# Astronomy Program Assessment Report

## Part I - Assessment SUMMARY (2004-2005)

### A. Program/Discipline Mission Statement

The mission of the Astronomy department is to support ACC's goal of being a world class learning centered institution, facilitate student learning and meet the needs of ACC's students. 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 non-science students. The department is committed to quality education in the area of astronomy, incorporating the most current astronomy technology and educational methods.

### B. Intended Outcomes

1. Demonstrate mastery of competencies identified by the competency-based syllabus for that specific course. See Appendix I.
2. Acquire the ability to analyze data and suggest answers or solutions to scientific problems.
3. Use appropriate technology and lab equipment such as calculators and/or computers.
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 the ability to read and write about scientific literature that is relevant and appropriate to a specific course.

### B. Benchmarks for 2004-2005

The average on of the previous year's scores on the Astronomy Assessment Test is the benchmark for this period. The Kepler's Law Lab scores will meet or exceed the average score from 2003. The score on the Scientific Method Lab will meet or exceed 17.9 which is 90 percent.

The benchmarks for this period are summarized below:

| **Assessment Tool** | **Benchmarked Score** |
|---|---|
| Astronomy Assessment Test | 16.1 |
| Kepler's Law Lab | 17.5 |
| Scientific Method lab | 17.9 |

## D. Assessment Results

### 1. Historical Context

The Kepler's Law Lab was developed by the Astronomy Department to address the increase and ensure student learning on the topic of Kepler's Laws. Its implementation in previous semesters has actually resulted in measurable improvement in the knowledge and understanding of Kepler's Laws by astronomy students at ACC. This is evidence that the assessment process does measure an increase in the comprehension of these concepts by our students as well as stimulate improvement in our teaching of them.

### 2. Current Year Data Results

The results of these assessments for 2005 are listed in the accompanying table. These are the raw scores on these tests and labs. There is a column for percentages of the max score.

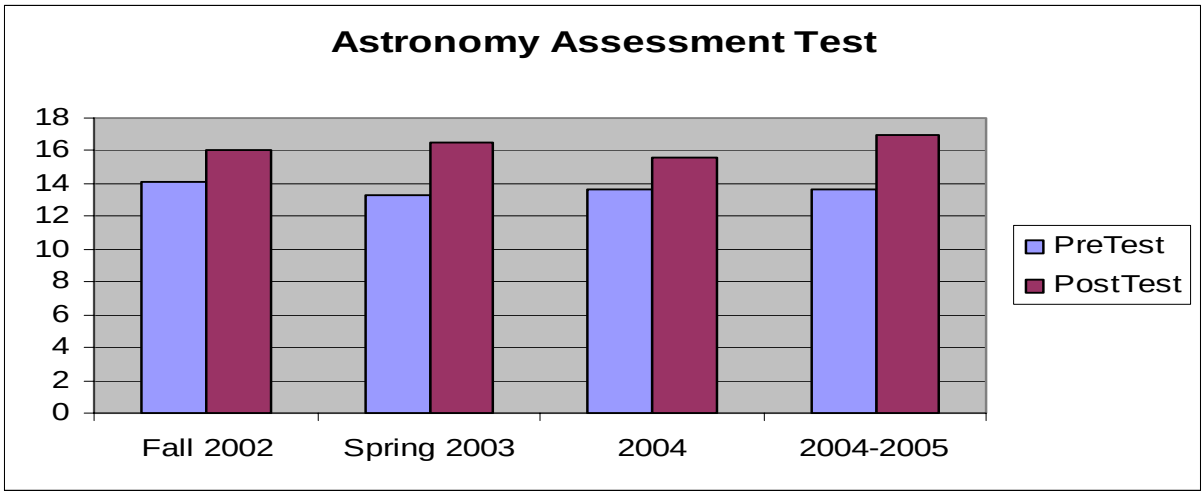
| Test | Number of samples | Average score | Possible max score | Average as a percent |
|---|---|---|---|---|
| Astronomy Assessment Test | 211 | 17.0 | 30 | 57% |
| Kepler's Law | 175 | 19.3 | 24 | 80% |
| Scientific Method | 145 | 17.9 | 20 | 90% |

