Report of the ad hoc Natural Science GER group
August 2004

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The working group met to discuss and develop an assessment approach to the natural science component of the GER. This summary presents an overview of the requirement and a plan for assessing the results.

Formal requirement

The introduction to the enabling legislation (Faculty Senate Doc. 1382) outlines some general GER goals, but the core requirements are in section II.7 and section V.5.d of the composite 1382/APCC procedure document. Section II.7 states that students are required to take six credits in at least two courses. At least one course “must include laboratory or field experience illustrating the generation and testing of data and the application of concepts and knowledge to the solution of problems.”

In section V.5.d, four criteria are itemized that a course must meet to satisfy the requirements:
   a) Introduce major concepts of a natural science discipline, providing insights into its breadth and its relationship to other disciplines.
   b) Illustrate relationships between experiments, models, theories and laws.
   c) Illustrate the generation and testing of data and the application of concepts and knowledge to the solution of problems.
   d) Discuss the limitations of data and the possibility of alternative interpretations.

The Natural Sciences GER requirement is a distributional requirement that is currently met by taking courses from among the offerings of four schools and colleges (Engineering, Health Sciences, L&S, Nursing).

An approach to assessment

The working group suggests a three-pronged approach to assessing the GER requirement. We recommend that UWM implement (1) a phased-in assessment of our design and content of our GER courses as part of our cycle of program reviews, (2) an on-going assessment of student learning in the GER courses, and (3) a regular review of GER courses linked to instructional improvements based on the assessments (i.e., feedback mechanisms).

Course design and content

The GER document lists criteria for courses to meet if they are to satisfy the requirement. We suggest that these criteria can be restated as a series of generalized student learning objectives that indicate students will be able to (a) use a major scientific concept to
explain natural phenomena; (b) explain the relationship between experimental or field data and general theories and laws, (c) generate and analyze scientific data, (d) solve problems with appropriate tools, and (e) identify underlying assumptions, alternative interpretations and ambiguous data. However we think that learning objectives need to be specific for each course if they are to be useful. (See appendix for some examples of course-specific learning objectives and how they might be assessed.)

We recommend that the GER courses be reviewed at the time of the undergraduate program review. In the review, GER course syllabi should be reviewed to determine whether learning objectives and assessment methods (laboratory sessions, essay assignments, etc.) are clearly and specifically stated and aligned to GER criteria. It is recommended instructors write learning objectives that follow the format of a through e cited above, and indicate what activities will be used to assess students’ performance (i.e., laboratory sessions, essay assignments, etc.).

We suggest that all GER courses be reviewed within the next five years. About half could be covered in the ten-year undergraduate program review cycle. The remaining courses should be reviewed on the five years anniversary of the last program review. (Thus the GER courses in a program reviewed in 2002 should be reviewed in 2007.) Subsequent assessments should occur at the same time as the undergraduate program reviews.

Assessment of student learning

The course review will provide an assessment of the course “input” for the natural science requirement. The working group strongly recommends use of more direct measures of student learning. The wide number of courses used to meet the natural science requirement makes this difficult, but we suggest the combined use of several assessment strategies.

1. Tracking of student assignments

At the time of the course review, instructors will be asked to indicate specific assignments that align with the student-learning objectives. Instructors should track pooled student performance in those assignments to assess the outcomes. This data would be used at the time of the ten-year GER course review.

2. Course surveys

Student evaluations are conducted at the end of each course. We recommend that GER courses evaluations should include some questions related to how well the course met the GER objectives. At a minimum, these questions could be: (1) were the GER course objectives clear to you?, and (2) how well did this course meet the GER course objectives?

3. Student exit surveys
The broader educational goals of the GER set forth in section I (Introduction) of the GER document are harder to assess. The educational experiences that help students meet these goals are diffused throughout their experiences at UWM.

We suggest that the exit survey of graduating UWM students can provide a means for getting information on students’ experiences with GER courses. A few questions could be added to ask students about the overall impact of GER courses on their educational perspective.

Some examples of possible questions are:

- How important was taking General Education courses in terms of positively influencing your overall educational experience?
  
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- How important was taking General Education courses in terms of positively influencing your educational experience in the major?
  
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- How important is it for General Education courses to remain a part of UWM graduation requirements?
  
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4. Alumni surveys

We recommend that some general questions be added to current alumni survey about the value of the GER program to preparing them for their post-UWM experiences. We think that the GER task force should consider developing such an alumni survey.

