

Department of Physics

Self-Study Report

February 12, 2003

Department of Physics

Program Review Committee

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Section 1. Statement of Purpose

The purposes of the Physics Department are:

- to provide students intending to pursue majors in Physics, Engineering, and related disciplines with foundation skills in introductory Calculus-based Physics which will prepare them for transfer and success in a baccalaureate degree granting institution.
- to provide students intending to major in Architecture, Biology, Pharmacy, the allied health sciences, as well as other disciplines with foundations skills in introductory, Algebra based physics which will prepare them for transfer and success in a baccalaureate degree granting institution or other professional program.
- to provide students skill development courses which will prepare them to pursue the introductory Physics Sequences.
- to provide students enrolled in vocational and technical degree programs with foundations skills in Physics which will prepare them to complete their programs and enter the work force.
- to provide students with general education courses in Physics which will assist them in thinking critically and to apply basic knowledge of Physics to their lives.

Section 2. Vision Summary

Physics teaching has been and will be affected more by two systematic factors in the near future: the increasing use of technology in the classroom and educational reform. Physics programs across the country have been leading research efforts into active learning in the classroom. Many physics instructors at Austin Community College have received training in active learning techniques and a number have implemented these techniques into their teaching curriculum.

It is likely that the use of active learning will increase over the next five years. The continuing strong research efforts in reform carried out by physics instructors nationwide (and worldwide) will be one factor in this increase since it will therefore be a sizeable portion of the faculty development our faculty receive. Another factor may be the impression among the faculty that our students are not doing as well as they used to do. Research done by reformists suggests that passive listening in the classroom does not constitute learning in physics and does not effectively aid the learning process either. The reform movement in physics thus attempts to move more of the actual learning into the classroom.

One of the early findings of instructors who have implemented these techniques at Austin Community College is that the traditional classroom full of individual desks is not in any way conducive to active learning. In order to use active learning techniques

effectively we have found that students must be seated in groups of 3 or 4 students around a table. Our anecdotal evidence on this point is consistent with the educational research. We see pressure on our program to transform our classrooms into active-learning friendly environments. The full fruition of this transformation will include a web-connected computer at each of these tables.

Technology is the second systematic factor we see affecting our program. The classroom of the next five years will be defined and centered around an effective multimedia presentation system. Our classrooms must be transformed so that diverse sources of information can be displayed quickly and easily. These sources include information written or portrayed on paper, compact-disc, DVD, the world-wide-web, personal computers, and transparencies.

It is of great importance that these sources of information can be displayed in a time-efficient manner and not conflict with chalk board space. The increased use of active learning will put extra pressure to implement these changes since in many cases it presupposes computers in the classroom. Moreover, active learning takes more time on individual topics, thereby increasing the pressure to time-effectively lecture on topics that are not a part of the active learning portion of the curriculum.

The current situation at Austin Community College is far from this goal. Most classrooms can only display transparencies and VHS tapes. In most of these cases, the use of these media directly affect chalk board space. For example, most of our projection screens cover the center (or some part) of the chalk board, and many of the televisions are connected on the wall directly at one end of a chalk board which make that part of the board unusable by the instructor, and finally, some of our chalk boards are old and damaged and need replacement.

Section 3. Strengths, Weaknesses, Opportunities, and Threats

3.1 Strengths

Faculty

- The program has a highly trained faculty that is committed to teaching.
- Subject matter is taught for retention of knowledge and skills.
- The small class size and the willingness of the faculty to give personal help offers students an excellent chance to learn.
- The faculty work well and learn better teaching from one another.

Laboratory

- The lecture and lab are integrated well and offer a synergistic learning experience to students.
- Good lab facilities, especially at the RioGrande campus.
- Technology is integrated into the labs and is kept up to date.

- Good quality lab assistants.

Service to Students

- Open door to community. Physics is offered at three different locations.
- Easy transferability of classes to 4-year Universities.
- Diversity of Physics classes offered.
- Tutoring and remedial help available to students.

Faculty Development

- The faculty actively participate in meaningful faculty development.
- The faculty give major consideration to the results of physics education research.

3.2 Weaknesses

Administrative Issues

- Hiring of faculty is handled too slowly – excellent prospective faculty are lost because of late decisions.
- Administration above the dean level is not responsive to faculty requests.
- Excess of busywork is placed on faculty.
- Reorganizations are too frequent and not fully thought out.
- Administration does not give enough consideration to the needs of lab courses.

Facilities – Lecture, Lab, and Office

- Insufficient lab space at the Northridge and Riverside campuses. Northridge shares lab space with Geology. The lab and especially prep room at Riverside are too small.
- Inconsistent lab equipment at different campuses.
- Insufficient number of classrooms - causes scheduling problems.
- Lack of group-work facilities in classrooms.
- Insufficient office space for faculty.

Facilities – Media Support

- Lack of multimedia presentation system in classrooms.
- Poor media equipment.
- Not enough computers in labs.
- No internet in some classrooms.

Student Issues

- Students lead busy lives and are unable or unwilling to do work outside of class.
- Many students are poorly prepared to succeed in a physics class, especially in their math backgrounds.
- Administration does not control prerequisite compliance.

Pay Issues

- Low pay scale.
- Less pay for lab sections.

Class Schedules

- Too few sections offered resulting in large number of students turned away.

Counseling Issues

- Poor advising, e.g. students told to take classes without prerequisites, students told to take the wrong sequence.

3.3 Opportunities

Funding

- Increase tax base.
- Pursue grants and other outside funding

Facilities

- Create dedicated lab space at Northridge campus.
- Increase lab space at Riverside campus.
- Expand media facilities.
- Replace damaged chalk boards. Increase the number of white boards.
- Create new physics lab at Cypress campus.

- Other Outside Opportunities
- Maintain and improve relations with high-tech businesses.
- Continue student opportunities with NASA

Student Issues

- Improve student advising and Math assessment.
- Mentor students.
- Provide Web help for students.
- Facilitate study groups.

Transfers

- Improve communication and feedback from the University of Texas and other Universities.

Faculty Issues

- Decrease time spent on administrative issues.
- Increase time spent on teaching-related issues.
- Improve faculty recognition.
- Follow up on faculty recommendations for hiring new faculty on a timely basis so that great prospective faculty members and leaders are not lost.

Expand Curriculum

- Offer General Physics II at the Riverside campus.
- Continue to expand the appeal and enrollment of Conceptual Physics.

3.4 Threats

Budget Issues

- More budget cuts.
- Tax base remains too small.

Changing Requirements

- Any negative change in enrollment policies for U.T. students taking classes at ACC.
- ABET dropped physics from explicit mention in its Engineering school requirements.
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Student Issues

- Low public scientific literacy.
- Lack of student interest in learning physics.
- Low enrollment of high school students in physics classes.
- Poorly prepared students.

Administrative Issues

- More section cutting.
- More administrative rules and paperwork.

Public Confidence

- Poor public relations resulting in loss of confidence by public in ACC.

Section 4. Summary Analysis of Core Indicators of Effectiveness

4.1 Need for the Program

There is a great demand for physics classes at ACC in large part because of the high tech community that the college serves. This demand is especially high in the summer when many UT students sign up for physics classes at ACC. By studying the data from the past five years, there is even an indication that more physics courses need to be added, especially in the summer.

4.1a Community Need

As shown below there is a substantial demand for physics classes at ACC, with more than 2000 students enrolling in a physics class in FY2002.

Central Texas is very much a high-tech community, and physics is the core science which underlies the information-age explosion, nano-technology, engineering, materials research, and even biotechnology. Our students, many seeking to contribute in these areas, must have a solid background in physics to be leaders in these areas. Since Austin is surrounded by anchor-universities such as the University of Texas and Texas A&M and others, it is a great source of potential for those seeking to work in technologically related fields. Our college, and our program, offers students an opportunity to educate themselves in this most fundamental of sciences and the chance to succeed in these challenging areas. Perhaps most importantly, it offers students who have no other opportunities a place to learn and advance themselves.

