The Impact of STEM, Systems Thinking and Authentic Learning in the Problem and Project Based Learning Classroom

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Life Sciences: Biology, Environmental Science, Marine Science 1 & 2
STEM Science: Experimental Science 1 & 2

Project Based Learning @ Flagler Palm Coast High School
Agenda

Authentic Learning- Norm Setting and Creating a Common Definition
- What is Authentic Learning?
- What is Authentic Science?
- The Power of Integration Concepts in student learning
- Biology, Marine Science, & Anatomy of Design Project Examples

2022-2023 PBL Integrated Project Planning example Project/ Lesson Building across Florida
Setting of Norms/
Common Beliefs and
Definitions
What is Authentic Learning?
What is Authentic Science?
How does Authentic Science and PBL/PrBL “Fit”?
How does Authentic Science and PBL/PrBL impact student learning?
## Authentic Science in PBL or PrBL impacts student learning by:

### PBL: allows students to:
- make the abstract concepts that are required a part of real knowledge across an extended learning time.
- take new knowledge and apply to a much deeper process, that requires background knowledge in topic not previously acquired.
- learn required material at individual level/pace (self differentiation).

### PrBL: allows students to:
- make the abstract concepts that are required a part of real knowledge in order to solve a significant problem.
- take new knowledge and apply to a much deeper process (Problems can sometimes be a small, but required part of a Project), that requires background knowledge in topic not previously acquired.
Authentic Science in PBL or PrBL impacts student learning by:
BioLit - (Integrated Biology and English I Course)

Authentic Projects and Labs:

- Macronutrients and Hurricane Relief
  - Organelle Debates
- Snake Breeding Project
BioLit

Macronutrients and Hurricane Relief

**Purpose:** To engage students in the nutritional needs of the body and then have them apply it in a meaningful way.

**Project:**
- Students researched macronutrient needs for different genders and ages for a day.
- Students had to create a plan to fulfill the needs of all people in response to a natural disaster—Florida - Hurricane Y, which hit the Panhandle of Florida, destroying infrastructure and supply lines for weeks.
**BioLit**

**Organelle Debates**

**Purpose:** To engage students in understanding the organelles of Cells so that they can argue the importance of their organelle vs the organelles of their peers.

**Project:**
- Students researched their chosen organelles and the organelles of their peers so that they could debate the importance of theirs versus those of their peers.
- Students designed arguments and included required material based on the required items in the assessment list.
BioLit

Snake Breeding Project

**Purpose:** To engage students in understanding Biology concepts that are difficult or challenging to understand- Genetics and the passing of inherited traits.

**Project:**
- Students researched their chosen Ball Python and created Punnett Square Models predicting the production of offspring in order to plan the breeding regiment.
- Design breeding regiment in order to sell offspring to support the breeding program long term.
Marine Science

Authentic Projects and Labs:

- Climate Change, Global Warming and Dune Restoration
- The Importance of Water and Learning Lab Establishment
Marine Science
Climate Change, Global Warming and Dune Restoration

**Purpose:** To engage and encourage PBL students to take a more active role in the understanding of the requirement Global and Local Biomes and Ecosystems

**Project:**
- Students researched appropriate growing methods (traditional growing systems, hydroponics, and aquaculture) in order to plan, design, and build an outdoor learning lab.
- Establishment of these growing systems will allow students to actively investigate and collect data to track Global Warming and Climate Change on our campus and grow Dune Restoration Plants and Vegetation.
**Purpose:** To assist our PBL students in making the connection between the importance of appropriate use of Natural Resources (renewable and non-renewable) and technological advances that have revolutionized the agriculture industry in the production of food.

