Connecting Projects to Standards

Steps for Success When Implementing PBL In Your Classroom

TANYA MACMARTIN

With the country's adoption of the *Next Generation Science Standards* (*NGSS*), K–12 teachers are beginning to acknowledge that those cookie-cutter labs that they have so diligently written and conducted for the last decade no longer allow students the freedom and independence to master the science and engineering practices recommended by *NGSS*. We've spent our professional development hours learning how to read, navigate, and implement the Performance Expectations (PEs), Disciplinary Core Ideas (DCIs), Cross-Cutting Concepts (CCCs) and Science and Engineering Practices (SEPs) in our respective grade levels. We have spent our holidays thumbing through new curriculum ideas to add to our upcoming calendars. We've brainstormed innovative approaches which allow our students the ability to explore, plan, and carry out their own investigations.

NGSS is a three-dimensional approach to science education; it places equal value on not just the content delivered in our classrooms, but also the *practices* used by scientists and professionals in today's workforce. It also brings into focus the value of the connections students make between science and their surrounding environment through CCCs. Assigning and implementing projects in your classroom is an ideal way for students to see this intertwining of information and skill.

However, providing students opportunities to explore, design, plan, conduct, and analyze their own experiments can be quite intimidating for many teachers. Allowing students to explore often means supplying students with a broad inventory of materials to facilitate their own experiments. Moreover, with students exploring in so many different directions, classroom management can be difficult. This leaves many teachers hesitant to assign projects, as they are faced with limited budgets and may have a resulting classroom buzzing with excited students researching in dozens of different directions. However, it is important to note that the skills acquired through these experiences prepare students not only to master content, but also helps them practice skills such as time management, collaboration, advocation, and communication—all critical skills needed in today's workforce.

The push for project-based learning (PBL) has been at the forefront of education for the last decade; there are dozens of ideas and strategies to use. Many teachers do not understand the nuances of project-based learning, and therefore think that any project in a classroom curriculum constitutes the latest and greatest ideas for PBL.

The Buck Institute of Education has identified and established the "gold standards" of PBL (Gold Standard PBL n.d.), and they continue to lead educators on effective ways to implement PBL in their classrooms. According to John Larmer, Editor in Chief at the Buck Institute of Education (www.bie.org), there are more than a dozen different types of "_____-based learning" conducted in classrooms around the globe. Each of them offers their own set of benefits both for student learning and curriculum planning.

Different types of projects

If you're intimidated by implementing a project, it's important to spend some time learning about the variety of ways teachers can fit projects into their agendas. Exposure to projects even in the lower grade levels helps students learn foundational skills that will strengthen the collaborative and leadership skills that will assist them as they get older. Taking the time to ensure your project is designed to accurately enhance your content and the required DCIs in your curriculum prevents time wasted with students researching concepts that are too broad, or with material that is not age- or skill-appropriate. Therefore, it is critical that you design the parameters of a project so that it fits the age, skill, content, and time restraints best for your classroom.

There are three main categories of PBL, and numerous hybrids within each category. PBL in its truest form comprises projects that are often multi-subject, cross-curricular approaches. They tend to be lengthy and assigned throughout the entire school year, which is sometimes difficult depending on scheduling and time available in a school day. The instructions given to students are general and broad and may be based loosely on scenarios or authentic experiences. The result of a typical PBL project requires students to create a product or perform a particular skill. In a PBL assignment, the students learn the content *through* the project, not before or after it (Larmer 2014).

PROBLEM-BASED LEARNING

Problem-based learning (PrBL) is often mistakenly identified as PBL because the students are challenged with designing a solution to a case study or scenario. PrBL assignments tend to be shorter in length, and are often single-subject, but may require students to apply material learned in other courses (Larmer 2014). The process of designing solutions requires students to follow a set of traditional steps, such as the steps of the scientific method or design process (Cornell University Center for Teaching Excellence n.d., para. 1).

PROJECT-ORIENTED LEARNING

Project-oriented learning (POL) is likely the most well-known application of projects in a classroom. POL is often assigned in a single subject classroom, such as those found in middle or high school classroom. The projects are short in length, with a tangible product produced in a matter of two to four weeks. These products are often demonstrative and summative in nature; the final product is assessed as a cumulative artifact. Students are often given instructions that are scenario-based and may or may not be a real-world problem (Robin, 2013).

Key strategies for implementing projects

All projects can boast beneficial learning for students, whether it is through content-based knowledge acquisition, or the practice of skills, such as collaboration and time management. However, before you and your students tackle a new project, spend time carefully crafting critical components of the instructions and expected products. Doing so will ensure that you don't go down the rabbit hole of a time-intensive project that may not focus on the appropriate standards for your grade level or require knowledge that is beyond the pedagogy of your students.

IDENTIFY THE CONTENT IDEAS YOU ARE TRYING TO ADDRESS

Using *NGSS* (or your state standards) as a guide, review the performance expectations you would like to address in this project and science unit. List the specific DCI you expect this project to emphasize. In addition, identify key SEPs you would like your students to execute, such as planning and carrying out an investigation, and use this to guide the topic or problem you will pose to your students. Don't expect one project to be the all-encompassing holy grail of instruction. It's quite possible that your project will only address one or two of the core content ideas for your unit. That's ok; understand classroom projects provide opportunities to hone skills that are necessary for today's workplace in addition to content. These skills are just as valuable as the content ideas you are trying to address.