4.1b Enrollment Trends

Enrollment held steady from FY1997 through part of FY1999, and appears to have declined moderately into FY2001, only to rise quickly in FY2002 to higher than FY1997 levels.

In the Spring of 2000, a change was made in the section counts that affects the FY2000 and FY2001 data provided by OIE. Since the change occurred in the middle of FY2000, this year must be handled in parts in order to analyze. An annotation on the FY2001 data indicates that the numbers reported are not complete for this year. Finally FY2002 data is preliminary as of this writing. The 5-year enrollment trends need to be analyzed with these facts in mind.

The change which occurred in Spring 2000 was to start counting Lecture/Lab classes as one section instead of as two sections. This caused the number of sections to drop from 178 in FY1999 to 94 in FY2001. In the Fall of 1999, 60 of 65 sections offered were, in effect, double counted as compared to the newly established system. Thus about 92% of the enrollment was “double counted”. The FY1997 enrollment of 3,578 students would thus be about $0.08 \times 3,578 + (\frac{1}{2} \times .92 \times 3,578) = 1932$ students. This compares reasonably with the incomplete FY2001 data of 1774 students. (The formula can be simplified to $0.54 \times$ enrollment.)

FY2000 data is estimated as follows. The fall semester had 65 sections. With an average enrollment of 19.5 students per section the number counted in the fall would be 1268 students, which should have been counted as $0.54 \times 1268 = 689$ students, an over count of 579 students. Thus FY2000 enrollment is adjusted to $2437 - 579 = 1858$ students. FY2001 is the first fiscal year to be counted completely in the new system and is thus un-revised. This numbers are shown in tabular form below.

For the same reasons outlined above, the number of sections must be adjusted to correct for changes in the way lectures and labs are counted. Using the approximate ratio that 92% of the sections are lecture/lab combinations we can adjust the section counts provided by OIE. This is done in the table below using the formula $(0.08 + \frac{1}{2} \times 0.92) \times$ #sections for 1997-1999. For FY2000 there were 60 sections of lecture/lab combinations

which converts to 30 sections in the new system, plus 5 other sections, for a total of 35 sections. The adjusted count is therefore $(125-65) + 35 = 95$ sections. FY2001 is the first year fully under the new system of counting and is thus un-revised.

Table 4.1a. OIE data adjusted to reflect the FY2000 change in the way the number of sections and the size of the student enrollment were counted. FY2001 and FY2002 fall entirely under the new system and are thus unadjusted data. FY2002 data is preliminary.

Data	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002
Adjusted #Sections	105	99	96	95	94	103
Adjusted Enrollment	1932	1944	1893	1858	1774	2195
Contact Hours	171,744	174,464	169,808	177,744	167,600	208,464

According to the adjusted figures, the number of sections went down by 10% while enrollment went down by 8% over this period. It should be noted that the number of sections offered was reduced in accordance with ACC directives to Task Forces, not market forces, to reduce costs by reducing section counts. The close correlation in the percentage drop in sections and enrollment may imply that some demand for classes was unmet due to reduced section offerings.

This statement appears to be justified by the preliminary FY2002 data included which shows that enrollment increased significantly by 421 students, or almost a 24% increase.

The increase in enrollment is only partly due to Summer 2002 which enrolled 231 more students than Summer 2001. The Summer 2002 increase in sections and enrollment in the Summer 2002 can be traced directly to the Dean of Math and Science requests for us to increase section count. There is very likely still unmet summer demand and this will be dealt with in other parts of the report.

In summary, enrollment was flat from FY1997 through FY1999, then declined moderately in FY2000 and FY2001, but now appears to be stabilized at FY1997 levels and can be raised significantly when section counts are allowed to rise as shown by the FY2002 preliminary data.

4.1c Outcomes

Very few students, as a percent of the student population, seek physics degrees at 2-year and 4-year institutions. Instead, most students taking physics are required to take physics as a part of another major program, e.g. Engineering, Computer Science, Allied-Health majors, etc. In addition, most students attending ACC do not intend to, nor do, graduate from ACC. The graduation numbers are in line with these facts. From July 1,

2000 to June 30, 2001, 3 students graduated with physics degrees from ACC. From July 1, 1999 to June 30, 2000, 1 student graduated with under physics.

4.1d Competition from other Institutions

Students in central Texas have many options for higher education. The primary competition in the Austin area is the University of Texas. However, since many students attending ACC want to transfer to U.T., the net effect of having U.T. in our area is most likely an increased enrollment at ACC.

4.2 Cost

The cost of running physics classes at ACC is moderately higher than for non-lab programs. One reason is because of the extra cost of running the lab component for each course; another reason is that physics courses have smaller class size than other classes offered at the college. On the other hand, the cost of running each physics class is slightly less than the cost of other science lab classes such as biology and chemistry.

4.2a Budget Analysis

The program budgets for the prior two fiscal years is shown in Table 4.2a below. The non-faculty budget for FY 2001 was 213,833 and increased in only one category, Classified Salaries, in FY 2002 resulting in a non-faculty budget of \$221,084 for that year, and a budget of \$693,719 for faculty.

Table 4.2a. Physics Budget Comparison FY 2001/2002.

Description	FY 2001 Budget	FY 2002 Budget
F-T Faculty Salaries	409,085	436,285
Adjunct Faculty Salaries	162,147	197,147
Faculty Overloads	0	35,000
Classified Salaries	110,242	117,493
Hourly Salaries	56,968	56,968
Employee Benefits Pool	24,369	25,287
Supplies Pool	14,876	14,876
Operating Costs Pool	280	280
Duplication	6,000	6,000
Telephone	2,304	2,304
Non-Capitalized < 500 Pool	23,163	23,163
Account Totals	809,434	914,803

Faculty salaries accounted for the majority of the increased budget. Part of the increase is due to pay-raises for faculty with the greater part of the increase being increased use of faculty due to increases in enrollment and contact hours in FY 2002.

4.2b Comparative Program Costs

To compare costs between programs it is desirable to look at faculty and non-faculty program costs as a function of contact hours. These comparisons are best made among lab-science courses exclusively in the first analysis, answering the question: How does the cost of our program compare to similar science programs? For example, physics classes with a lab-controlled enrollment of 24 students will not compare favorably to English classes with an enrollment of 36 students on a faculty cost per contact-hour basis.

Referring to Table 4.1a, the number of contact hours for physics in FY 2002 was 208,464. The faculty cost is $\$693,719 / (208,464) = \3.33 per contact-hour. The non-faculty cost is per $\$221,084 / 208,464 = \1.06 per contact-hour.

The closest science to compare physics to is probably chemistry. The FY 2002 budget numbers for chemistry are: Faculty expenses \$942,967, non-faculty expenses \$309,438, and contact hours were 218,720. The faculty cost is \$4.31 per contact hour while the non-faculty cost is \$1.41 per contact-hour.

The cost of the physics faculty on a contact-hour basis is surprising, and indicates either a higher average salary or, more likely, a smaller number of students per section. The non-faculty cost of chemistry of \$1.41/hour compared to physics of \$1.06/hour is probably indicative of the time and material expense of preparing laboratories in which materials such as acids, bases, salts, etc. will be consumed by students carrying out the experiments. On the other hand, the non-faculty costs of the physics labs is due largely to the initial expense and cost of repair and replacement of the laboratory equipment and computers.

