

College of Geosciences QEP Annual Progress Report Academic Year 2007-8

Geosciences QEP Council: R. Bednarz (chair, geography, r-bednarz@tamu.edu), R. Carlson (geology/geophysics, carlson@geo.tamu.edu), C. Schumacher (atmospheric science, courtney@ariel.met.tamu.edu), R. Stewart (oceanography, stewart@ocean.tamu.edu), V. Tchakerian (assoc. dean for academic affairs, v-tchakerian@tamu.edu)

For the current school year, A. Kronenberg (kronenberg@geo.tamu.edu) replaces R. Carlson and S. Bednarz (assoc. dean for academic affairs, s-bednarz@tamu.edu) replaces V. Tchakerian.

II. Summary of Activities

The College of Geosciences proposed to increase the quantity and quality of research- and inquiry-based learning (RIBL) in the introductory courses (lecture and labs) of each of the College's departments or degree programs (i.e, atmospheric science, geography, geology/geophysics, oceanography). To accomplish this goal the committee hoped to identify teams of faculty and graduate students who would create learning modules that would be inserted into the curricula of each of the courses.

Our first activity, aside from committee meetings for planning purposes, was to convene an initial meeting of interested volunteers from each department. The purpose of the meeting was to explain the nature and value of research- and inquiry-based learning and to acquaint potential participants with the College proposal. Drs. N. Simpson and J. Schielack attended and served as outside experts, discussion leaders, and advocates for research- and inquiry-based learning. This meeting was followed by a planning session to give disciplinary teams a chance to cross-fertilize and firm up their plans for module development.

Teams in the Departments of Atmospheric Science and Geography were formed quickly and began working soon after. In the Departments of Geology/Geophysics and Oceanography it proved more difficult to assemble teams. Oceanography is unique in the College because it has no undergraduate degree program, although it does offer undergraduate courses. In Geology/Geophysics, a shortage of graduate students proved to be an insurmountable difficulty. All of Geology/Geophysics' graduate students were fully employed and engaged in other teaching and research tasks, and thus, none were available to participate in the creation of learning modules.

Progress in the Departments of Geography and Atmospheric Sciences has been steady. Both have created appropriate leaning materials that fit seamlessly into the introductory courses.

In Atmospheric Sciences, three graduate students, working with faculty instructors, prepared four inquiry-based modules for ATMO 201, the department's survey course intended primarily for

non-majors. Each module encompasses one week's worth of material. The topics of the modules and the responsible graduate students are:

- Tropical cyclones, Matt Mosier
- Air pollution, Crystal Reed
- Climate change, James Tobin
- Severe weather, Matt Mosier, Crystal Reed, and James Tobin

Each of the modules includes four components:

1. A self-guided website using Walden's path (a resource provided by TAMU's computer science department)
2. Powerpoint lecture slides
3. Small-group in-class activities
4. A database of clicker/test questions

Faculty teaching ATMO 201 can use part or all of the modules or they can choose to have the graduate students present the material. The modules are in the final phase of fine-tuning, and therefore have not yet been tested in the classroom or labs.

When the modules are in final form, all of the materials will be made available on a password-protected website. Dr. C. Schumacher, the lead faculty participant, is confident that this can be accomplished before September 30th as the modules are very near completion.

In Geography, Dr. S. Quiring, with the assistance of a graduate student, developed three RIBL modules for GEOG 203, the introductory physical geography course that serves both geography majors and non-majors (typically as a tier II science course). Each of these modules closely corresponds to topics that are currently covered in the course.

- Module 1 – text chapters 2, 4, and 5 – Temperature controls and global temperature patterns
- Module 2 – text chapters 6, 7, 8, 9, 10 – Precipitation controls and global precipitation patterns
- Module 3 – text chapters 14, 15, 16, and 17 – Erosion, deposition, transportation, and how it reshapes the earth

The modules were also designed to address content and skills identified in the following National Geography Standards.

- Essential Element 1 – The world in spatial terms: How to use maps and other geographic representations, tools, and techniques to acquire, process, and report information from a spatial perspective (Standard 1); How to analyze the spatial organization of people, places, and environments on Earth's surface (Standard 3)
- Essential Element 2 – Places and regions: The physical and human characteristics of places (Standard 4)
- Essential Element 3 – Physical systems: The physical processes that shape the patterns of Earth's surface (Standard 7); The characteristics and spatial distribution of ecosystems on Earth's surface (Standard 8)
- Essential Element 5 – Environment and society: How human actions modify the physical environment (Standard 14); How physical systems affect human systems (Standard 15)
- Essential Element 6 – The uses of geography: How to apply geography to interpret the past (Standard 17); How to apply geography to interpret the present and plan for the future (Standard 18)

Each module is structured so that the lectures provide the conceptual building blocks and the modules provide the opportunity for the students to synthesize and apply this knowledge by completing a small project.

III. Outcomes

The Geosciences proposal sought to accomplish three learning outcomes.

- improve their ability to examine, identify, and gather information pertaining to authentic questions, problems, and issues around which the modules will be built;
- become more skilled at formulating conclusions and justifying why the conclusion they select is best; and
- gain greater ability to interpret and communicate the results of their analyses.

Although Geosciences proposed to have pilot-tested the learning modules by this time, perhaps not unexpectedly, progress has been slower than anticipated. Nevertheless, both lead faculty

members are confident that the modules can be tested and that an assessment of their impact on student learning can be accomplished during this academic year.

