How-to

Creating STEAM-infused PBL activities

Here are some ideas for implementing STEAM-infused PBL to help students become creative tinkerers, cycling processors, curious and critical thinkers, clarifying content communicators and persistent refiners.

Creative Tinkerers

Set up a tinkerer station somewhere in your room with electronics that the students can assemble and disassemble. Include building blocks for students to design various structures. Bring in recyclables for students to build prototypes. Also gather materials such as small cardboard boxes, bubble wrap, plastic bags, vegetable bands, clothespins, chenille sticks, string, straws, foam boards, glue, tape and staplers to design STEAM products. Some teachers prefer materials in closable and stackable bins so that materials do not end up all over the room.

Have a technology station with computers where students can tinker on information sites, coding sites and design sites. Include tablets with preloaded apps that are STEAM-related. Establish a resource library with multilevel, visually-rich STEAM nonfiction and fiction literature, including prior students’ products. Have the computers and tablets visible to the teacher and others in the room for security purposes. Some teachers prefer the classroom library to be on a rolling cart that can be easily moved when it is not in use.

Cycling Processors

Create or have the students redesign a modified PBL engineering design process such as the following:

- Determine an essential question and entry event.
- Brainstorm and research ideas, including criteria and constraints of the project.
- Collaborate on a product or process with peers or experts.
- Create the product or organize the process.
- Evaluate and redesign or refine the product or process.
- Present the results, products or processes.

Once the modified PBL engineering design process is created, place it in a prominent spot to assist you and the students in moving smoothly through the cycle. The visual helps you and the students in knowing where you have been and where you are going. The cyclical nature provides the understanding that this is an ongoing and refining process.
Curious and Critical Thinkers

Place a large sheet of butcher paper somewhere in the room where you and the students can get to it. Model for the students the things that you wonder about and add them to the chart. When a student comes up with an idea, validate it by suggesting that the student add it to the chart. When the chart is full, or you are ready to prepare the next STEAM-infused PBL, have the students cut up the chart and organize the wonderings into various categories. Based on the categories created, the relevance and authenticity of the wonderings and the importance to students and a potential audience, offer possibilities of STEAM-infused PBL based on the standards for the grade level. Prepare the STEAM-infused PBL using the backward design model, and begin the modified PBL engineering design cycle.

As students are making their way through the modified STEAM-infused PBL engineering design cycle, use explicit instruction and constructivist techniques to encourage students to help each other be more successful through respectful discussions and critiques. Facilitate students in becoming critical thinkers through each step of the engineering design cycle.

Clarifying Content Communicators

Use both intensive-explicit instruction and constructivist instruction as you work your way through the STEAM-infused PBL. The explicit instruction will be useful for students who are ready for a specific content topic to help them continue on their STEAM PBL pathway. Explicit instruction will also be helpful as you facilitate clear communication between peers and experts, aiding students in learning the skills and processes of conversation to elaborate, clarify, support with evidence, compare, build upon, paraphrase, synthesize and critique personal work and peer work in a respectful manner. Intensive-explicit instruction uses questions for predetermined content and cooperative learning for mastery of that content.

Constructivist instruction is what PBL is all about. Students will negotiate content meaning as they work through the STEAM-infused PBL modified engineering design cycle. They will also build higher-level thinking skills and abilities in a real-world, authentic setting. Constructivist instruction uses questions for guiding the direction of the student and cooperative learning for helping students negotiate meaning while solving complex problems.

Backward design ensures that the standards to be met and the critical thinking skills desired are in place throughout the STEAM-infused PBL. Thus, the performance and formative assessments are already established and visible on a rubric(s) to guide students through the process. Rubrics for skills, processes and content are available at the outset and clarify what success looks like. They can easily be viewed to ensure that students are on a pathway to success.
Persistent Refiners

Be prepared to assist students who are not used to being persistent when faced with a challenging task. Model, question and guide them enthusiastically and positively to stay focused on the STEAM-infused PBL engineering design process. Depending on the stage that they are at and the product they are designing, model, question and guide them to rehypothesize, redesign, reinvestigate, re-refine, reanalyze and recritique their skills, processes and products. Be positive and upbeat for their continued success by pointing out the steps completed so far. Use the rubric and engineering design model to show them where they have been, where they are and where they are going. Help them visualize the final product and the benefit it will have for them and their audience.