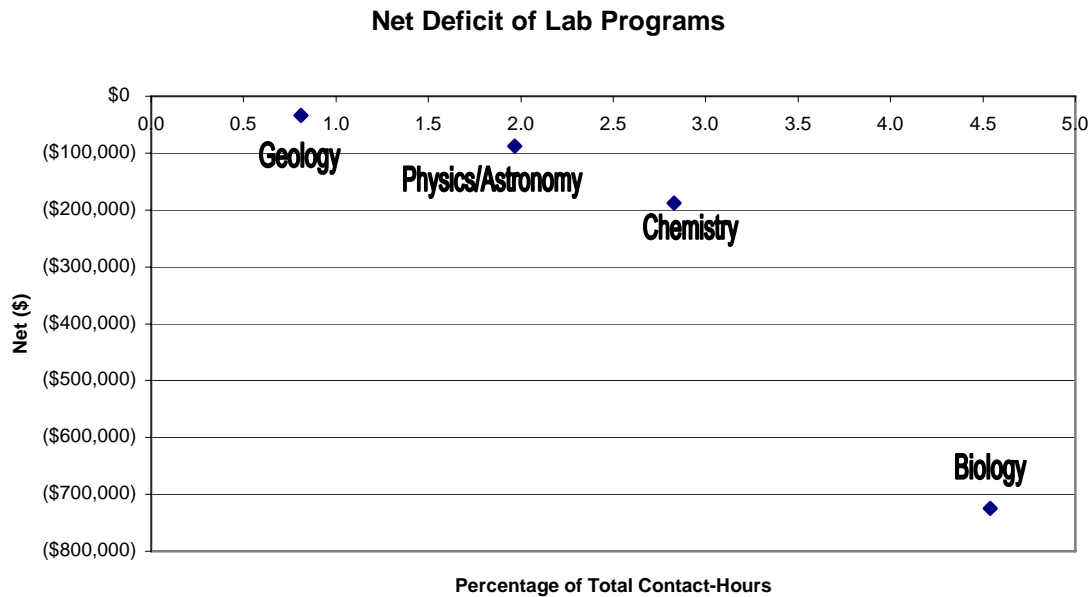
In Table 4.2b, the cost comparison is extended to include Biology. As can be seen the Physics program budget is lower than either Chemistry or Biology in both categories of expense, faculty and non-faculty. This comparison suggests that physics faculty are being used cost effectively and that the non-faculty costs are reasonable and in line with other laboratory programs.

Table 4.2b. Budgeted cost per contact-hour for FY 2002: Comparative Costs for Chemistry, Biology, and Physics Lecture/Lab Programs.

Program	Non-Faculty Cost	Faculty Cost
Chemistry	\$1.41	\$4.31
Biology	\$1.15	\$3.43
Physics	\$1.06	\$3.33

The program cost data as it is presented to academic departments is unreliable. Furthermore it is likely biased strongly against lab programs, particularly larger lab programs. As can be seen in Fig. 4.2c there is a general trend toward greater deficits as the programs grow in size. This trend is more pronounced as the size of the program grows. Yet, our analysis shows that these programs do not greatly differ from one another in terms of expenditures per contact-hour. The cost-analysis data appears to be biased against the size of the lab program.

Figure 4.2c. Net Deficit of large lab programs plotted versus the size of the program as measured by contact hours.



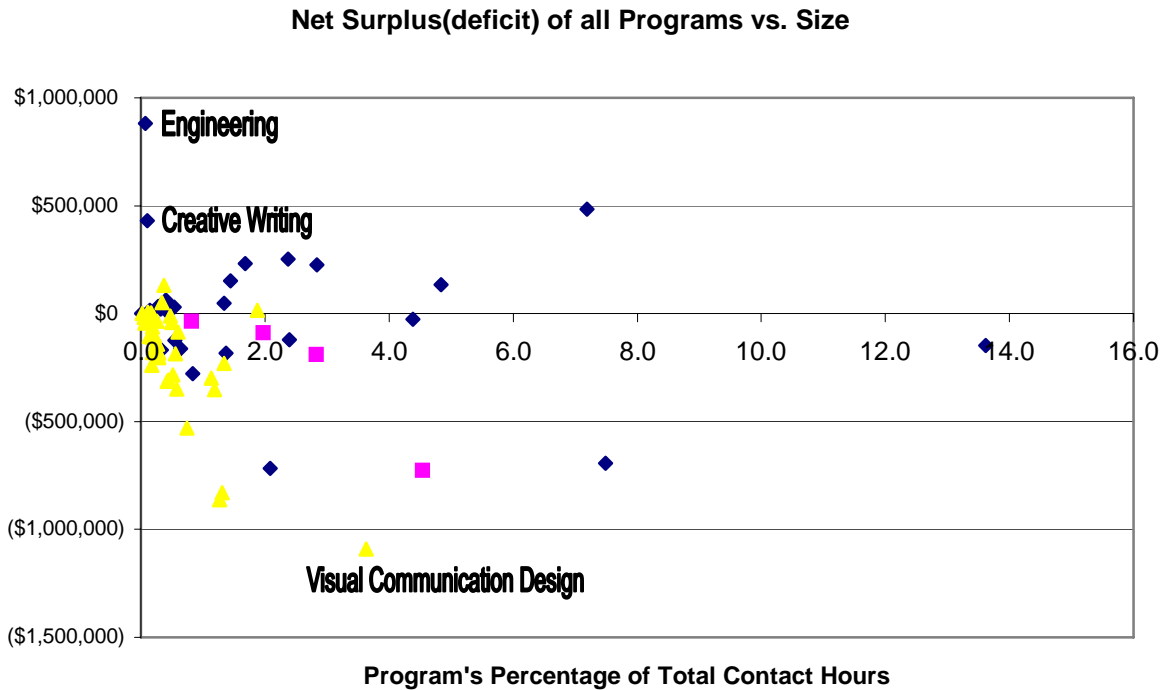
Much more distressing data is found when an attempt is made to visualize the program-size effect in a graph of all programs. As can be seen in Fig. 4.2d, there is no sense or logic to surpluses or deficits as plotted versus program size. This may be true for most programs. However, it is impossible to know since the data is clearly impossible. A few example programs are highlighted on the graph. Engineering, with 0.068% of total contact-hours, has a surplus of \$881,000. Creative writing, with 0.105% of contact-hours has a surplus of \$431,000.

Other programs have stunning net losses. Visual Communication Design lost a net of over \$1,000,000. Is this a real or virtual loss? Many other examples of large losses, some with small enrollment abound. It is not possible to analyze the data until very large discrepancies are corrected.

In summary, there appears to be an unfair bias in the way lab program costs are accounted for by the college and the data provided to the programs is inaccurate. A fair and balanced view of the programs relative to one another is therefore not possible nor advisable until better data and cost accounting schemes are devised by the administration.

A sample accounting of total costs of running a lab class is given in Appendix 3. Until better ways of analyzing total costs are found this analysis could be used to determine the effect of adding (or cutting) sections on the college budget.

Figure 4.2d. Net surplus or deficit of all programs plotted versus the size of the program measured as a percentage of total contact hours.



4.3 Program Effectiveness: Student Achievement

ACC classes have the second to highest withdrawal rates in the school. This may be due to physics classes requiring skill levels in math, reading and writing that many students may be deficient in. There are also other barriers to students which may contribute to the high withdrawal rate as will be discussed in section 4.62.

4.3a Course Completion Rates

Physics classes, being a blend of mathematics and real-world situations, have relatively high rates of non-transfer grades and withdrawals. A 1998 OIE report, “Analysis of Non-Transfer Grade and Withdrawal Rates”, prepared by Vicki Reid, notes that Physics had the second highest withdrawal rate in the college, a rate of 37.4%. Other high withdrawal rate classes were Chemistry 38.0% (1st), Biology 31.3% (3rd), Math 29.3% (4th), and English 25.9% (5th).

The top five departments in withdrawal rates can be classified into four Core-Skill areas: Reading, Writing, Math, and Science. The top three departments resulting in withdrawals Physics, Biology, and Chemistry require students to combine all four Core-Skill areas into one class, thereby being somewhat more difficult than departments requiring less emphasis on Core-Skills, i.e. Math tends to use less reading and writing skills than Physics, Biology, and Chemistry whereas English students need little or no skills in Math and Science, resulting in a somewhat lower withdrawal rate.

Based on the Core-Skills analysis, it is no surprise to see Chemistry, Physics, and Biology at the top of Withdrawal Rate and Non-Transfer Grade Rate lists. Lower completion rates for these courses are due to significant need of mastery level knowledge in four Core-Skill areas. Further evidence that this is the case comes from comparing Biology withdrawal rates to Chemistry and Physics withdrawal rates. Biology requires with less mathematics makes it closer to a 3-Core-Skill Department, while Chemistry and Physics with much greater need for mathematics make these departments closer to four Core-Skill Departments.