### 3. Analysis

Astronomy Assessment Test

The accompanying table lists the results of the Astronomy Assessment Test. Scores are listed for 2002 through 2005. For a 2002 and 2003 the test was administered as both a pre and a post test. It is currently administered only at the end of the semester. The point of this is to show that there is incremental learning on the part of the students and to measure it.

| Date | 9/02 pre | 12/02 post | 1/03 pre | 4/03 post | Average pretest score from previous years | 12/04 and 5/04 post | Average pretest score from previous years | 2004 - 2005 post |
|---|---|---|---|---|---|---|---|---|
| Avg. Score | 14.1 | 16.1 | 13.3 | 16.5 | 13.7 | 15.6 | 13.7 | 17.0 |


Astronomy Assessment Test
18
16
14
12
10
8
6
4
2
0
Fall 2002
Spring 2003
2004
2004-2005
PreTest
PostTest

| Semester | Fall 2002 | Spring 2003 | Avg. 2002-2003 | Combined 2003-2004* | 2004-2005 |
|---|---|---|---|---|---|
| improvement | 2.0 | 3.2 | 2.6 | 1.9 | 3.3 |
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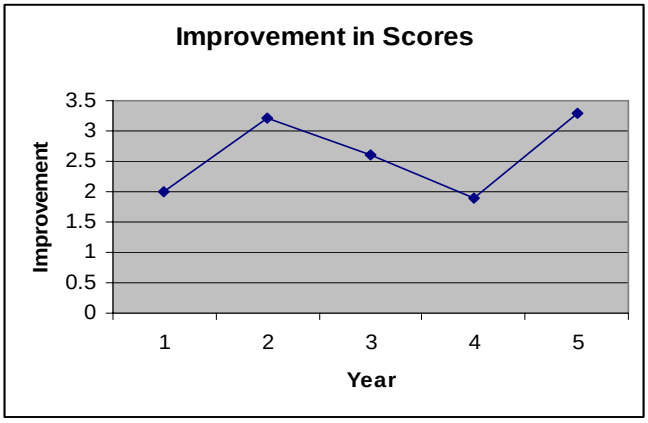


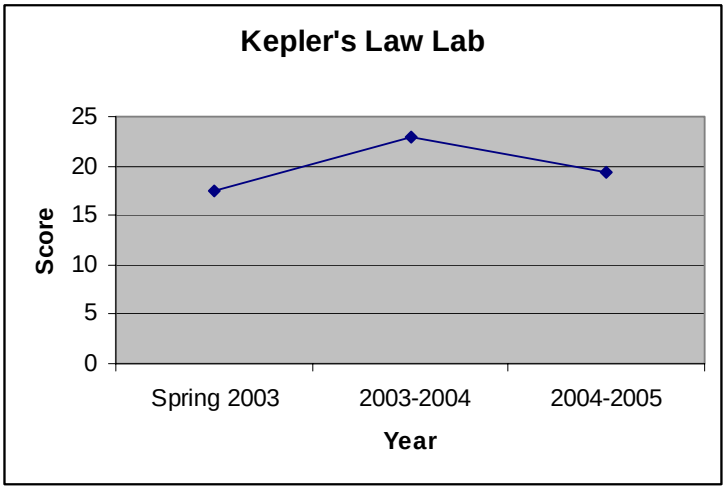

The improvement last year was 1.9 points. This year it was 3.3. The average score of 17.0 is well in excess of the benchmark of 16.1 for this vehicle.

Kepler's Law Lab

The spring 2003 average score on the Kepler's Law Lab was 17.5. The average score went up to 22.9 in 2003-2004 which is a great improvement. However, there was a problem with the Kepler's Law scores in 2003-2004. The average score for that period does not represent a fair assessment of the actual understanding of the students. It is too high. The score was affected by the inconsistent grading of at least one adjunct faculty member. To reduce this problem one person did all of the grading of these assessments for 2004-2005. The resulting score is a more consistent measurement. The result for 2004-2005 is 17.9. This represents a modest improvement.

