

GACE EVALUATION
SECONDARY SCIENCE EDUCATION PROGRAMS
Committee Report

Date: 08/01/2007

Committee Members:

Yasar Bodur, Chair

Jessica Orvis, Member

Michelle Cawthorn, Member

Karen Chassereau, Member

Process:

This project was conducted as a form of program evaluation by the committee members. First, the committee chair reviewed GACE objectives for secondary science programs. Second, the committee chair contacted the Student Success Center and obtained information about course descriptions of required content courses in secondary science education programs. The committee chair, then, created a matrix for each science content area that included the GACE objectives for the given content area (rows) and the list of required content courses (columns). The committee chair also prepared a document for each science content area that included the course descriptions of each content course.

After all the groundwork for the evaluation was completed, the committee members were provided with the materials to conduct the evaluation (the matrix and the course descriptions). The specific distribution of tasks in the evaluation process was as follows:

Yasar Bodur: Coordinated the evaluation process, created the evaluation matrix for each content area and compiled descriptions of content courses.

Jessica Orvis: Evaluated Chemistry Education

Michelle Cawthorn: Evaluated Biology Education

Karen Chassereau: Evaluated Physics Education

The committee members determined the GACE objectives that were met by the content courses using the materials provided, and indicated these on the matrices (please see attached matrices). Also each committee member provided a narrative description of the patterns they identified in the matrix they had completed.

The following sections of this report address each science content area separately. In doing so, both a description of the degree to which each science content area meets GACE objectives and program recommendations are stated.

Biology Education

1. Indicators for Biology which are not covered include:
 - a. All of the indicators about human anatomy and physiology (rows 103-109)
 - b. The indicator about ethical issues related to genetic engineering (row 53)
 - c. The ecology indicators that refer to specific biomes (row 133) and ecological succession (rows 136-137)
2. All of the other indicators for Biology are met. Many of the indicators are covered multiple times, especially the *characteristics of science* and *evolution* indicators. Each of the classes considered for this matrix is a beginning level class; each topic is covered more thoroughly in the upper level courses.

3. As of fall 2007, Biology is starting a new introductory sequence, Bio I and Bio II. Bio I will contain most of the content of the current cell biology (Biology 2131). The content of Bio II is still being hashed out, but it's likely that it will contain much of the current content of Biology 3132 with a smattering of content from Biology 3133. *Thus, it is probable that even though the current introductory courses meet most of the indicators, future introductory course sequences will not, especially in the areas of ecology and evolutionary theory.* Future majors will be taking other courses that they currently are not, including Genetics, so the indicators may be met in other upper-level courses.

Recommendations

BIOL 3132 and BIOL 3112 seem to cover the same GACE objectives under "Characteristics of Organisms." GACE objectives on "the structure and function of the human body" which are currently not covered by any of the Biology Education content courses are also placed under the topic "Characteristics of Organisms." One of the two courses mentioned above can integrate the objectives on the structure and function of human body by removing some of the currently covered objectives that are already covered by the other course.

The GACE objective on ethical issues related to genetics can be integrated into one of the courses that meet GACE objectives on heredity. BIOL 3240 can be recommended as it includes heredity in its content and covers a smaller number of GACE objectives than the other courses with similar content.

The ecology objectives that refer to specific biomes (row 133) and ecological succession can be integrated into BIOL 3133 and/or BIOL 3113 as both courses cover content on characteristics of ecosystems and biomes.

Chemistry Education

1. The performance indicators for the GACE objectives mostly mirror the first year general chemistry course CHEM 1145/1146, which is no surprise given that many high school courses attempt to cover the same material as is covered in the first year of college level chemistry. The chemistry curriculum at Georgia Southern University is set up so that students are introduced to almost all of the performance indicators in the first year. Upper level chemistry courses then explore these topics at a much greater depth.
2. All the courses cover objectives on “Characteristics of Science.”
3. The only gap not currently covered in Chemistry Education program is in the area of nuclear transformations. Currently the topic is taught in the nursing chemistry course, CHEM 1140, and in the environmental chemistry course, CHEM 1040, but not in the courses required for the major.
4. It can also be observed that CHEM 2031 has few boxes marked on the grid. The lack of “x”s on the grid belies the usefulness of the course. It is designed to introduce students to tools and skills that they need in order to perform well in the upper level courses. The course focuses on using chemistry related software, writing laboratory reports, and accessing chemistry information.

Recommendations

All the courses provide some coverage of atomic structure and the properties of matter. Consequently, many of the objectives under this subarea are covered multiple times. The indicators that are not covered in the area of nuclear transformations are also under atomic structure and the properties of matter. Therefore, one of the courses that cover identical objectives with another course can remove some content from its curriculum and integrate nuclear transformations into its content.

Physics Education

1. Introductory courses in physics, including lecture classes PHYS 1111 and PHYS 1112 and the co-requisite laboratories PHYS 1113 and PHYS 1114, offer a foundational understanding of mechanics, motion, thermodynamics, electricity, magnetism, optics, and some modern physics.
2. The Modern Physics series (PHYS 3536 and PHYS 3537) require the application of these concepts to understand complex interactions on the atomic and subatomic level. According to the syllabi, the GACE objectives are met with these courses. However, to acquire an in-depth understanding these concepts, the following courses provide extension and enrichment necessary for the student to be able to teach physics at the secondary level: PHYS 3131 (Optics), PHYS 5151 (Classical Mechanics), PHYS 5152 (Classical Electricity and Magnetism Theory), and Advanced Physics (PHYS 3420). All GACE objectives are met.
3. The general view of the matrix indicates that each course places an emphasis on the characteristics of science in addition to the specific physics content.

Recommendations: Some courses cover a large number of GACE objectives whereas some courses cover very few. It can be assumed that the upper level courses cover a smaller number of objectives because they provide an in-depth study of the content they offer. PHYS 5130 covers only five GACE objectives all of which are on characteristics of mechanical waves (excluding characteristics of science), which are also covered by four other courses including an upper level course (PHYS 5151). It can be recommended that PHYS 5130 include more physics content that is not studied in-depth in other courses.

Conclusion

All three science education programs seem to cover most of the GACE objectives. Integrating the objectives that are not covered into the courses may require small adjustments in some courses in coordination with other program courses. Providing students with multiple exposures to the objectives, as seen in all three programs, is likely to allow them to learn the content well. Overall, we do not have recommendations that require major changes. The current organization of the secondary science education programs seem to be aligned with GACE objectives to a great degree.