The intrinsic relative difficulty of physics classes increases the need for regular attendance. Our students have multiple demands on their time and miss classes for a variety of reasons. Students who miss multiple classes are often unable to master the missed material. In physics, mastery of prior material is necessary to successfully continue in the class.

In conclusion, course completion rates for physics classes are significantly affected by their heavy use of Core-Skills areas. The higher number of withdrawals within the Physics Department as compared to ACC as a whole is best understood in terms of deficiencies in one or more of the Core-Skill areas. In classes requiring more Core-Skill areas there will be a greater percentage of students who have a deficiency in one or more skills than there will be for classes requiring less Core-Skill areas.

4.3b Program Completion and Student Transfer Rates

For the years 1999-2000 Physics/Astronomy had 67 students listed as majors in this category. Of these 67 students none received degrees in this area. The transfer rate for this time period was 39% with 26 students transferring to another institution in the Fall of 2000. Of the transfer students, 27% (18 students) were enrolled at the University of Texas at Austin, and 12% (8 students) enrolled at other Texas institutions. These 8 students were spread broadly: 2 at UT San Antonio, with the remaining 6 all attending different institutions. Surprisingly only 1 student was enrolled at Texas A&M.

This data is obviously a sub-set of the general student population. Since few students actually receive degrees in physics or astronomy (none did for the time period analyzed) at ACC or from four-year institutions, the sub-set in question is probably fairly representative of the entire population of students of taking physics and astronomy

classes at ACC. The 39% percent transferring to other Texas Public Institutions is an indicator that a sizeable percentage of students taking physics classes are performing well and succeeding in their academic studies for the time period in question. It will be very helpful to find data for long term success of all our students at other institutions and to track students at all other institutions transferred to (not just Texas Public Institutions covered in this data) and to track all students (not just the ones who listed physics or astronomy as a major). However, this data is not available at the time.

4.4 Program Effectiveness: Student Retention

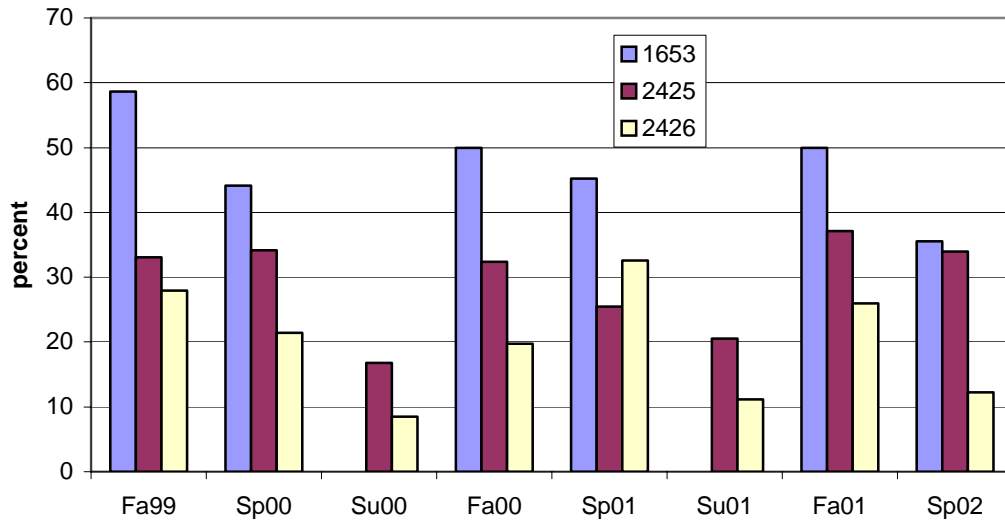
Withdrawal rates vary significantly depending on several factors, including, semester, type of class, and whether the course was an introductory course. As noted and explained in section 4.3, withdrawal rates for physics classes are above the college norm. The college average for withdrawals as of the 1998 OIE report cited above was 20.5%.

The withdrawal rates for the Engineering Physics Sequence by semester are shown in the Figure below. The average rate of withdrawal for PHYS 1653 is the highest at 47%. As the sequence progresses the average withdrawal rates decrease significantly, 29% for PHYS 2425 and 20% for PHYS 2426.

These data highlight the importance of ensuring that students have the proper background before taking the Engineering Physics classes. Deficiencies in a student's background are often found out in the PHYS 1653 class. Students who have withdrawn may wait and repeat courses as they gain mathematical skills in other classes. As students progress through the sequence the withdrawal rates decrease significantly even though the difficulty of the courses increases through the sequence.

Figure 4.4a. Withdrawal rates for the Engineering Physics Sequence.

Withdrawals: Engineering Physics Sequence

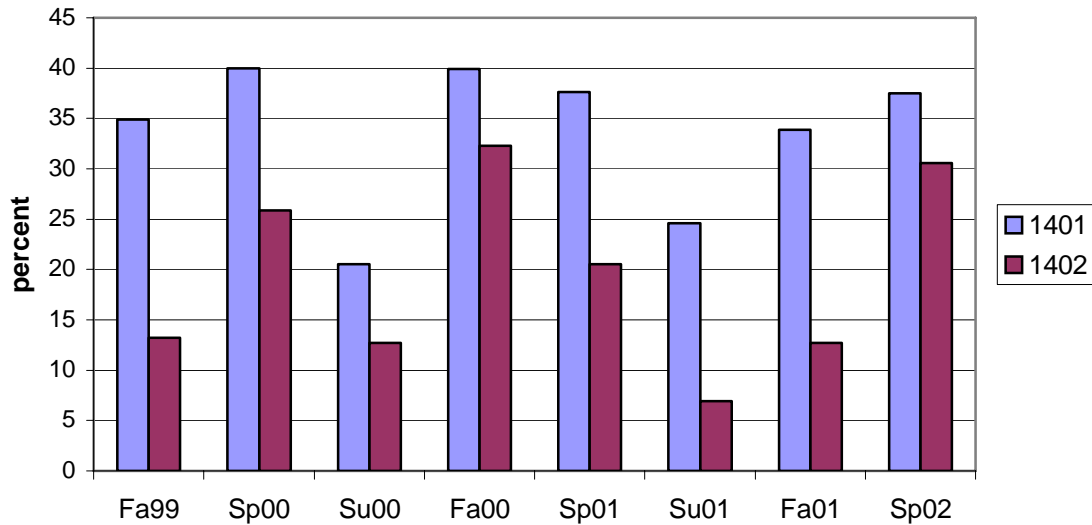


Withdrawal rates for the General College Physics sequence are shown in Figure 4.4b. The average withdrawal rate for the Physics 1401 introductory class is 34%, significantly higher than for the follow-up course, Physics 1402, which had an average withdrawal rate of 19%.

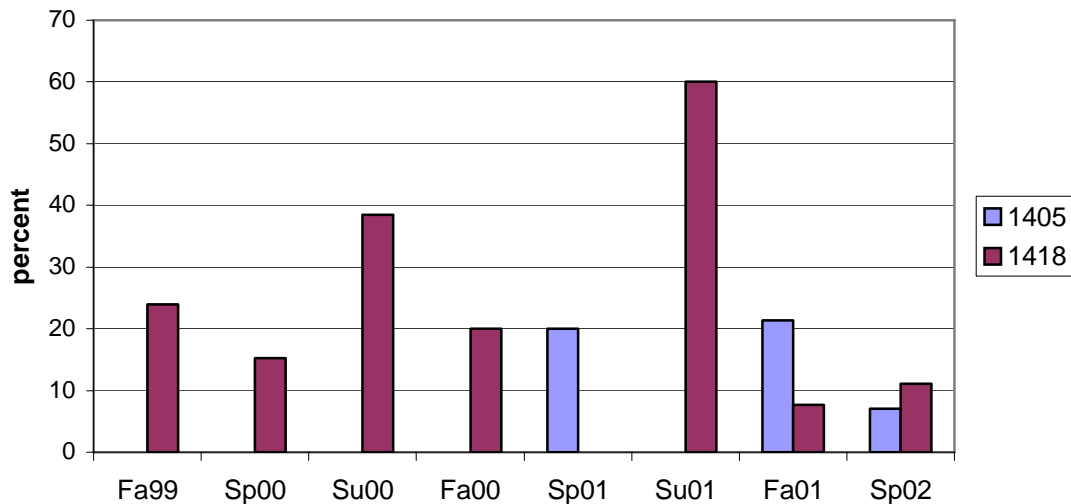
It is interesting to note that the withdrawal rates for PHYS 2426 and PHYS 1402, the last course in each sequence, are below the college-wide average of 20.5%.