AFTER IDENTIFYING THE CONTENT IDEAS, TRY TO LIST ALL REAL-WORLD EXAMPLES OF THIS CONTENT

By doing so, you begin brainstorming all the areas your students could explore to acquire or practice this knowledge. Read current magazines, television programs, focusing on phenomena that students would enjoy exploring. Be sure to use material that is age-appropriate and easily acquired for the reading level of your students. For younger grade levels, create a general list of topics that students could research. Identify and provide a list of websites that are age- and skill-appropriate for your students. Ask your school's librarian for a list of skill-appropriate websites or journals that your students could use to gather background information on their topic or problem.

IDENTIFY HOW MUCH TIME YOU ARE WILLING TO ALLOT TO THE PROJECT, FROM BEGINNING TO END

The available time you have determines your approach of PBL, PrBL, or POL. If scheduling allows you to work on a project throughout the whole year, then PBL might be best for you. If your time is limited and you may not be able to focus on this project for longer periods of time, consider PrBL or POL as a guide to design your instruction.

DRAFT A RUBRIC THAT YOU WILL USE TO ASSESS THE PRODUCTS

As suggested by the Understanding by Design Framework (McTighe and Wiggins 2013), identify the desired results you'd like your students to achieve. Start with the end in mind. What do you want the student to know at the end of this project? Remember the standards you are planning to address. What would a conversation the student sound like when you discussed the core ideas with them? What key vocabulary would they include in their conversation? What sorts of questions could they answer? How do these conversations change between a student who is an expert (an A student), an intermediate (a C student) and a below-average student? Think of categories such as key vocabulary, calculations, concepts, and other variables surrounding your DCIs to include in your rubric. Consider using rubrics provided by the Buck Institute of Education (PBL Works n.d.) as a start, or draft your own to cater to your students' individual capabilities.

DESIGN YOUR STUDENT GROUPS DEPENDING ON THE SKILLS YOU WOULD LIKE YOUR STUDENTS TO PRACTICE

These skills might include collaboration, work ethic, questioning, supporting their team's work, and accepting feedback and responding to it. Depending on your class size, keep groups small enough so that every student will have plenty to do. A good group size is three to four students, with various levels of knowledge and skill. Groups larger than four students may allow for some students to sit back and let others complete the work for them. Each day,

facilitate group discussion by providing statement prompts to get your students used to working collaboratively. Include these prompts as part of your exit tickets or journaling exercises and allow time for students to verbally discuss their answers.

Offer opportunities for class share-outs so students can observe other students verbally acknowledging what their group has successfully accomplished and what their group must continue to work on. For example, if you want them to learn how to collaboratively support each other's ideas, include statement prompts such as "I like this idea, and I'm wondering if we can build on it by…" to show students how to support new ideas and make their teammates feel included.

CREATE A SENSE OF URGENCY IN YOUR PROJECT DUE DATE

If you provide too much time to do a project, the students will feel they have time to sit idly. You can always expand your timeline if students need more time, but you will not be able to move a due date up without student revolt. However, if the students think the project is due sooner than it really is, they may tend to be more driven to complete it. Think of when you would like the students to present their products and tell them the due date is sooner than this. This way, they can always use the extra time you might provide to polish their finished product.

DEVELOP A WAY TO CHECK ON STUDENT PROGRESS EVERY DAY

Do not assign the project and expect to sit behind your computer for the next few weeks. A well-designed curricular project will require the teacher to facilitate and move between the groups of students several times each class period. Have goals for students each day and require them to submit daily progress checks. Consider disseminating progress checks with Google Forms, exit tickets, or journals. Review these progress checks so that you can ascertain whether some groups are off task. You can also use these to identify which groups will need your intervention.

SET ASIDE A SMALL AMOUNT OF TIME IN EACH CLASS PERIOD FOR INSTRUCTION ON KEY COMPONENTS OF MISSING DCIS

A delicate balance exists between the application of content and the acquisition of foundational knowledge about the content. Your project may not encompass all parts of the DCIs for this unit; try mixing in other types of instruction to ensure your students can see the theoretical part of this content as well. This is often what's missing in PBL, and this gap leaves students unable to identify information about the content when it is delivered through more traditional forms of instruction.

Diversifying your instruction is critical when students are learning typical math and scientific calculations, as they may be confronted with it through standardized testing or college entrance exams. A project will help them see the applications of the mathematical concepts, but they may need your help to see what it looks like when posed as a traditional problem.

Once you have the basics of your project designed, review your project design against the Project Based Teaching Rubric provided from the Buck Institute of Education's PBL Works (PBL Works n.d.) Continue to review the progress and achievements of your assignment as the project develops; this will help you modify it for following years.

Conclusion

If implemented strategically, incorporating projects in your classroom curriculum can provide opportunities for students to practice skills that are missing in the instruction of traditional classrooms. Skills such as time management, collaboration, and the ability to accept and respond to feedback are vital to a student's success in the workforce and will prepare a student well-beyond the pages of a textbook.

As your students grow and practice their new skills with your assigned projects, you'll watch them become more comfortable contributing ideas, analyzing information, and voicing their thoughts. And it's these skills that will help our young scientists etch their mark on the world.

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Tanya MacMartin, Ed.D. (*tmacmartin@powayusd.com*) is a middle school science teacher and university professor in San Diego, California.