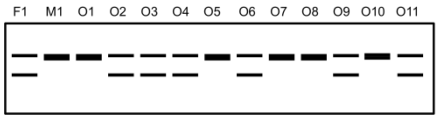
Biology Levers Out of Mathematics (BLOOM)

Background

The *Next Generation Science Standards* highlight understanding and application as well as the integration of mathematics and computational tools into science. The gap between these goals and classroom reality is particularly salient in high school biology, where memorization is king and mathematics/computational tools are largely absent, even though they are critical for understanding many big ideas and even more critical for later instruction in biology (including AP Biology exams and all biology-related majors in college). As biology is typically a first exposure to high school-level science, it is particularly unfortunate that students experience such an uninteresting, memorization-driven approach.

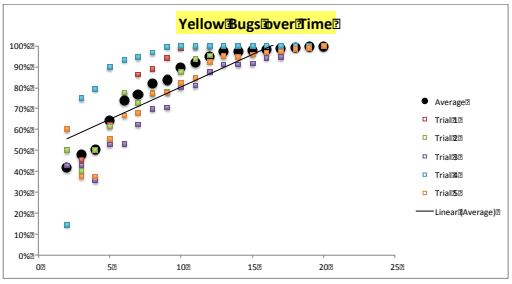


We present a new approach to teaching core biology concepts (inheritance and evolution) involving engaging engineering design challenges that students solve using a combination of inexpensive hands-on materials, basic mathematics, and simple simulations.

These materials are made available to teachers through an online tool called iPlan, which gives just-in-time guidance on the how and why of the curriculum steps, an opportunity for teachers to customize the materials to their own classroom needs, an opportunity to see how other teachers have customized each lesson, and an opportunity to engage in discussions with other teachers about these materials.

Documented Results

Through engineering design challenges (breeding rare animals for a zoo or breeding rare insects to help children in developing nations), students see purposes and applications of science not normally presented in a science classroom. As a result, we find increases in student engagement during our lessons, and increases in science and engineering career interest.



Because students are asked to reason through how to apply mathematics and computational tools to solve the problem, they build deeper understandings of inheritance and evolution concepts. This allows them to solve science problems beyond the memorized examples, and sets a foundation for stronger learning of later science topics. Further, their mathematical skills improve as well, which will be important in the broader high-stakes testing environment (in science and in mathematics).

Through use of these materials, teachers also develop a deeper understanding of the concepts they are teaching (e.g., a better understanding of inheritance and evolution). Teachers also learn about engineering design practices (e.g., constraints, optimization, tradeoffs), something that most biology teachers have little knowledge of but will be asked to teach their students about under the *Next Generation Science Standards*.

Potential Applications
Variations of the materials have been used successfully implemented across multiple states in a range of urban, suburban, and rural schools districts in the following high school science courses: Biology 1, Honors Biology, Ecology, and AP Biology.

For More Information
Contact Christian Schunn at schunn@pitt.edu.
http://www.lrdc.pitt.edu/schunn/research/design.html