Figure 4.4b. Withdrawal rates for the General Physics sequence.

W-Grades PHYS 1401/1402



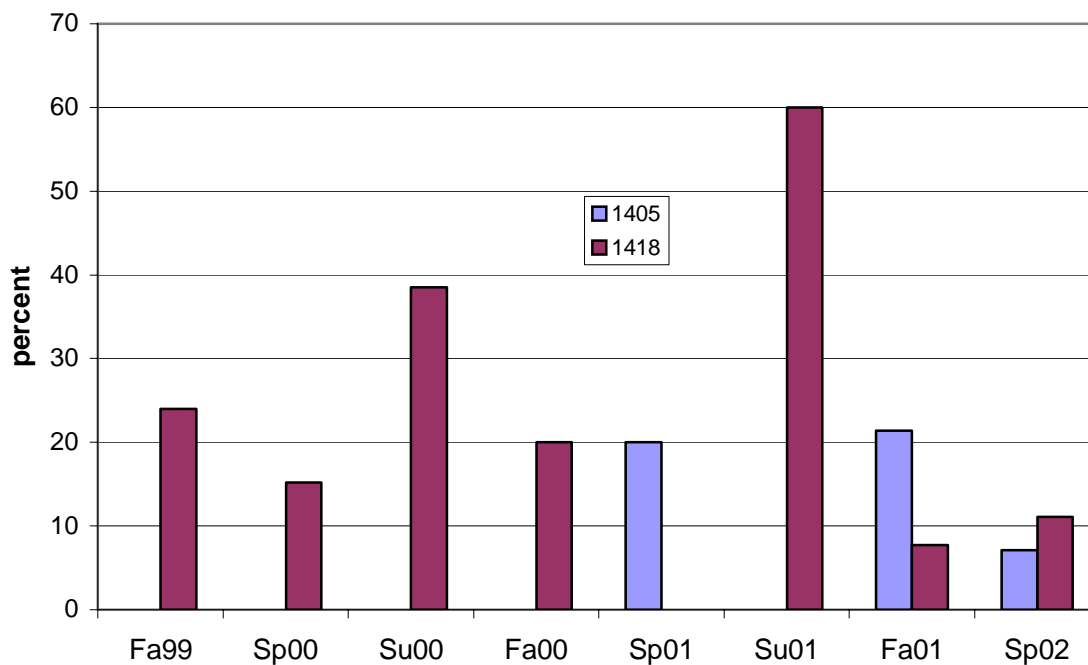
W-Grades PHYS 1405 and SCIT 1418



Withdrawal rates for the two specialized courses PHYS 1405, Conceptual Physics and SCIT 1418, Applied Physics, are shown in Fig. 4.4c. SCIT 1418 is a non-academic course serving the workforce semiconductor manufacturing program and students who take this class have little background in math. The data for SCIT 1418 stand out for each summer semester shown. In each of these semesters the enrollment was in one small class. For example, the Summer 2001 semester had an enrollment of 5 with 3 withdrawals. It is not surprising that these students encountered more difficulty with this class since it is condensed into the shorter summer semesters.

PHYS 1405 is a new offering at ACC and is geared for the non-mathematically inclined student seeking to satisfy a laboratory science credit. The class is conceptually based and requires almost no math. The average withdrawal rate for the three semesters available is 16%, significantly less than the college average, pointing out very effectively the effect of Core-Skill requirements have on withdrawal rates.

Figure 4.4c. Withdrawals for PHYS 1405 and SCIT 1418.



4.5 Program Effectiveness: Student Outcomes

For 1999-2000 there were data available for 67 former students who listed Physics or Astronomy as their major. For this dual Physics/Astronomy class of declared majors 38.8% were receiving additional higher education, 56.7% were receiving no further higher education and were employed, with 4.5% not found. The closest discipline to compare these rates to is Chemistry which had 59.2% receiving additional higher education, 33.3% were receiving no further education and were employed, with 7.4% not found, for the same time period. The pool of declared chemistry major students was 135 versus 67 declared majors for physics/astronomy students.

Since the physics faculty are typically aware of only 1 to 2 serious physics majors within an academic year the dual Physics/Astronomy data of declared majors is likely a very ambiguously formed group. It is supposed that many of the 67 declared “physics/astronomy” majors listed astronomy as their major. If this is true the data are completely meaningless to an analysis of declared physics majors at ACC.

A much more representative data set would include all students taking physics classes which would be a group of about 2000 students (1893 in FY1999 and 2195 in FY2002), breaking these groups up into the various sequences, e.g. Engineering Physics, General Physics, etc. Grouping the students this way would exclude declared Astronomy majors from the data who have never taken a Physics class.

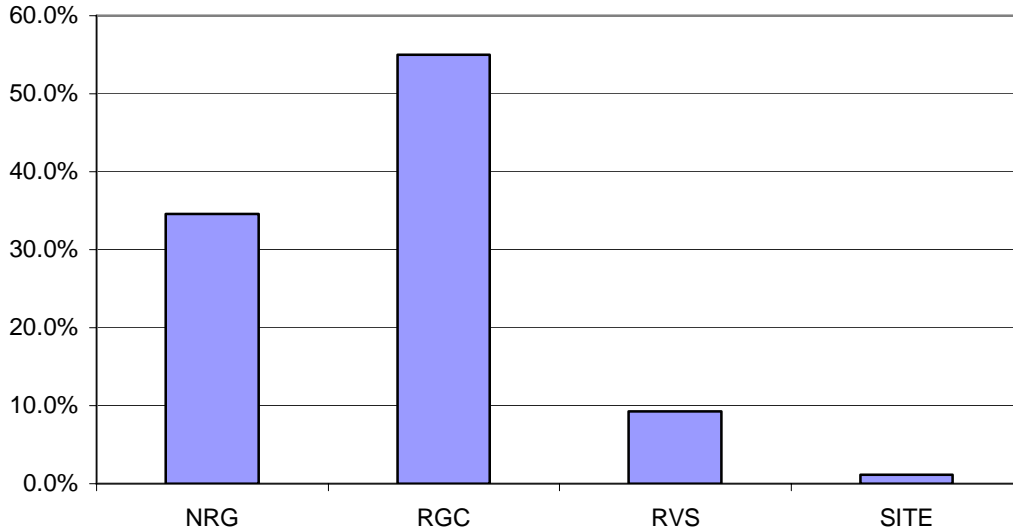
Only two program graduates responded to the 2000/2001 Graduate Follow-Up Survey. No data on the grade point average of majors, graduates, and other transfers who took physics classes were available to the Physics Program Review Committee. Hopefully this data will be available in the near future as it would be very helpful in assessment of the Physics program. The general data for the college indicate that ACC transfer students to 4-year programs perform equally to transfers from all other sources.

4.6 Program Effectiveness: Access

4.6a Course Availability

Physics classes are mainly offered at three Austin Campuses, Northridge, Rio Grande, and Riverside. Approximately two classes are offered at Wimberly H.S. each year and account for only about 0.5% of the total enrollment. The section count by campus is shown in Fig. 4.6a below.

Figure 4-6a. Section Analysis from Fall 1999 to Spring 2002 by campus.



