Learning By Design

Discovering Pattern and Purpose in the World Around Us

Observe

The natural world is characterized by order and purpose. In fact, the notion of biomimicry suggests that many innovative ideas follow forms and functions found in the environment. Phil Gates notes many of these parallels in his book *Nature Got There First* (1995). A simple field trip to Lost River Cave could underscore elements of design in physical geography, as well as in the plant and animal kingdom. As they explore such concepts as adaptation and change over time, students will discover that the natural world functions with remarkable efficiency. Students can also find patterns in the manmade landscape. Bridges, highways, and commercial structures all reflect a high degree of intentional design. From the sleek stylings of a Corvette to the intricate workings of a server farm, the designers' stamp is evident. These observations often pique a student's natural curiosity, leading to the next stage of inquiry: Why are things designed in this way?

Analyze

Walt Streightiff once noted, "There are no seven wonders of the world in the eyes of a child; there are seven million." A sense of wonder can be a powerful motivator for learning. Based on connections made during observation, students are eager to further investigate both the natural and the built environment. Why do many plants tend to grow toward a light source? How do honeybees "measure" their comb with such consistency? What makes crystal form inside a geode? The answers to some questions are even more concrete. The timing of a traffic light is deliberately programmed. The modern CFL bulb is simply more energy efficient than incandescent lighting. And the columns on your front porch may have both a structural and an aesthetic function. Exploring the purpose of design presents tremendous opportunities for students to collaborate with professional scientists, mathematicians, and engineers. And, thanks to free technologies such as Skype, the world is the limit.

Create

One of the greatest joys of being human is the ability to create - to take the wisp of an idea, create a plan and then bring it into being! After they observe and analyze the elements of natural and manmade design, students will participate in the creative process as both individuals and members of collaborative teams. They won't just work within the realm of the hypothetical, but will actually be putting their ideas into tangible practice. Professional designers integrate mathematical and scientific processes and skills to effectively design products, buildings, and mechanical infrastructures that are viable and efficient in form and function. What could be more motivating as a reason to learn complex mathematical concepts than to actually *need* them to properly plan, model and build something of your own design? Creativity and innovation are critical skills for the next generation as they strive to create a positive impact in the rapidly changing world they will inherit.

Experiment

Experimentation is a key element of the learning process. The cycle of experimentation is a circular, ever-evolving journey which continually builds upon itself as students create ideas and put forth hypotheses to test, design valid experiments, collect and record data, and generate further questions and refinements for their next steps. We learn just as much from our errors and unexpected results as we do from "successful" experiments, and students need the opportunity to experiment with, well...experimenting! Experiments are not meant to be "canned" activities out of a science textbook with a specific desired result to be attained, but should be driven by real world questions, connections, and theories as is done by real world scientists and mathematicians. In a typical school setting, students rarely have the opportunity to design and test their own ideas, or experience the power of collaboration as they present, discuss and analyze their own experiments with their peers.