

Feature

Project-Based Learning: Changing the Classroom Paradigm

Truly exemplary classrooms across the country are not necessarily those with a lot of computer hardware. Such well-endowed environments may look impressive, but we need to look deeper to see whether they're really as great as they seem. Advances in equipment and abundance of technology do not push students into new realms: It is classroom structure and function that make for higher levels of engagement in teaching and learning. Project-based learning uses technology tools as a medium for students to construct computer models and simulations of concepts they are learning.

Constructivism and Project-Based Learning

We can define constructivism as students constructing their own understanding of concepts based on their experiences. It is these experiences that inform students and help them build understandings.

In project-based learning classrooms, for example, the environment is set up to give students valuable experiences, say, in science, team collaboration, and scientific inquiry while requiring them to build a project that uses the knowledge they have accumulated and the understandings they have realized. A variety of experiences thus helps students construct deeper and more comprehensive understandings.

In oceanography, for instance, students might be interested in whales and how they live. As more science experiments and discussions enhance their understandings, they are likely to ask deeper and more concept-oriented questions. During discussions about food webs, the students may ask where whales, their object of inquiry, fit within the system. The more the inquirers discover, the deeper their science understanding becomes and the more inquiry they are likely to make. Their increased knowledge is reflected in their project building. Within this structure, the process is cyclical and uses its own feedback to maintain itself: Students do more questioning to build their project, more information leads to more project building, more building brings more questioning, and so forth. Questions and discussions with peers in their groups, the larger class, and the teacher enrich the discussions and the environment of inquiry. Discussions about toxins released into the ocean then may lead to questions about their effects on plants and animals in the ocean environment. These questions may lead to discovery of other effects on the food web and the place of the whales in the food web. Students begin to understand interdependencies in systems as they learn, discover, and continue questioning.

The effect is a spiral of science experiences, scientific inquiry strategies, team collaboration, and project building. Each part of the spiral exists simultaneously with and continues to inform the other parts. The result is a rich environment of inquiry and discussion in which students continually challenge their own and others' understandings of the physical world.

Deriving Information

In the traditional classroom, textbooks are the source of information. Using science textbooks in this age of the information era, however, is ludicrous. By definition, textbooks offer two versions to a class: A student edition includes all of the information a publisher deems worthy for transmission to students, and a teacher's edition includes more information that only the teacher--the "keeper of information"--will have. This concept of a teacher having more information than students is only part of the traditional model and should no longer apply in our 21st-century world. Internet-savvy students can easily access science sites that have more information than the teacher edition--and usually it's more accurate and more current information.

In the oceanography example, students who were interested in which plants and organisms lived at different depths in the ocean would find only the information available at the time of the textbook's printing. More than likely, this information will be considerably out of date. Monterey Bay Aquarium (Monterey, California), for example, is discovering an average of one new marine life form a week. These discoveries are posted on the Internet with scientific notes and comments.

Textbooks, students, and teachers cannot possibly keep current about all of the information

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available in the sciences. The questions that students ask frequently go far beyond the classic textbook curriculum and into a deeper and more exciting realm of discovery. Fortunately, current information from experts is now more frequently available. It makes for a rich learning environment in which students can process new information and incorporate it into their frameworks of the way the world works, just like scientists conducting their inquiries on a daily basis.

In the inquiry classroom, it is not just the information that is valuable, it is how that information fits within a framework, is part of a system, or explains a concept. Little bits of information--what Seymour Papert calls "bricolage"--are useless on their own. The way in which the information flows between teacher and student is dynamic, not a static didactic exercise. Students must relate the bits to other bits in a way that helps construct their own understanding and build a project from the constant spiral interface of science experiences, inquiry questions, and collaboration.

Technology as a Bridge Between Teacher and Student

How students and teachers work together collaboratively in questioning and in science explorations develops at the same time as modeling and simulation in a technology project. Both interactions are shaped by the same philosophy: Students will learn not only science concepts, but also how to express their knowledge and ideas with the tools of technology.

Both teachers and students should adopt technology in doses they can readily handle within the classroom. They can become comfortable if each piece of technology is introduced slowly and students are given time to learn to use them. The more seamless its application, the more that students will need to learn to use a particular technology in working on a project. And the simpler the technology, the faster it will be used within the class. Tutorially driven programming tools such as Cocoa are relatively easy to use because they let students teach themselves a lot of content and to develop competent understanding without the need for adult help. An adult can show students how to approach working together. MicroWorlds Logo has a higher student learning curve, but the benefits in problem solving, animation and simulation abilities for even primary students is well worth the effort and time. Once students become used to the program, they can accomplish large animation and simulation tasks in relatively short amounts of time.

Summary

In some classrooms, computers have become burdens to teachers, extra resources that teachers must use in addition to everything else they do in the classroom. They should reframe the classroom structure instead. Project-based learning environments allow teachers to spiral the elements of curriculum content, inquiry, collaboration, and project building so that they happen simultaneously within the classroom. This allows many possible groups to share computer resources, small groups to meet for instruction and discussion, and the teacher to provide expertise and guidance. The paradigm of knowledge construction using technology tools should always be in mind as teachers make changes in their classrooms.

The 21st-century classroom will be qualitatively different from its 20th-century predecessors. As educators, we must be willing to break the mold of the old and build new construction zones in which to engage our children in meaningful learning. We must keep working on doing different things instead of doing the same things differently.

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