Project Based Learning

The Basics

Project-based learning is an instructional model for classroom activity that shifts emphasis away from practices of isolated, short term, teacher-centered lessons in favor of learning activities that are more long-term, interdisciplinary, and centered on the student. These projects are complex, centered around challenging questions or problems which involve students in investigative activities, problem-solving, design, and decision making. This model of instruction allows the opportunity for students to work autonomously over significant amounts of time and often culminates in realistic presentations or products.

This definition covers a broad spectrum ranging from projects of one week that are based on a single subject in a single classroom to year-long, interdisciplinary projects that involve widespread community participation.

Project-based instruction differs from inquiry-based activity -- activity most of us have experienced during our own schooling -- by its emphasis on cooperative learning. Inquiry is traditionally thought of as an individually done, somewhat isolated activity. Additionally, project-based instruction differs from traditional inquiry by its emphasis on students' own artifact construction to represent what is being learned.

Students pursue solutions to nontrivial problems by

- asking and refining questions
- debating ideas
- making predictions
- designing plans and/or experiments
- collecting and analyzing data
- drawing conclusions
- communicating their ideas and findings to others
- asking new questions
- creating artifacts (Blumenfeld et al., 1991).

Design Features of Project-Based Instruction

A major hurdle in implementing project-based curricula is that it requires simultaneous changes in curriculum, instruction and assessment practices--changes that are often foreign to the students as well as the teachers (Barron et al., 1998). However, research has identified four design principles that appear to be especially important:

(1) Defining learning appropriate goals that lead to deep understanding

(2) Providing support such as beginning with engaging problems that lead to learning before completing projects, using teaching embedded in the doing of the project in a "just in time" manner, and technology support

(3) Including multiple opportunities for formative self-assessment. These include opportunities for students to make active investigations that enable them to learn concepts, apply information, and represent their knowledge in a variety of ways

(4) Developing social structures that promote participation and revision. This includes collaboration among students, teachers, and others in the community so that knowledge can be shared and distributed between the members of the "learning community"

The Benefits of Project-Based Instruction

Project-based instruction appears to be an equal or slightly better pedagogy for producing gains in academic achievement, although results vary with the quality of the project and the level of student engagement (Krajcik, 1998). Project-based instruction is not appropriate as a method for teaching certain basic skills such as reading or computation; however, it does provide an environment for the application of those skills.

Evidence shows that project-based instruction enhances the quality of learning and leads to higher-level cognitive development through students' engagement with complex, novel problems (Krajcik, Czerniak, and Berger, 1998). It is also clear that project-based instruction teaches students complex processes and procedures such as planning and communicating (Barron, et al., 1998). This requires time for both teachers and students to master the behaviors and strategies necessary for successful project-based instruction. Project-based instruction has important benefits for today's students. According to the Buck Institute for Education, teachers report that project-based instruction:

- Integrates curriculum areas, thematic instruction, and community issues.
- Encourages the development of habits of mind associated with lifelong learning, civic responsibility, and personal or career success.
- Overcomes the dichotomy between knowledge and thinking, helping students to both "know" and "do."
- Assesses performance on content and skills using criteria similar to those in the work world, thus encouraging accountability, goal setting, and improved performance.
- Engages and motivates bored or indifferent students.
- Supports students in learning and practicing skills in problem solving, communication, and self-management.
- Creates positive communication and collaborative relationships among diverse groups of students.
- Meets the needs of learners with varying skill levels and learning styles.

At its best, project-based instruction can help teachers create a high-performing classroom in which students form a powerful learning community focused on academic achievement, mastery of the content, and contribution to the community. It allows focus on major themes in the curriculum, creates challenging activities in the classroom, and supports self-directed learning among students.

Challenges Raised Concerning Project-Based Learning

Despite considerable potential, project-based instruction is not without challenges.

Students sometimes have difficulty with:
1) Generating meaningful scientific questions - students, like most people, often have little experience in this area
2) Managing complexity and time- Again, like most people, managing a complex activity measured in days and weeks is much different than the "due tomorrow" nature of many student assignments
3) Analyzing and evaluating data
4) Developing a logical argument to support claims

Teachers sometimes have difficulty with:
1) Time- projects often take longer than expected and this is exacerbated by the time to implement in-depth approaches often found in project based learning.
2) Classroom Management- in order for students to be productive, teachers must balance the need to allow students to work on their own with the need to maintain order. This is especially difficult for new teachers who often are concerned about classroom management issues.
3) Control- teachers often feel the need to control the flow of information while at the same time understanding that this approach requires students to build their own understandings.
4) Support for Student Learning- teachers sometimes have difficulty supporting students' activities, giving them either too much independence or too little modeling and feedback.
5) Assessment- teaches have difficulty designing assessments that require students to demonstrate their understanding.

Administrators sometimes have difficulty with:
1) Classroom practices that appear different than typical classrooms common in many schools
2) Coverage of district or state approved curriculum
3) Uncertainly that project-based instruction will lead to increased scores on high stakes testing measurements

The Student in Project-Based Instruction

Students can be responsible for the creation of both the question and the activities, as well as the nature of the artifacts. Additionally, teachers or curriculum developers can create questions and activities.

