

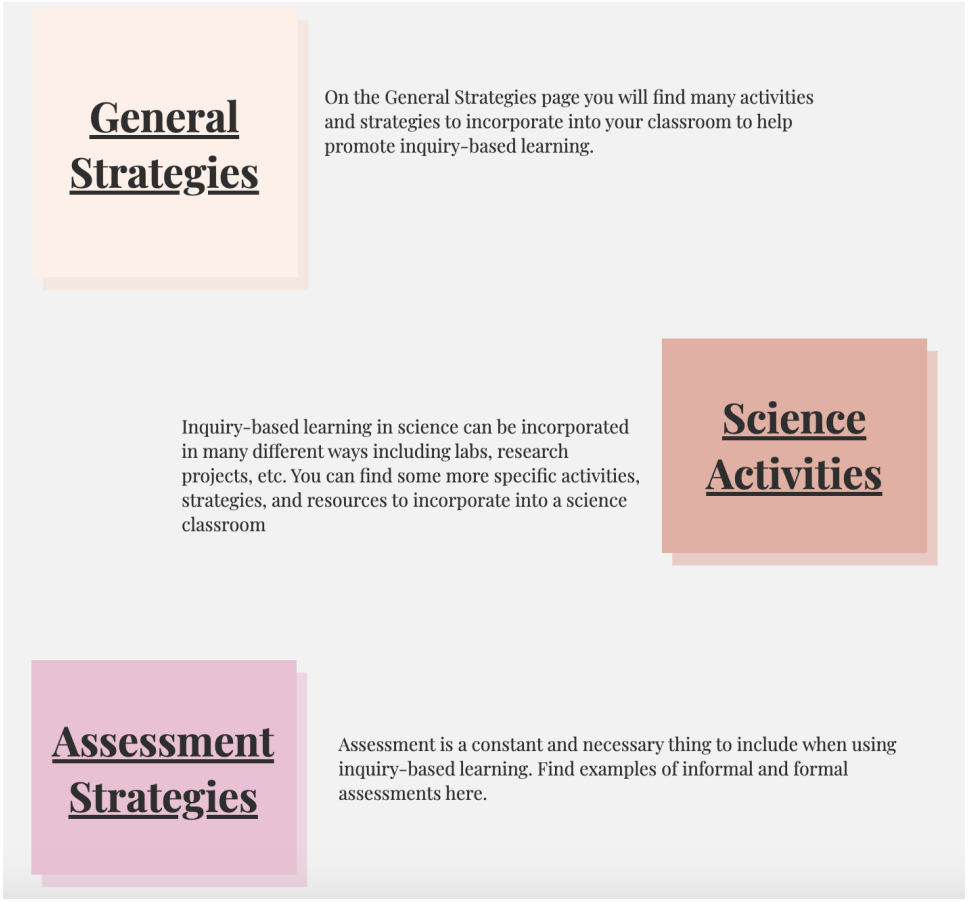
4

RESOURCES

On this page you will find examples of lessons and activities that use a inquiry-based learning strategies.

LEARN MORE

Since a big reason teachers shy away from inquiry-based learning is because they are unsure of where to start or how to start incorporating it into their classroom, I put a big focus on providing resources and examples of how to use inquiry-based learning in a classroom. Under the *Classroom Incorporation* tab, teachers can find three different areas of resources: General Strategies, Science Activities, and Assessment Strategies. There is a brief description for each section and users can click on the section they would like to learn more about. Most of the resources and examples are short activities that can be used to slowly start the incorporation process. Many of these activities focus on helping students learn problem solving skills, ask questions, gather data/information, make a prediction, support their prediction with data and evidence, and work collaboratively with their peers.



Write-share-SHARE

This strategy is based on the common Think-Pair-Share strategy. While similar, this strategy provides more structure and direction for students. Instead of just providing students with the opportunity to think and learn from a good question, you are making sure they are thinking and learning by having them write down their ideas and giving more structure to the sharing portion.

Write

- Don't just "think"
- Provide the students with the question.
- Give specific instructions like "Take ____ minutes and write a response to the question in/on _____" and specific a location where they should write their answer.
- Walk around the classroom during this time to look at the responses as the students write.

share

- Don't just "pair"
- Partner students up. Instruct them to share, compare, and discuss their responses and come to a consensus if they can.
- Tell them to be prepared to share out and make sure to give them a specific time limit.
- Walk around during this step and listen to pairs as they share.

SHARE

- The big share! Time for partners to share with the class.
- Call on individual students to share out what their partnership talked about. This is "warm"-calling, not cold-calling. It takes the pressure off the individual student while still having a single person share out.
- After calling on multiple students in a row, ask "What else can your partnership add to this discussion?" instead of "Is that about what you got?" or "Did your partnership come to a similar conclusion?" This will draw out more ideas from the students and lead to a more in-depth discussion.
- If responses get off-track, find a way to incorporate small tidbits of correction to help build them toward a correct response.

Generic Lab Report Format

Provide students with this generic lab report format to follow when working on labs. This gives students enough structure when writing their information but still gives them the freedom of inquiry throughout a lab. Often students are given a "worksheet lab" that lays out every instruction, detail, provides data tables and such that students don't do much thinking or inquiring during the lab. Having students use this generic form allows them to be curious about the lab they are preforming, create a hypothesis or claim and support it with data and observations they collected. If students use lab notebooks, this can be taped or attached in the front of the notebook for easy access.

Generic Lab Report Format Handout ("Lab Report Format" by Sarah Hick)
Generic Lab Report Format Teacher Handout ("Lab Report Format - Teacher" by Sarah Hick)

Example Labs:
Windmill Project
Tiny Dancer
Snap Circuits
Roller Coaster Lab
Paper Plate Race Car
Marshmallow Building Project

Resources

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