Feedback

Historically, once courses are approved for GER credit, there has been little tracking of how well the courses meet the GER objectives. This would change if the GER courses were re-evaluated at the time of the program reviews. Instructors will need to track student performance on the assignments that they identify as appropriate for tracking GER learning objectives. We think that an additional step is needed: instructors should be able to demonstrate how assessments of student learning affected subsequent course offerings. Although in some cases the assessments may indicate that little change is needed, we anticipate that some assessments will indicate modifications are needed. Instructors should track the changes and their impact in such cases.
A final thought

The changes proposed above would change the GER courses from an exposure-based approach to a learning-objective program. This will require our faculty and teaching academic staff to rethink the role of GER courses. It may also change our students’ perception of the intention of the requirements. However, this shift may require the reconsideration of Faculty Document 1082 or the APCC procedures.

We would suggest two changes that should be considered.

1. The criteria presented in section V.5.d indicate the course content that reflects an “exposure” approach to GER. We suggest that the criteria for the distributional components of GER should be restated in terms of learning objectives.

2. Section II.7 indicates that the requirement that a course “must include laboratory or field experience illustrating the generation and testing of data and the application of concepts and knowledge to the solution of problems” is linked natural science courses with a laboratory or field experience. However, in section V.5.d the requirement is applied to all natural science GER courses. We recommend that section V.5.d be revised to specify that this requirement only applies to courses with a laboratory or field experience.
Appendix

The following examples illustrate how these recommendations can be implemented using GER courses taught by committee members. These examples indicate the documentation that could be provided when a course is initially reviewed for GER approval. These statements would be augmented by student performance data when the courses were reviewed at the time of a later program review.

**Human Kinetics 230: Health Aspects of Exercise and Nutrition**

This course examines the interaction between physical fitness and optimal nutrition as they relate to weight control and overall health.

The student will be able to:

a) Use a major scientific concept to explain natural phenomena by identifying and explaining macro and micronutrients and the role each plays in basic metabolic processes. The student will apply these concepts by assessing his/her daily physical activity level and writing a nutrition/physical activity program.

b) Explain the relationship between experimental or field data and general theories and laws by discussing a peer-reviewed article on exercise and nutrition. The student will apply these concepts by writing a critique addressing theoretical and experimental design factors determined by the instructor.

c) Generate and analyze scientific data by understanding the interaction of exercise and caloric consumption in weight control and body composition. The student will apply these concepts by calculating body composition using several indirect methods.

d) Solve problems with appropriate tools by understanding the mechanisms and considerations for planning diet and exercise programs. The student will apply these concepts by writing a five page paper analyzing the diet and exercise factors of an assigned chronic disease.

e) Identify underlying assumptions, alternative interpretations and ambiguous data by comparing and contrasting hypotheses relating to the mechanisms and health implications of obesity. The student will apply these concepts by writing an assessment of a nationally known diet program.

**Geosciences 102: Historical Geology**

Historical geology serves as the second course in the undergraduate major sequence and as a general education course. The course objectives related for GER are for students to be able to:

(a) Use the concepts of geological time, plate tectonics, evolution and facies to explain earth history. The student will demonstrate this ability through
homework problems and exam questions require students to use the basic concepts to explain the history of the earth, and (2) a final project (and related group work) requires the integration of plate tectonics and facies patterns throughout the last half billion years of earth history.

(b) Explain the relationship between field data (facies patterns, geological sections and fossil distributions) and tectonic/environmental interpretations of past conditions. The student will do this directly in two exercises. In the field trip exercise, students measure geological sections, use their data to construct a stratigraphic cross section, and develop an environmental interpretation. Students also will complete a depositional environments laboratory project that requires them to relate an array of samples to past environmental conditions.

(c) Generate and analyze field data (geological sections and fossil distributions). Students will do this for the field trip exercise.

(d) Solve geological problems with appropriate tools and concepts. Students will do this in solving geological problems during several activities in the course, such as homework, exam and laboratory exercises.

(e) Identify underlying assumptions, alternative interpretations and ambiguous data. Students will do this in solving the depositional environments and field trip exercises, both of which require students to consider a variety of interpretations and develop an interpretation based on a reasonable geological model. Alternative solutions are possible, and need to be considered in solving these problems.

An assessment note.

The final class meeting is used for course assessment activities that allow students to provide their input on the course. In addition to the rather brief and standardized department evaluation form, the instructor conducts an additional course assessment exercise. Usually this has taken the form of a detailed student survey. Most recently, the TA used a group synthesis and discussion procedure to elicit student comments on the positive and negative features of the course. The student input has resulted in substantial shifts in the format and structure of the course. In all cases, student comments are not released to the faculty member until after final grades are submitted.