Regardless of who generates it, the question cannot be so constrained that outcomes are predetermined, leaving students with little opportunity to develop their own approaches to investigating and answering the initial question.

Students' freedom to generate artifacts is critical, because it is through this process of generation that students construct their own knowledge. Because artifacts are concrete and explicit (e.g., a model, report, consequential task, videotape, or film) they can be shared and critiqued. This allows others to provide feedback, makes the activity authentic, and permits learners to reflect on and extend their knowledge and revise their artifacts.

Projects are decidedly different from conventional activities that are designed to help students learn information in the absence of a driving question. Such conventional activities might relate to each other and help students learn curricular content, but without the presence of a driving question, they do not hold the same promise that learning will occur as do activities orchestrated in the service of an important intellectual purpose. Supporters of project-based learning claim that as students investigate and seek resolutions to problems, they acquire an understanding of key principles and concepts (Blumenfeld et al.,1991). Project-based learning also places students in realistic, contextualized problem-solving environments (CTGV, 1997).

Projects can thus serve as bridges between phenomena in the classroom and real-life experiences. Questions and answers that arise in daily enterprise are given value and are proven open to systematic inquiry.

- Project-based education requires active engagement of students' effort over an extended period of time.
- Project-based learning also promotes links among subject matter disciplines and presents an expanded, rather than narrow, view of subject matter.
- Projects are adaptable to different types of learners and learning situations.

Instructional Sequence in Project-Based Instruction

The **Mission to Mars** unit is a prototypical example of a model of project-based instruction. Beginning with a problem generation anchor video a context is set for students to generate their own problems in which they will be engaged for the remainder of the unit. Let's break down the instructional sequence:

The problem generation consists of **problem posing, problem definition,** and **problem categorization**.

This leads directly into the project-based portion of the instructional sequence

Next is the creation of cooperative teams in which individual expertise will be acquired as groups begin to solve the problems posed and categorized in the preceding section.

After sustained study students break into Jigsaw groups, which provide a forum for the distribution of individual expertise to that of other students in the class.

It culminates with a consequential task in which students' thinking is made both visible and public (Brown & Campione, in press; Glaser, 1998).

Problem-based learning & project-based learning
(Barron et al., 1996).

Summary

1) Although schools attempt to prepare students for everyday life, school cultures are vastly different, and "success within this culture often has little bearing on performance elsewhere" (Brown, Collins, & Duguid, 1989).

2) In fact, schools may actually be antithetical to any useful domain learning because resources, promotion of analytical skills, and types of activities differ dramatically in their use in out-of-school settings, including scientific activity (Roth & Bowen, 1995).

3) These apparent discrepancies are particularly noticeable in school science classes, which, in general, appear to be made to promote rites of passage rather than enculturating students into habits of mind and the high standards of experts (Roth & Bowen, 1995).

4) The long-term goal is to assist in the development of the students' abilities to learn for themselves If learning is properly understood as an activity of constructing knowledge, then students need to be mentally active. Since this type of thinking activity is consistent with that of experts in the field, it is unrealistic for students to "come upon" these habits of mind on their own.

5) Inquiry can no longer be interpreted by teachers as simply an investigative approach to the content. Disciplinary knowledge as inquiry must now also mean a minds-on approach.

Four Stages of Inquiry: Applying Theory to Projects in This Web Site

Here is a process you can use as you work through the problems and projects included in this web site.

Searching: requires the identification and representation of a scientific problem. Students studying the environment in the sixth grade might suggest, for example, air pollution, rainfall last year, and energy from the sun as suitable topics for a project. They might even divide into groups by interest area and narrow their focus, putting their ideas into a question format. As they are doing so, they are identifying and representing a problem. A "solar energy" group, for example, may decide to measure "how solar energy can be used to heat buildings."

Solving: solving the problem involves gathering information and generating a solution. In this phase, the groups collect and analyze data. The sixth-grade solar energy group, for example, might gather information about the ways solar energy is used to heat buildings, or about the number of hours of sunshine in different regions. Another group might gather information to predict rainfall in the state or county this year, based on comparisons with previous years. A third group might conduct a survey of students concentrating on what they believe to be the most important source of air pollution.

Creating: creating refers to the creation of a product, such as a presentation to class members or the school. In this phase, the solar energy group might devise an oral report with visual aids about how different buildings are heated with solar energy. In addition, group members might construct models or make bar graphs on posters.

Sharing: sharing involves the actual communication of findings. It should also result in the generation of future search questions, such as "Can heat from the sun be stored?"

Use of the **Searching/Solving/Creating/Sharing** model with higher grade levels might involve computers as tools for recording or manipulating data. Each group may require some guidance in determining how to gather information and answer research questions but, given this guidance, will be capable of solving the problem.

Reminder:

A project is an extended inquiry into various aspects of a real-world topic that is of interest to participants and judged worthy by teachers. Because of its real-world appeal, students are motivated to investigate, record, and report their findings. The hallmark of project learning is greater independence of inquiry and "ownership" of the work on the part of students. When contrasted with more formal instruction, it allows students a greater degree of choice and capitalizes on internal motivation.

Work through a project and you will learn more about learning!