The use of the Kepler's Law Lab does increase student learning in this area. So it is probably safe to say that though we have not accurately measured a trend, these data do represent an increase in the understanding of the students on this topic. Next year we will be able to more accurately interpret the results of the assessment.

| Spring 2003 | 2003-2004 | 2004-2005 |
|---|---|---|
| 17.5 | 22.9 | 17.9 |




Scientific Method Lab

The newly implemented Scientific Method Lab is designed to ascertain whether students have a good comprehension of the Scientific Method. There is no previous years result to use for comparison but the score of 17.9 is equivalent to about 90 percent of the maximum on this Assessment.

**E. Use of Results**

1. These results will be shared with all faculty members who teach Astronomy at ACC.
2. The astronomy department will continue to use the Astronomy Assessment Test, Kepler's Law Lab and Scientific Method Lab to assess student performance in Astronomy classes at ACC.
3. The following changes will be introduced in the appropriate ACC Astronomy classes:
   a) Spend more time on Kepler's Laws with the emphasis on the comprehension of their meaning rather than rote memorization.
   b) Spend more time on The Scientific Method offering a greater opportunity for students to describe their personal experiences as examples of the application of the scientific method.
4. Determine if and how student performance on the 2002-2003 Astronomy Assessment Test was affected by changes in instruction.

## Part II – Assessment Plan (2004-2005)

**A. Intended Outcomes:** same as above

**B. Identify Assessment Procedures/Methods**

For 2005/2006 these specific learning outcomes will be assessed by administering The ACC Astronomy Assessment Test and assigning a Kepler's Laws Lab as well as the Scientific Method Lab for all ACC Astronomy 101 students. This will satisfy the requirement to assess all outcomes at least two ways.

| Learning Outcome | ACC Astronomy Assessment Test question numbers | Kepler's Law Lab question numbers | Scientific Method Lab question numbers |
|---|---|---|---|
| 1 | 1 through 30 | 1, 2, 3.e,f | A. B. C. D. |
| 2 | 18,19,21,22,26,27 | 3.a,b,c,d | |
| 3 | | 3.a,b,c,d | D. (part 1) |
| 4 | 1,4,28 | | B. C. D (part 2) |
| 5 | 1 through 30 | 4,5 | A. B. C. D (part 2) |

**C. Benchmarks for 2005-2006**

The benchmark for this period is that the score will meet or exceed 16.1 on the Astronomy Assessment Test. This is the average of the previous year's post test scores. The Kepler's Law Lab scores will meet or exceed 17.5 (the average score from 2003 ). The score on the Scientific Method Lab will meet or exceed 17.9.

## APPENDIX I - Learning Outcomes and Topical Outline

This class addresses the following learning outcomes:

1. Define each of the related vocabulary words.
2. Recognize the appropriate symbols used.
3. State the concepts introduced.
4. Distinguish between different concepts within a topic.
5. Interpret tables or graphs.
6. Collect and organize data in a systematic manner.
7. Present data by construction of charts and graphs.
8. Evaluate the relevancy of data.
9. Write a formal report.
10. Set up and solve problems using geometry, algebra and trigonometry.
11. Apply concepts to new situations.

OUTLINE

I. History of Astronomy
- A. Astronomy vs. Astrology
- B. Pre-Copernican
- C. Copernicus, Galileo, Brahe, Kepler, and Newton

II. The Observed Night Sky
- A. The Motions of the Moon and Sun
- B. The Motion of the Visible Planets
- C. The Celestial Sphere
- D. The Calendar and the Seasons

III. Observing Instruments
- A. Geometrical Optics
- B. Refracting Telescopes
- C. Reflecting Telescopes
- D. Space Telescopes
- E. Introduction to Light

IV. The Solar System
- A. Structure
- B. Properties
- C. Cosmogony

V. The Moon
- A. Origin of the Moon
- B. The structure of the Moon

C. The Apollo Findings

VI. The Planets
A. Interior Structure
B. Surface Features
C. Atmospheres
D. Satellites and Rings

VII. Minor Bodies of the Solar System
A. Comets
B. Asteroids
C. Meteoroids

VIII. Life in the Universe
A. Origin of Life
B. The Search for Extraterrestrial Life