TEACHING WITH
PROJECT-BASED LEARNING
An AFT Resource to Promote Science Education

WHAT IS PROJECT-BASED LEARNING?

• Project-based learning (PBL) is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, phenomena or challenge.

Source: Buck Institute for Education (http://bit.ly/2n0AdK)

WHY PBL?

• Because learning is a social activity that takes place within the context of a student's community, culture and past experiences, through PBL, students will have the ability to use what they know to negotiate, explore, interpret and create.

• With PBL, students have the opportunity to construct solutions.

• PBL increases the emphasis on standards, clear outcomes and accountability.

• PBL reinforces the Science and Engineering practices of the Next Generation Science Standards (NGSS), which gives students the opportunity to do the following:

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OUR MISSION

The **American Federation of Teachers** is a union of professionals that champions fairness; democracy; economic opportunity; and high-quality public education, healthcare and public services for our students, their families and our communities. We are committed to advancing these principles through community engagement, organizing, collective bargaining and political activism, and especially through the work our members do.

1. Ask questions (for science) and define problems (for engineering).
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematics and computational thinking.
6. Construct explanations (for science) and design solutions (for engineering).
7. Engage in argument from evidence.
8. Obtain, evaluate, and communicate information.

- Standards-based PBL helps students navigate through the unit/curriculum by driving questions, problems and/or natural phenomena that create a desire to learn the material.

Through effectively planned PBL, teachers will be able to:

- Recognize students' innate drive to learn, their capability to do important work and to place them at the center of the learning process.
- Engage students in the central concepts.

- Highlight important issues or phenomena that lead students to in-depth discussion and exploration of credible and significant topics.
- Require students to use tools and skills such as project and time management, self-discipline, technology and higher-order thinking.
- Specify products or ideas that explain dilemmas, solve problems, or present information generated through investigation, reasoning or research.
- Include a variety of products that allows for frequent feedback and consistent opportunities for students to learn from experience.
- Use performance-based assessments that convey rigorous challenges, high expectations, and demand a range of skills and knowledge.
  - Encourage collaboration through student-led presentations, whole-class evaluations, and small groups.

Source: Buck Institute for Education (http://bit.ly/2n0AdK)

HOW DOES PBL TIE IN WITH THE NEXT GENERATION SCIENCE STANDARDS?

"Project-based science is an exciting way to teach science that aligns with the NGSS. By focusing on core ideas along with practices and crosscutting concepts, classrooms become learning environments where teachers and students engage in science by designing and carrying out investigations and making and debating claims supported by evidence and reasoning." (Krajcik, 2015)

Project-Based Learning vs. Problem-Based Learning

Similarities

Both PBLs:

- Focus on open-ended questions or tasks.
- Provide authentic applications of content and skills.
- Build 21st-century success skills.
- Emphasize student independence and inquiry.
- Are longer and more multifaceted than traditional lessons or assignments.

Differences

Project-Based Learning	Problem-Based Learning
Often multi-subject	More often single-subject, but can be multi-subject
May be lengthy (weeks or months)	Tends to be shorter, but can be lengthy
Follows general, variously named steps	Classically follows traditionally prescribed steps
Includes the creation of a product or performance	The "product" may be tangible or a proposed solution expressed in writing or in a presentation
May use scenarios but often involves real-world, fully authentic tasks and settings	Often uses case studies or fictitious scenarios as "ill-structured problems"

Source: Larmer, 2015

BENEFITS OF PROJECT-BASED LEARNING

For students—

Can transform a traditional classroom in which students move from:

- Following orders to self-directed learning.
- Memorizing and repeating to integrating, discovery and presenting.
- Listening and reacting to communicating and taking responsibility.
- Knowledge of content, terms and facts to understanding the actual process.
- Theory to application.
- Being teacher-led to students being empowered.

For teachers—

- Provides teachers with an opportunity to build a positive relationship with students.
- Because PBL provides a wide range of learning opportunities, it cultivates an atmosphere to accommodate all learners.

Source: Intel (http://intel.ly/2nD2Lbx)

WHAT IS THE BEST WAY TO STRUCTURE PROJECT-BASED LEARNING?

- Begin with the end in mind.
  - » Before beginning any PBL activity, you need to ask: What is the purpose of the project? What do I want my students to learn and know by the end of the project?
  - » Project-based learning is a little different from problem-based learning. The goal of the latter is to solve or answer a problem. A project may be part of the evaluation, but it is not the end result. With project-based learning, students learn a concept through the construction of a project as the end result.
- Pinpoint the essential question.
  - » Determine the question that you will pose to the students and what you want them to come up with in the way of a response.
  - » Some resources may call this the driving or essential question for the learning.

- » Having a hard time coming up with a good driving question? Have students help you determine what the question will be. Give them an exit ticket requiring them to come up with a question of their own about a specific topic.
- » An article on the Edutopia website discusses why it is important to include a verb in your project. (Why Your Project Needs a Verb: http://edut.to/2qT4kGN)
- Plan the timeline and activities.
  - » Decide how you are going to guide the students in gaining the information they need to solve the problem. What background information will the students need to arrive at a solution?
  - » Keep in mind that the students don't know what they don't know. Select activities that will allow the students to discover what they don't know and delve more deeply into the problem.
    - » Activities should have a clear purpose and help students solve the problem; they should not be done just for the sake of being done. Activities should be purposeful and beneficial.
    - » Create rubrics for your project-based learning.
    - » Have an idea of what you are looking for and what you will be assessing from the students.
      - » The more details and instructions you can provide to students, the better they will be able to meet and exceed your expectations.
        - » The rubrics should not just give answers to the problem, but should include a list of key components in your project.
        - Think timing
          - » When planning your PBL, be mindful of how much time you want to include with your unit. The length of time can vary from a few weeks to an entire semester.

Sample PBL units

- High school project-based learning on energy and land reclamation: http://bit.ly/BiomassPBL

- Middle school PBL from the Buck Institute that is aligned to NGSS Disciplinary Core Ideas (DCIs), practices and Crosscutting Concepts (CCCs): http://bit.ly/2IvHjGj

- Seventh-grade PBL posted from the National Science Teachers Association that is aligned to the NGSS: http://bit.ly/2mhuv4W

Resources for more information and guidance on PBL

- **Buck Institute for Education (BIE):** This organization's highest priority is to help teachers prepare students for successful lives through the use of project-based learning. www.bie.org

- **PBL examples through BIE:** Examples of vetted PBLs that you can select and then create your own twists to the project. Incorporates a variety of grade levels and disciplines. http://pblu.org/

- **Resources for getting started with PBL:** Edutopia web article that gives insight on what project-based learning is and is not, and how to create successful PBL lessons. http://edut.to/2uhPLvw

- **National Science Teachers Association:** This article is about the connection between the Next Generation Science Standards and project-based learning. Ties in how PBL is directly connected to the practices utilized in the NGSS. http://bit.ly/2sEJ8kN

REFERENCES

Krajcik, J. (2015). Project-Based Science. *The Science Teacher*, 25-27.

Larmer, J. (2015, July 13). "Project-Based Learning vs. Problem-Based Learning vs. X-BL." Retrieved from: https://www.edutopia.org/blog/pbl-vs-pbl-vs-xbl-john-larmer

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