Undergraduate Program Assessment

**Department of Astronomy**

**Student Learning Objectives**

- Clearly describe basic astronomical facts and concepts and apply these to solve problems or form reasoned explanations of phenomena. These basic facts and concepts include: the various kinds of objects in the universe and their relative size; motions of the sky and their connection to Earth’s rotation and orbital motion; basics of stellar evolution; Kepler’s Laws; inverse-square laws.
- Apply physics and math to astrophysical problem solving. This includes applications of Newton’s laws of mechanics and gravitation, radiation formulae, differentiation and integration, and simple differential equations.
- Write a clear and well-reasoned scientific paper about work they have done.
- An outstanding major should be able to: demonstrate excellence in an individual area related to their career plans. Examples of this might be the application of upper-level physics and computations skills to complex astronomical problems, using astronomical instrumentation and software tools to collect and analyze astronomical data, or to develop a planetarium program at a local museum for a public audience.

**Assessment tools**

- Direct: Samples of student work will be collected from courses that all majors take (Astro 228, 335, Junior Year Writing, and 452). Samples will be examined and scored by the Undergraduate Curriculum Committee. At the conclusion of our Integrative Experience course, the students present the results of their semester-long capstone project to a panel of faculty experts.
- Direct and indirect: Assessment instruments to include brief problems and survey questions will be designed and administered in 335, Junior Year Writing, and 452, to ascertain what students have retained from earlier courses in comparison to student learning objectives.
- Indirect: the department chair, undergraduate program director, and chief undergraduate advisor meet with groups of seniors to discuss their undergraduate experience.

**Highlighted recent activities**

- Undergraduate Curriculum Committee plans to meet at least twice annually to review results, will present results to the faculty at the annual retreat or a faculty meeting, possibly resulting in changes to the program.
We made some small, but significant alterations in our initial astrophysics course for majors, Astro 114, as a result of our reviews. We were finding that a significant percentage of the students in the class were non-majors with far too low a level of mathematical understanding to allow them to do well on the problem sets. This tended toward lowering the level of the entire course so that students were also less-well prepared for the intermediate astrophysics course Astro 335. While we want to encourage possible majors to try out the initial course, it was serving no one well to present this course at too low a level to support later courses. Talking with the students, the perception that this was a 100-level course that carried a physical-science gen-ed designation caused many students to sign up because the course fit their schedule and they needed a “PS” course. We changed the course number to 228 and added a co-requisite that students be taking at least an initial calculus class, and this seems to have improved the situation greatly. We are pleased also to find that this has not lowered enrollment in the course, but has in fact attracted a number of students with stronger mathematical backgrounds to try out the course.

In reviewing our intermediate astrophysics course, Astro 335, which is required of all our majors, we found that students in the B.A. track who took the lower-level sequence of physics and math allowed in that track were not well-enough prepared to succeed in the course. We also found that students who had not taken our computational techniques class were also at a disadvantage in the upper level courses. We therefore modified the requirements of our tracks, raising the minimum math and physics courses for our B.A. students, and requiring all majors to take the computational techniques course. These changes have just been approved by the faculty senate, so it will be two to three years before we see if new students have greater success in the course. In meeting with our students, the B.A.-track students thought this change would have helped them greatly in what was for them their most difficult course.

We have also taken advantage of the implementation of our new Integrative Experience course to provide an opportunity for our students to display the breadth of their abilities to a panel of faculty with some expertise in the field. This gives us an opportunity to see and hear our students near the end of their undergraduate careers in a context in which they are pulling together all their coursework. This was designed into the course, which was offered for the first time this spring.

We have found that many of the review activities for our courses have more useful results when we hold face-to-face meetings with students and faculty. This provides opportunities to clarify what we mean and to probe into questions as we proceed. The faculty who teach the central courses in the major have also led discussions at faculty meetings about course coverage and outcomes that have helped to clarify some misperceptions about what we should expect of our students at each level. In the meantime, we will also continue to gather and review sample materials from our central courses.