IV. Assessment Methods

The assessment methods in Atmospheric Sciences focuses on the willingness of faculty to adopt the modules and the modules' impact on student learning. The former will be measured by the number of faculty who include the modules in their courses and their enthusiasm, or lack thereof, for the materials. Student learning will be assessed through the inclusion of items on scheduled exams and tests. Performance of students after inclusion of the modules will be compared with that of students who completed the course before the modules were introduced.

Dr. Quiring has developed an assessment plan for the geography materials that depends on continued funding. He hopes to evaluate the modules' effectiveness by comparing student performance from lecture-only verses lecture-enhanced versions of GEOG 203 in order to answer the following research questions:

1. Will pairing Google Earth with inquiry-guided learning pedagogy improve undergraduate student attainment of concepts in an introductory physical geography course?
2. Will student opinions of the course improve as a result of this pedagogical approach?
3. Will students' metacognition be impacted by this pedagogical approach?

Two semesters of students will be assessed in this study. This fall semester this large survey course (approximately 150 students) is being taught using traditional lecture pedagogy utilizing PowerPoint during lectures. This group will serve as the control group. In the spring, Dr. Quiring will again teach this course using the same lectures and PowerPoint presentations; however, he will introduce the treatment of three class inquiry-based project modules during the semester utilizing Google Earth and global datasets.

Prior to the first lecture, students will be given a 20 multiple-choice question test (pretest exam) designed by the professor to assess current level of physical geography knowledge. The students will be told that it will be graded but not counted towards their course grade. A 10 question Likert scale survey will also be administered to assess student attitudes and metacognition.

The professor will deliver lectures in the same format as in previous semester, using the same lecture notes and PowerPoint presentation, however, he will introduce 3 small group class projects utilizing Google Earth as a treatment. Through an inquiry-guided learning model, students will put into action the information presented in class lectures and course textbook to complete these projects.

The final exam will incorporate the pretest questions (serving as the “posttest exam”) mixed in with reworded questions from the final exam given to the control group. The posttest questions will be isolated during data analysis to compare with the pretest exam scores. In this way, data can be gathered that will assess (a) change during the semester (pre/posttest exam) of the experimental group and (b) difference between the control and experimental groups (comparing exam scores of the two groups).

Normally, students complete end-of-the-term course evaluations during the final week of regular classes, prior to the final exam. At this time, students will be given the pretest survey again to serve as the “posttest survey.” Comparison of the pre and posttest survey will provide insight into effects of the treatment on the way students think about their thinking and learning (metacognition) as well as effect on student attitudes (satisfaction) towards the course.

V. Summary of Results

The most concrete results of the project consist of the development of learning modules that fit into the curricula of the introductory courses in atmospheric science and geography. Progress has not occurred as rapidly as planned, and only half of the College’s departments have succeeded in creating learning materials.

Plans to test and assess the impact of the modules have been developed and will be initiated during the fall 2008 semester. To assess the impact of the geography modules on student learning as proposed by the lead faculty member will require additional support.

VI. Closing the Loop

The results accomplished so far will improve RIBL in the Departments of Geography and Atmospheric Sciences by increasing the level of student engagement in these activities in the introductory courses of both departments. Activities during the 2008-2009 academic year will build on the results accomplished last year by demonstrating the effectiveness and ease of incorporating the modules into courses. Instructors who adopt the modules will serve as advocates and disseminators for the materials within their own departments. The IPAC (formerly QEPC) will also assist in disseminating information between departments and in encouraging the involvement of oceanography and geology/geophysics during this academic year.

If continued funding allows for the careful analysis of the impact of the modules on student learning, strong evidence for the value of RIBL can be marshaled to make the case for further activity of this type in other courses in geography and atmospheric science as well as in geology/geophysics and oceanography. The analysis planned by Dr. Quiring in geography also has the potential to lead to publishable results in an appropriate, peer-reviewed journal.

Once the assessment has been completed, sustainability of the program should not prove difficult. The modules will require periodic revision, but once their value is established, that relatively simple task can be delegated to faculty and graduate students responsible for the courses in question.

During a recent meeting convened by Associate Dean of Academic Affairs S. Bednarz, representatives from the College departments expressed a strong desire to collect information about the perceived successes and failures of their degree programs from graduating and recently graduated students. Thus, as part of our assessment activities for 2008-2009, the College requests funding to support this additional project.

IPAC, with the cooperation of Associate Dean Bednarz and departmental representatives, will develop a survey instrument to acquire the desired information. Part of the instrument will be common to all four departments and will be especially interesting to the College administration.

Each department will also collect information specific to its programs. After the instrument is developed, data will be collected face-to-face and via telephone, Internet, and mail. Data collection will be performed primarily by undergraduate students supervised by the Associate Dean's office. Once data have been collected, graduate students will be employed to organize, process, and present the data. Both the departments and College will use the results to modify, strengthen, or reduce aspects of their programs. The College and departmental participants are aware that other colleges have already gathered information from their current and former students and that this data has proven to be very useful in assessing program success.

VII. Budget

Materials (\$250 X 4 depts.)	1,000.00
Copying (\$150 X 4 depts.)	600.00
Brown bag lunches	400.00
Ugrad/Grad student support (\$4000 X 4 depts.)*	16,000.00
Geoscience matching funds	<u>(8,000.00)</u>
Total Requested	10,000.00