Historically physics was only offered at the Rio Grande campus which still accounts for over half the sections offered. In the fall of 1994 Physics was first offered at the Northridge campus. Northridge now carries about 35% of the section load. Beginning in the summer of 1997 Physics was first offered at the Riverside campus. Riverside now accounts for about 10% of the sections offered. As can be seen in Table 4.6a campus enrollment, credit hours, and contact hours closely follow the section offerings at these campuses due to similar enrollments per section at each campus.

Table 4.6a: An analysis of sections, enrollment, average enrollment per section, credit hours, and contact hours by site. Data is from Fall 1999 to Spring 2002.

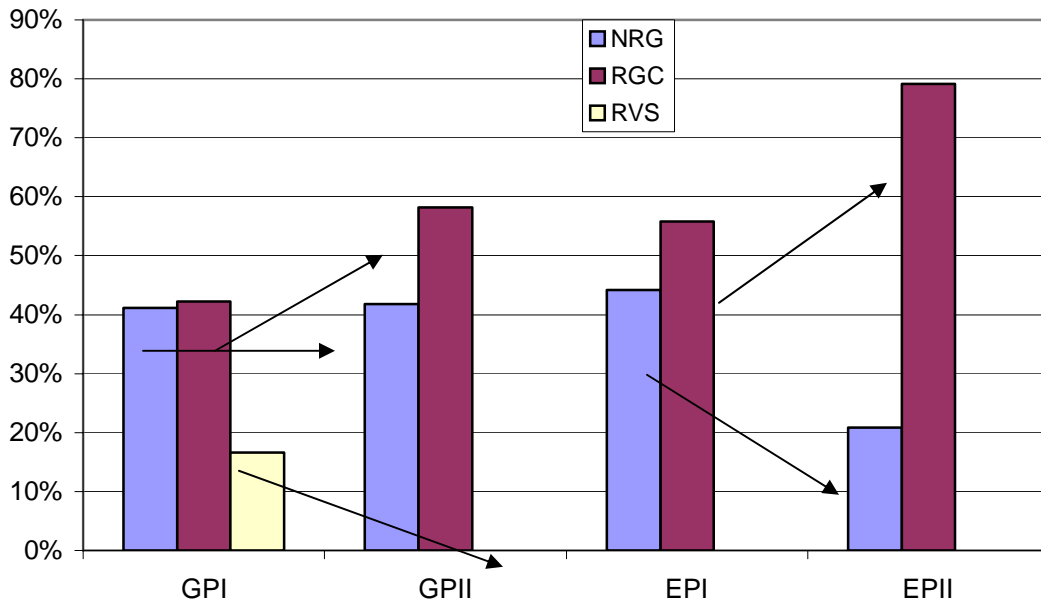
	NRG	RGC	RVS	SITE	Totals
sections	34.6%	55.0%	9.2%	1.2%	100.0%
enrollment	35.3%	56.1%	8.2%	0.5%	100.0%
enroll/sect	19.8	19.8	17.2	8	
credit hours	35.3%	56.0%	8.3%	0.5%	100.0%
contact hours	34.9%	55.8%	8.8%	0.5%	100.0%

Enrollment in physics classes by campus for Fall 2001 and Spring 2002 are shown in Fig. 4.6b and Fig. 4.6c below. When course offerings are analyzed by campus two prominent features appear. First, that Riverside does not offer classes in General Physics II, Engineering Physics I, or Engineering Physics II. These classes may be introduced in the future if demand for them increases and if we have resources available to expand our lab facilities and lab equipment. Looking at the enrollment charts for Fall 2001 and Spring 2002 a second feature is evident in the physics II classes at the

Northridge campus. Enrollment in Engineering Physics II (EPII) in the Fall 2001 semester was 7% at Northridge and 93% at Rio Grande. The situation was somewhat better in the Spring 2002 semester, where enrollment in EPII at Northridge accounted for 21% of the total EPII enrollment. The enrollment charts also reflect a significant drop in percent of enrollment from the EPI to EPII in both the Fall and Spring semesters but is most prominent in the Fall data.

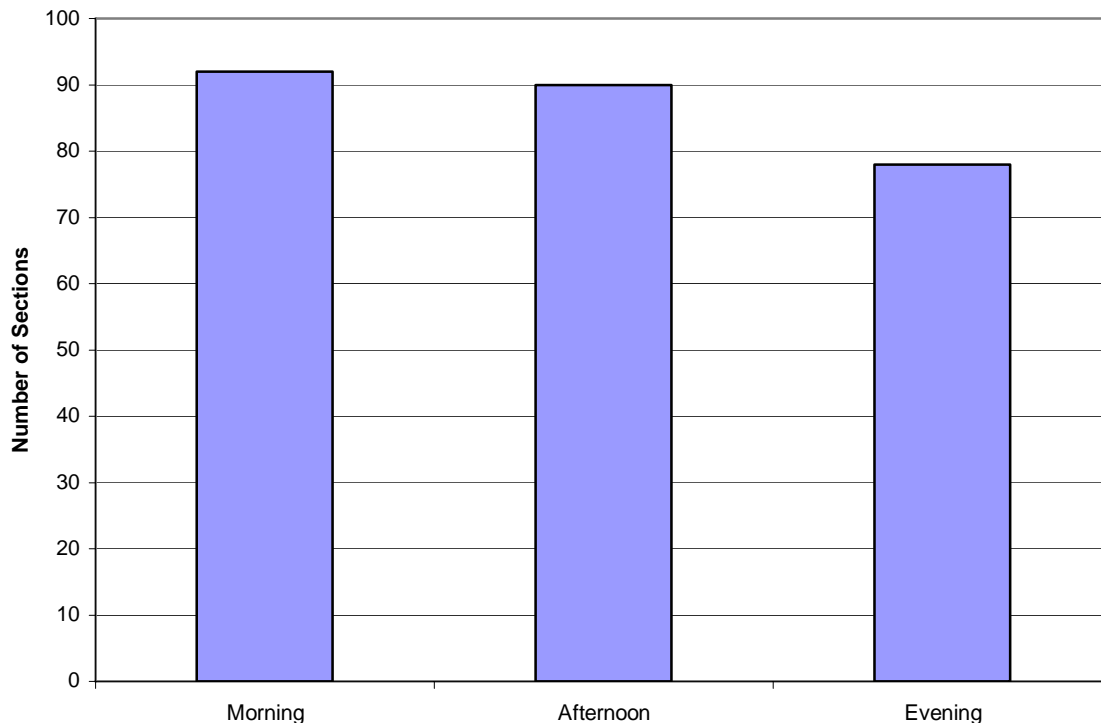
A similar drop in enrollment occurred at Northridge from General Physics I (GPI) to General Physics II (GPII). The most significant drop is again observed in the Fall 2001 semester. Since physics is well-established at the NRG campus it seems unlikely that these drops in physics II enrollments are due to lack of demand. Instead, it is more likely based on when and how many courses are offered at NRG where the Physics lab is shared with the Geology and other disciplines.

Figure 4.6c. Spring 2002 Course Enrollment by Campus



As can be seen from Fig. 4.6d below, the number of Physics classes offered are nearly the same in the morning, afternoon and evening. From the Fall 1999 to the Spring 2002 evening classes were offered at rates of greater than 85% of either morning or afternoon sessions. Physics classes are offered at all times of day, making Physics accessible to all of our students. Further, in looking over the data provided from OIE, all of our courses were distributed in the pattern shown in Fig. 4.6d except for courses which had one section in a term. These courses were mostly offered in the morning or afternoon.

Figure 4.6d. Number of Uncombined Sections of Physics by time of day from Fall 1999 to Spring 2002.



Two main considerations are considered in scheduling classes at ACC . First, that enough prime time classes, classes offered between 9:10 am and 1:25 pm, be offered and that these prime time classes be taught by full-time faculty. These considerations offer convenience to the students and allows the maximum number of students to benefit from the experience of our full-time faculty.

