

**ASTRONOMY DEPARTMENT
ASSESSMENT RESULTS
2002-2003**

I. Program/Discipline Mission Statement

The mission of the Astronomy department is to support ACC goal of being a world class learning centered institution, facilitate student learning and meet the needs of ACC students.

II. Program/Discipline Purpose

The purpose of the Department of Astronomy is to provide educational services in the areas of astronomy for the residents of Arapahoe and Douglas counties and surrounding areas. The department takes a learner centered approach. The courses support transfer requirements for science and nonscience students. The department is committed to quality education in the area of astronomy, incorporating the most current astronomy technology and educational methods.

III. Intended Learning Outcomes (competencies)

After taking any astronomy course at ACC, the student will:

1. Master specific course Learning Objectives/Outcomes at the appropriate level.
2. Be able to analyze data and suggest answers or solutions to problems.
3. Use appropriate technology and lab equipment.
4. Apply the logic, thinking and application of the scientific method to topics in astronomy and be able to apply these principles to "real life" problems.
5. Demonstrate their ability to read, comprehend and write about science related materials.

IV. Assessment Procedures, Measures and Criteria

Since Spring Semester of 2003 one of these specific learning objectives/outcomes has been assessed each semester by administering a pre and posttest which objectively measures the following specific learning objective/outcome(s):

Upon completion of AST101, the student will be able to:

- 1.0** Correctly identify a proper interpretation of any one of Kepler's laws.

An objective quiz was given at the beginning of the semester and again at the end in all AST101 sections. The quiz addressed the knowledge and understanding of all or some of Kepler's laws as part of its makeup. Item analysis of the particular questions regarding Kepler's laws was tabulated and analyzed.

V. Assessment Implementation Plan

The ACC Astronomy Assessment Test is based closely on The Astronomy Diagnostic Test developed by The Collaboration for Astronomy Education Research (CAER). The test was administered at the beginning and at the end of Astronomy 101 sections both semesters. The test covers a broad range of topics covered in Astronomy 101 and will assist us in evaluating the effectiveness of our pedagogical methods for many of the stated learning objectives of Astronomy 101.

For this semester we evaluated learning objective 1.0 (Correctly identify a proper interpretation of any one of Kepler's laws.) in two separate ways, via the Astronomy Assessment Test and a separate Kepler's Laws Laboratory Activity (see Appendix A).

Two questions on the Astronomy Assessment Test address the particular learning outcome:

14. (T/F) Kepler said planets move in circular orbits around the Sun.

30. Kepler's second law says that:

- A. The planets orbit the Earth in perfect circles.
- B. The planets orbit the Sun in perfect circles.
- C. The planets move at varying speeds.
- D. The planets move at a constant speed.

VI. Results - 2002

In 2002 item analysis of the two questions of interest on the test was performed.

Here are the results for the number of students who answered the questions *incorrectly*:

<i>Semesters</i>	<i>Q14-Before</i>	<i>Q30-Before</i>	<i>Q14-After</i>	<i>Q30-After</i>
Spring 2002	57%	45%	42%	39%
Fall 2002	65%	57%	63%	50%

The results show that, on average, the students were able to answer the two questions correctly more often after having had an Astronomy 101 class than

before. However, the result was not impressive and there was clearly room for growth.

Results - Spring 2003

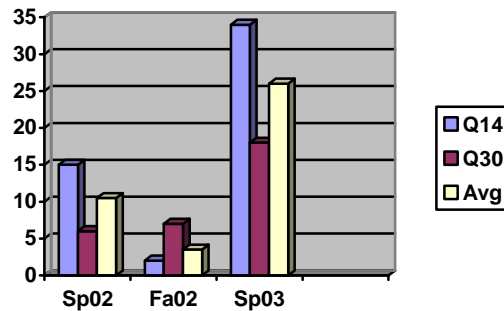
A. Assessment Test Results

In Spring 2003 all astronomy instructors did the special Kepler's Law Lab (See Appendix A) in their classes as part of the assessment activity and in an attempt to increase learning and measure any improvement in scores using the assessment tool. Here are the results on the same questions for that semester.

<i>SEMESTER</i>	<i>Q14-Before</i>	<i>Q30-Before</i>	<i>Q14-After</i>	<i>Q30-After</i>
Spring 2003	72%	58%	38%	40%

A summary of the results to date:

<i>SEMESTER</i>	<i>Q14-Improvement</i>	<i>Q30-Improvement</i>	<i>Average Improvement</i>
Spring 2002	15%	6%	10.5%
Fall 2002	2%	7%	3.5%
Spring 2003	34%	18%	26%



Clearly the outcome of improvement in the pedagogy regarding Kepler's Laws was increased learning about Kepler's Laws as demonstrated by these scores.

While we apparently did not set any benchmark when writing the Assessment Plan for this year, these results would correspond to achieving a nominal 10 percent improvement in these scores.

However, before we become overly self-congratulatory we should stop to consider some important facts. These impressive results must be tempered with the sober realization that while encouraging instructors to concentrate more on Kepler's Laws improves the scores on these questions it may have the effect of lowering the scores on the other questions on the Astronomy Assessment Test as other areas of course content are neglected. We have not yet evaluated that.

We will have more meaningful information when we incorporate all of the learning outcomes in the Assessment Process.

B. Assessment Lab Results

For Spring 2003 we did an assessment of Kepler's Laws in a second way (using the special Lab, see Appendix A), which actually improved, the results on the Assessment test (see part A above).

There were problems evaluating the Lab Assessment due to differences in the approaches and grading schemes for various instructors. Most of these differences should be alleviated in the future by the use of a Rubric for all instructors. Normalized to a maximum score of 20 the average score on the Labs for Spring 2003 was 17.5. This number should not be considered to be very meaningful due to the problems mentioned above. The administration of the Kepler's Law Lab Assessment in the spring of 2003 should be considered a practice run. The plan for next year will include a Rubric for evaluating the Kepler's Laws Lab Assessment so that the scores will be more meaningful. In addition the Lab Assessment will be revamped and expanded to address more of the learning objectives listed in Section III.

VII. Feedback Channels

These results will be disseminated to the Department Chair all the astronomy teachers at ACC. The next iteration of the assessment will address more of the learning outcomes and many of them in two ways.

APPENDIX A

Kepler's Laws

NAME _____

1. Including the Sun in your diagram, draw different orbital trajectories with
 - a. High eccentricity

 - b. Low eccentricity.

2. On the orbit you drew in part 1.a. with high eccentricity show where the orbital speed will be:
 - a. The highest
 - b. The lowest.

3. Planet Zorg has the same mass as the Earth and orbits the Sun at an average distance of 2.0 AU with an eccentricity of 0.00001
 - a. What is the orbital period of Zorg in years? _____
 - b. If we double the mass of Zorg what will the orbital period be? _____
 - c. If we triple the mass of Zorg and move it to an average distance of 3.0 AU what will its orbital period be? _____
 - d. If we keep everything as in part c but now change the eccentricity of Zorg's orbit to 0.99678 what will its orbital period be? _____
 - e. If we keep everything as in part d will Zorg move more rapidly when it's:
close to or far from the Sun? (Circle one)
 - f. If we keep everything as it is in part d but triple the mass of Zorg again will it move more rapidly when it's:
close to or far from the Sun? (Circle one)