**Project:** The establishment of the PBL outdoor learning lab and its growing systems (student researched, built and placed within the lab, and maintained/monitored) will allow our students to form that concrete connection needed to understand the challenges faced by those in agriculture when growing and maintaining a crop and using Natural Resources appropriately.
Anatomy of Design

Authentic Projects:

- Anatomy and Physiology Honors and Portfolio of Design
- Project X= 2D and 3D Design of Space Suits and Lunar Habitats?
Anatomy of Design

Anatomy and Physiology Honors and Portfolio of Design - Science and Art Integration

**Purpose:** To integrate the Anatomy and Physiology and Drawing 2-(2D/ 3D Portfolio) concepts so that they support the students in their learning and understanding of the Anatomy and Physiology Honors level content and material.
What Happens to the Human Body in Space?

Not understanding the full affects being in space has on humans can become hazardous if the proper precautions are not put into place. NASA plans to put astronauts in space for longer periods of time and get them there.

The Affects of Low-Gravity on Humans

Without the downward force of gravity as we are used to on Earth, being in space makes our bodies react in strange ways.

Nausea
- Without the gravity our bodies are used to on Earth, astronauts may feel nauseous.

Bone
- Low-gravity environment
- This results in bone density loss when levels in the blood and bones is a greater chance of fracture.

Floating Fluids
- Fluids move freely through our bodies and to the top of our heads
- When astronauts are on Earth, they use their legs to move fluids up to their heads.

How Astronauts Counteract These Affects

To prevent these problems, astronauts are subject to a space suit. They exercise vigorously using specially designed machines around the space station.

Unlike Earth, Mars does not have any form of natural shielding from high energy radiation.

The ISS has artificial shielding that helps protect the astronauts.

Without gravity, the fluids in the body leak into the head. There is pressure on the other parts of the body because of this.

On Earth, the inner ear is where you hear. If you are in space, your hearing is damaged.

In space, astronauts cannot get motion sickness from your inner ear, as they are not working. It stops working because of the microgravity.
Anatomy of Design

Project X= 2D and 3D Design of Space Suits and Lunar Habitats?

Purpose:
- Our PBL Anatomy of Design class met at the end of the school year to decide on the year-long Project focus for the Anatomy Design course.
- Living in Florida, our learners were very interested in the re-introduction of the exploration of Space at Kennedy Space Center and decided that they wanted to relate everything learned in our class to the exploration of Space!
BioLit, Chemistry, Marine and Environmental Science Integrated Subject Example Project
BioLit, Chemistry, Marine and Environmental Science Example Project

Gulf of Mexico “Dead Spot”

**Purpose:**
To integrate the **PBL** Physical and Life Science courses in order to study a real world issue that is in close geographical proximity.

**Project:**
- Current research taking place in the Gulf of Mexico has identified a “Dead Zone” that is forming and is approximately 8,000 square miles in size.
- **PBL** Biology, Marine and Environmental Science, and Chemistry courses will be integrated and will study this occurrence through the lenses of the courses in order to understand why this is happening, and how to bioremediate or stop it in the future.

How do you fund Authentic Science in your classroom?

**Total Grants and DonorsChoose Projects Awarded and Tricks**

Twelve year Grant Total: $200,000+

Total DonorsChoose Projects funded: $32,000+

**Outright In-Kind Donations through Community Partners** $30,000+

**Important Funding Websites:**

- [https://www.donorschoose.org/](https://www.donorschoose.org/)
- [https://grantsalert.com/grants/all](https://grantsalert.com/grants/all)
- [https://www.nsf.gov/funding/](https://www.nsf.gov/funding/)
- [https://www.tgci.com/funding-sources](https://www.tgci.com/funding-sources)

Are you afraid of being told “No”?
Authentic Science Project Building

Purpose:
To give participants time to interact with peers across the State of Florida time to collaborate and build Authentic Science Projects!
Authentic Science Project Building

Task:

1. Please find a peer that teaches the same content as you that you can begin to collaborate and plan a project with!
Contact:

Email: medearisa@flaglerschools.com

Twitter: @medearis_pbl or @i3foreverflagl1

Instagram: @medearis_steam_pbl or @the_forever_flagler_project