The Spring 2003 schedule of classes for Physics 1401 and 1402 is shown in Table 4.6b. The ratio of classes for NRG to RGC is $\frac{2}{3}$ for both courses in this semester. The number of prime-time starts for NRG is two for both courses. The number of prime-time classes for RGC is six. Based on the $\frac{2}{3}$ ratio NRG should have two classes moved into prime-time slots, i.e. 9:10 am or 1:25 pm. The negative aspects of two 7:45 am start-times is exacerbated by the difficulty in staffing these courses with full-time faculty who in generally prefer to teach prime time classes. When the second full-time faculty member is added at NRG next year, there will not be enough prime time courses available for both full-time faculty members which may be an issue for those faculty with children.

Table 4.6b. Spring 2003 schedule of classes for General Physics I and II.

	1401 Time of Day				1402 Time of Day		
	NRG	RGC	RVS		NRG	RGC	RVS
7:45 AM	2			7:45 AM			
9:10 AM		1		9:10 AM			
10:35 AM		2	1	10:35 AM	1	1	
12:00 PM				12:00 PM			
1:25 PM	2	3	1	1:25 PM		2	
2:50 PM				2:50 PM			
4:15 PM		1		4:15 PM			
5:40 PM	1			5:40 PM			
7:05 PM	1	2		7:05 PM	1		
Totals	6	9	2		2	3	0

Another issue emerges when looking at the spring schedule for Engineering Physics classes. The total number of classes offered at NRG compared to RGC is now 4/9 compared to 2/3 for General Physics classes. The change in ratio occurs because only one PHYS 2426 class is offered in the spring compared to five at RGC. It is likely that there is enough demand at NRG to be able to add one or two sections of PHYS 2426 during prime times. A schedule of these classes is shown in Table 4.6c.

Table 4.6c. Spring 2003 schedule of classes for Engineering Physics I and II.

	2425 Time of Day				2426 Time of Day		
	NRG	RGC	RVS		NRG	RGC	RVS
7:45 AM				7:45 AM			
9:10 AM	1	2		9:10 AM		1	
10:35 AM				10:35 AM			
12:00 PM	1			12:00 PM			
1:25 PM		2		1:25 PM		1	
2:50 PM				2:50 PM			
4:15 PM				4:15 PM		1	
5:40 PM	1			5:40 PM			
7:05 PM				7:05 PM	1	2	
totals	3	4	0		1	5	0

In contrast to the Spring 2003 semester, the Fall 2002 semester appears to have no major scheduling problems for General Physics classes. The RVS campus offers one more section of PHYS 1401 than in the spring. The ratio of classes at NRG to RGC is 8/9, somewhat higher than in the spring, and two prime-time classes are offered at NRG compared to three at RGC.

Table 4.6d. Fall 2002 schedule for General Physics I and II for NRG, RGC, and RVS campuses.

1401 Time of Day				1402 Time of Day			
	NRG	RGC	RVS		NRG	RGC	RVS
7:45 AM				7:45 AM			
9:10 AM		1		9:10 AM			
10:35 AM	1	1	1	10:35 AM	1	1	
12:00 PM	2			12:00 PM			
1:25 PM	2	2	1	1:25 PM			
2:50 PM				2:50 PM			
4:15 PM		1		4:15 PM		1	
5:40 PM				5:40 PM			
7:05 PM	1	2	1	7:05 PM	1		
totals	6	7	3		2	2	0

The Fall 2002 semester for Engineering Physics classes is shown in Table 4.6e. The ratio of classes at NRG to RGC is 4/8. One section of PHYS 2426 is offered at NRG compared to three at RGC. The number of prime-time starts at NRG is two compared to three at RGC.

All things considered, the Fall semester offerings match the general enrollment needs at all the campuses. However, the Spring semester offerings must be considered to be an anomaly which must be addressed.

Table 4.6e. Fall 2002 schedule for Engineering Physics I and II for NRG, RGC, and RVS campuses.

2425 Time of Day				2426 Time of Day			
	NRG	RGC	RVS		NRG	RGC	RVS
7:45 AM				7:45 AM			
9:10 AM	1	2		9:10 AM	1		
10:35 AM				10:35 AM		1	
12:00 PM				12:00 PM			
1:25 PM				1:25 PM		1	
2:50 PM	1	2		2:50 PM			
4:15 PM		1		4:15 PM			
5:40 PM	1			5:40 PM		1	
7:05 PM				7:05 PM			
totals	3	5	0		1	3	0

4.62 Barrier to Students

Students come to ACC Physics with eighteen or more years worth of “everyday” representations and attitudes of what science is and with inadequate or incorrect explanations of physics concepts. This information often comes from an accretion of non-physics sources such as the media, astrologists, companies trying to sell their product

by presenting non-scientific claims, from textbooks with errors, and even from instruction of physics taught by non-physicists as will be discussed below.

In addition, there seems to be an anti-science attitude in our culture. It is not uncommon, for example, to have television personalities treat scientific guests with suspicion and to even ridicule them for their use of scientific language and ideas. On the other hand, artists, athletes, entertainers are treated as if they are royalty. These attitudes are unfortunately present in some K-12 teachers. Even in the cases where teachers are science minded, they are often poorly prepared to answer students' questions and help them excel in science. As a small example, it is not uncommon for students in our classes to tell us that the football coach taught their physics class in High School.

Another big issue are societal attitudes and stereotypes towards women and minorities who are often perceived as not being able to understand physics. Another major problem is peer pressure from other students, especially in junior high and high school. It is often perceived by teens and pre-teens that doing well in school, especially in math and science, makes the individual a "nerd". Students have shared that they were often teased or isolated because they studied hard or were taking "hard" classes like physics.

These societal factors combine their influences in causing fear, disinterest, suspicion, and lack of proper preparation, with each aspect reinforcing the other. These factors are most apparent in our introductory classes, General Physics I and Conceptual Physics I, and result in relatively high withdrawal rates.

The physics program at ACC does not have any barriers beyond the societal barriers described above. In fact, every effort is made to play down the traditional barriers to students. Instructors are encouraged to advise students at the beginning of the semester which they do on their own time. Many instructors review the required math background and offer math screening exams at the beginning of the semester to help students decide if they are in the right class. Unfortunately, we have found that students rarely follow up on the instructors' advice. An important case in point is a new "Math for Physics" class spawned by our department and headed up by Jim Heath. This class was designed for students wanting to take General Physics I but who needed to improve some math skills needed for the class. Many faculty members gave math screening exams and advised students to take this class. The result was enrollment of 1 to 2 students per semester from a pool of over 300 students taking General Physics I.

In summary, the physics program at ACC has committed, caring instructors who are cognizant of the issues facing students. Our instructors act on these issues by advising students and providing specialized attention that would not be available to them at a large university. Some fantastic turn-around success stories do occur. However, our experience indicates that it is difficult to overcome a lifetime of scientific neglect, negative sentiment, and inadequate training that is common in our society.

4.63 Course Demand

a) Number of sections taught by location

The RGC campus carries about 55% of the enrollment in physics classes. The higher enrollment at RGC is likely due to its central Austin location, close to UT. RGC also has twice the lab facilities of Northridge, and was originally the only campus to offer physics. The NRG campus is in north-central Austin and is the second campus to offer physics and has about 35% of total physics enrollment. The third and currently last campus to add physics, RVS, carries about 10% of the physics enrollment. The next campus to start a physics program may be the CYP campus which is currently in a state of initial planning. No other offerings are being planned for at the moment.

b) Number of sections closed/canceled by course

The number of canceled sections by location from Spring 2000 through Spring 2002, a total of seven semesters, were NRG:10-sections, RGC: 20 sections, and RVS: 3. This is an average of 1.4, 2.9, and 0.4 sections per semester for the respective campuses. In the Spring 2002 semester only two sections were cancelled (one PHYS 1402 and one PHYS 1407) and none of the recommended classes were cancelled in Spring 2002. No physics section has been cancelled in a summer session since the Summer of 2000 where five sections were canceled. Two of the sections cancelled in that summer session were not-for-credit tutorial classes. In summary only the Fall semester schedule appears to be near optimal scheduling.

c) High demand course analysis

A list of classes which turned away students in the Spring 2002 semester is shown below. The data is broken down by location and time of day. In order of NRG, RGC, RVS, the number of students turned away were 144, 202, and 53. These numbers indicate that sections could be offered at each of the campuses offering physics.

