



Curriculum for the Bioregion¹

Sound Science

An activity for a math/biology linked learning community.

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Summary

Many students complete both math and science courses without ever making a connection to real activities and/or opportunities outside the classroom. The curriculum and activities we are planning for a math/biology linked learning community will give students this opportunity. In “Sound Science,” students will engage in meaningful, shared, “active learning” activities during “lecture” time as opposed to the passive learning of listening to a lecture and taking notes.

Learning Goals and Big Ideas

Expected student outcomes:

- Students will collect, organize and analyze data related to the health of Puget Sound;
- Students will experience the design of experiments in the sciences;
- Students will experience applying mathematics to real biological issues that affect their lives;
- Students will gain confidence with mathematics, modeling and computer use; and
- Students will develop an awareness of the personal and professional usefulness of mathematics, biology and modeling.

Clearly, this will create opportunities to deepen and reinforce the mathematics (modeling) students have learned in their math and biology classes, apply it in context, and understand its greater importance and application in their lives, meeting the goals of *Mathematics Across the Community College Curriculum*. We believe that the benefits to students will be profound. Statistics students will

¹ *The Curriculum for the Bioregion is an initiative of the Washington Center for Improving the Quality of Undergraduate Education at The Evergreen State College. This “teaching and learning activity” is one of several developed by a faculty learning community in math in February, 2010.*

act as consultants to the biology students. Biology students will in turn act as software analysts to help analyze trends as models are created.

We expect that after an experience linking a math and science class, students' attitudes toward both math and science will improve.

Context for Use

By the end of the fall 2010 quarter, students in the integrated (soft-linked) statistics and biology classes will have had experience with developing and using models to make decisions about issues that affect the Puget Sound bioregion. We expect that they will better understand that ecosystems are dynamic entities and that the physical factors of ecosystems impact living organisms and may dictate which organisms can survive in the ecosystem.

Description and Teaching Materials

Timeframe

The activities will take place over the course of the entire quarter. One of the first major activities will be a field trip with Ocean Research College Academy (ORCA) students (led by Ardi Kveven, Executive Director, ORCA). Students in both the Biology and Statistics classes will experience data collection first hand. This field trip will take place in the third week of the Fall Quarter. Prior to that, students in both classes will have met to discuss issues with sampling plans, data collection, and computer modeling. After our major data collection activity, students will meet periodically throughout the quarter to develop graphs, discuss case studies, and plan posters for their presentations.

The Assignment

Math students will gather data on the Bioregion (to experience the data production and organization process) which they will then present to the Biology students to create models using STELLA software to both quantify and model the experimental results.

All students will examine the quantitative relationships and draw conclusions by representing the relationships in the form of tables, and describe the salient features of the physical relationships in the form of a graph (both 2-D and 3-D), justifying their conclusions about the physical situations.

Students will then organize the information into a case study that will then be used in both classes in discussions where the complex issues of environmental quality and sustainability are the key topics. The students themselves will write the case studies, meeting our goals of reflective writing across the curriculum.

In preparation for these classes we will collect as many articles on the specific topics we choose (climate issues, water, and population are the three we have identified).

Throughout the term our classes (deliberately scheduled at the same hour of the day) will meet to perform “lab” experiments. Students will be given sample data and will discuss presentation (graphs) from both a math perspective and a science perspective. Later we will meet as a class to discuss modeling data, and still later we will meet again to discuss case studies and presentations.

Activities

- Our classes will begin with a “pre-test” in which we ask students “what is sustainability?”
- Students will do a 1-minute paper about their understanding of this topic. This will help us measure where students stand with respect to an issue they will be studying about in the class.
- During the next several months we will be doing a literature search for scientific articles (appropriate for the college learner) that students will begin reading.
- Activities in which students graph small data sets from the South Puget Sound website (SOPS): http://www.ecy.wa.gov/programs/eap/mar_wat/data.html. The website will include a discussion of presentation of information to the general public and use of this information to make decisions (public policy decisions, local political issues, etc).
- Students will take a field trip to collect data; data collection will include surface temperature, turbidity and salinity. Students will reconcile their data with data collected by the Washington State Department of Ecology probe. Guest speakers (Washington State Department of Ecology) will give students background on the marine ecosystem.
- Readings will include articles about ecosystem structure and function. Students will also examine recent weather events to determine any correlation between rainfall patterns and trends in the data. Students will use their data to build a STELLA model of the system interactions over the course of several quarters. Small data sets will be given to the statistics students to begin model construction.
- The end result will be a report, a poster presentation, and building a case study of the experience.

Assessment

Our final and most formal assessment will be a poster presentation at the end of the term in which students will present the results of their data collection and analysis. An additional component of the final assessment will be a written project report (graded based on a rubric used in current Biology classes). Additionally, students will submit their case studies to be used in future classes.

Informal assessments in each of the classes will include short papers on sampling techniques, data collection, graphical displays, and descriptive data analysis using small data sets. These components will be graded based on a rubric currently used in science classes. We will also conduct a “post-test” using a 1-minute paper asking the question “What is sustainability” to determine whether there is any change in students’ understanding of the concepts and framework of this issue.

Other non-graded assessments will include discussions of model breakdown, potential errors in data collection, future experimentation, and literature searches.

References and Resources

An important resource for us will be Ardi Kveven, Director of Ocean Research College Academy (ORCA) who has agreed to take our students on the field trip to collect data, and who has also agreed to be a guest speaker in our classes and provide us with contacts in regional offices that could lead to other guest speakers.

We have a list of websites, access to many articles and textbooks from which we can draw activities, and both Pamela and I are registered with OER Commons (Open Educational Resource materials) which we plan to draw from. We also have the full support of our Division Dean, Al Friedman.

Web resources include:

Open Education Resources: <http://www.oercommons.org/>
Water on the Web: <http://waterontheweb.org/>
Mukilteo data collection site: <http://stccmop.org>
Partnership for Puget Sound: <http://psp.wa.gov>

Other resources:

Sim-Biotic Nutrient Pollution simulation
Software, including STELLA and Excel
Department of Ecology guest speaker
SOPS database http://www.ecy.wa.gov/programs/eap/mar_wat/data.html
Journal articles appropriate for the college learner on sustainability, ecosystems, water quality, etc.

