Using Gene Ontology to Enrich Student Learning

Teaching and learning in the information age can be stressful if you decide that new vocabulary, programs, wikis and blogs are taking us away from the essence of our profession. It seems only yesterday we were trying to imagine what the information age would be like. Now our brains are bombarded by billions of words every time we perform a "Google Search." There is a calm to the chaos when we focus on the foundation of our profession. Our role as teachers is to design learning activities that will actively engage students to be independent learners. The focus is on student learning, and we as teachers are in the background of the process.

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As we identify new avenues for student learning, there are basic questions that are part of the instructional design process. We consider: What concepts will the students learn? Will it be depth or breadth? Will they utilize technology to acquire the new skills? What will be the students' deliverable? What will the assessment rubric look like? In my own teaching, these are the guiding questions that go through my mind each time I encounter a new topic or process.

Over the summer the terminology "Gene Ontology" was introduced to me at the Institutes for Science Teaching sponsored by American Society for Microbiology's Functional Genomics Institute at Hiram College. Although we learned updated methods in biotechnology, the real take away message was about how scientists are managing all the informatics data generated since The Human Genome Project. If you do a search for Gene Ontology, at the top of the list will be http://www.geneontology.org/ . It gives the history and rationale for the project and illustrates how the world community of scientists are organized to understanding genes across species.

During the institute Professor Jim Hu of Texas A & M's Dept. of Biochemistry and Biophysics introduced the CACAO project that engages undergraduates to learn how to annotate genes. As I was listening to his presentation and wandering through his wiki [gowiki.tamu.edu], my instructional design mode was in full gear. Questions I had: Can this be a way for my biotech students to be engaged with current science? What do they need to know before they get started? Wow! Other NCSSSMST students and teachers might like this! So, I invited Jim to present at the NCSSSMST Austin Conference. Within 24 hours he uploaded his presentation and included his post-doc, Brenley McIntosh in the presentation. At the conference we had over 10 NCSSSMST schools at the session.

In my own biotechnology lab class, I challenged two of my students who are taking computer science to read about GO and make a short presentation to the group. Within 15 minutes the two students were figuring out that computer programming is behind the project and that scientists from all over the world are working on the GO project. It was noteworthy that they recognized that evidenced based research comparing molecular functions and cellular components across genomes. As the teacher, I was jumping for joy because they were able to ascertain

the connections on their own AND explain them to their peers. Is there a learning curve with GO? Yes, there is, but the way the scientific community has organized the information, paths of communication, and discovery make it an ideal way for groups of students to explore a gene with limited background preparation. They learn as they go along. They chuckle at the terms used to organize the process and see cross pollination with computer science terms.

Jim's group has developed a competition phase for undergraduates. Brenley manages and coaches the competitions. So, what is the next step for GO? One suggestion is for our NCSSSMST students to be involved as teams to help annotate genes. The GO project fits the model for designing instruction. The deliverable is the team's annotation. The assessment is when their annotations are accepted by the curators. Students can be organized within a class or by interest group. Their involvement can be documented for their future science work and NSF grants.

How exciting for our students as they can have the opportunity to connect with other NCSSSMST peers and at the same time assist scientists by learning how to annotate the International Gene Database. For more information about CACAO at TAMU, contact Brenley McIntosh at brenleymcintosh@gmail.com.

— Cheryl A. Lindeman, Ed.D.

Cheryl A. Lindeman is a biology instructor/partnership coordinator at Central Virginia Governor's School in Lynchburg, VA. She can be reached at clindeman@cvgs.k12.va.us.