In terms of number of classes, at 24 per class, this corresponds to about 6, 8, and 2 full classes of students. Due to inefficiencies of scheduling less than this number could reasonably be added. On a 50% efficiency basis, a total of 3, 4, and 1 classes could be added at NRG, RGC, RVS, respectively for this semester.

For the Spring Semester, starting with NRG, two sections of PHYS 1401 should be added to the schedule as well as one section each of PHYS 2425 and PHYS 2426. At RGC, one section of PHYS 1401 and PHYS 2425 should be added as well as two sections of PHYS 2426. Finally, at RVS, one more section of PHYS 1401 should be added.

Table 4.6f. High-demand analysis, number of students turned away in Spring 2002.

NRG	class	time	No. turned away	Course Total	Location Total
	PHYS 1401	7:45 AM	21		
	PHYS 1401	1:25 PM	50		
	PHYS 1401	5:45 PM	19	90	
	PHYS 1402	7:05 PM	10	10	
	PHYS 2425	9:10 AM	2		
	PHYS 2425	12:00 PM	7		
	PHYS 2425	5:40 PM	15	24	
	PHYS 2426	7:05 PM	20	20	144

RGC	class	time	No. turned away	Course Total	Location Total
	PHYS 1401	9:10 AM	7		
	PHYS 1401	10:35 AM	12		
	PHYS 1401	1:25 PM	20		
	PHYS 1401	7:05 PM	7	46	
	PHYS 1402	2:50 PM	9	9	
	PHYS 2425	9:10 AM	7		
	PHYS 2425	1:25 PM	5		
	PHYS 2425	2:50 PM	28	40	
	PHYS 2426	9:10 AM	40		
	PHYS 2426	1:25 PM	21		
	PHYS 2426	7:05 PM	46	107	202

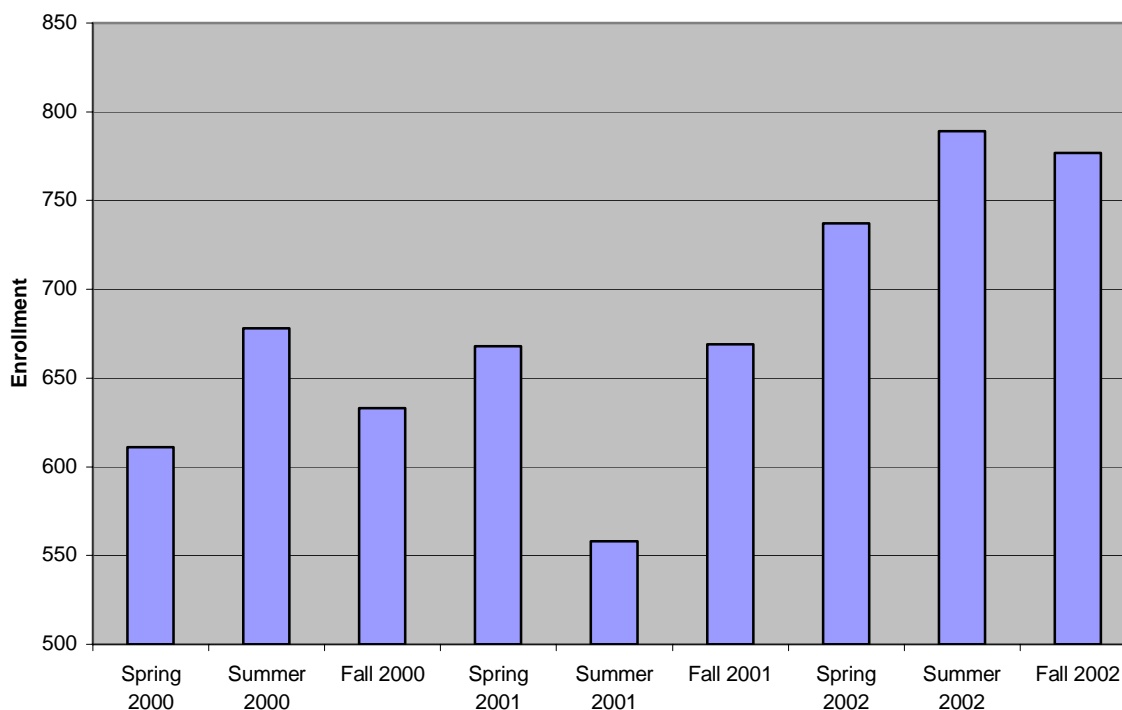
RVS	class	time	No. turned away	Course Total	Location Total
	PHYS 1401	10:35 AM	27		
	PHYS 1401	1:25 PM	26	53	53

A summary of enrollment trends and high demand analysis by semester is shown below for the last nine semesters. A general trend toward sharply higher enrollment can be seen from this data. The positive enrollment trend is very obvious in the bar chart of Fig. 4.6h below. The artificially low enrollment of Summer 2001, created by section cuts, resulted in well over a thousand students to be turned away, of which 889 could not find another physics class and of which 393 did not attend ACC at all. This situation was partially rectified in the Summer of 2002 where enrollment increased by 231 students and 595 were turned away. Unfortunately, without more facilities, it will be difficult to meet the high summer demand for physics classes. In fact, more facilities will be required in order to meet the increasing demand in the Spring and Fall semesters.

Table 4.6g. Number of students turned away by semester.

Semester	Enrolled	Turned away	Did not find other	Not at ACC
Spring 2000	611	153	61	12
Summer 2000	678	320	153	52
Fall 2000	633	155	73	16
Spring 2001	668	151	71	10
Summer 2001	558	1361	889	393
Fall 2001	669	165	88	25
Spring 2002	737	181	101	18
Summer 2002	789	595	316	117
Fall 2002	777	199	118	20

Figure 4.6h. Recent enrollment trends in physics.



4.64 Marketing of program/courses

The conceptual physics course which is just over one year old was successfully marketed by placing advertisements on bulletin boards. The visibility of the other main sequence classes is such that marketing is unnecessary. As mentioned above direct marketing of the off-sequence class Math for Physics by instructors was unsuccessful. A bulletin-board approach could be considered in the future. Finally, considering the low enrollment in Elementary Physics Methods, a line-item advertisement in the course catalog explaining the advantage of this class might be successful.

4.65 Accessibility of course content

The course content and level of Physics classes at ACC is on par with standard college classes offered in the U.S. Of students writing comments, about 10% comment that the amount of material covered in the class is too large. Fewer comment that the material is too difficult.

4.7 Program Effectiveness: Curriculum

4.7a) Course Texts and Content.

All textbooks for physics classes are currently in two or three year revision cycles and are up to date at this time.

4.7b) Learning Outcomes.

The physics department has established a list of core-content topics for PHYS 1401, 1402, 2425, and 2426. These topics lists may be viewed on the departmental web site: http://www2.austincc.edu/physci_tf/PAECurriculum/GuidelinesPAE.html. PHYS 1405 and 1407 are new offerings at ACC and the core-content topics lists are being developed and refined among the several instructors teaching the class. The lists should be published soon. In addition PHYS 1401, 1402, 1405, 1407, 1653, 2425, and 2426 have departmental syllabi published at the same web site. Each syllabus has generalized course objectives listed in it and faculty include these lists in their course syllabus.

4.7c) Catalog Content.

The ACC catalog entries were revised by the department in 2000 and are up to date. No revisions appear to be necessary at this time.

4.7d) Instructional Resources.

Laboratory materials for demonstrations and labs are in general adequate at RGC and NRG. The RVS campus is currently outfitted for General Physics I and will need substantial capital inflows to complete its offerings. The NRG campus still lacks some basic demonstration and laboratory equipment that instructors teaching at RGC are used to having and frequently request, demand, or bring with them to NRG. This situation is slowly being rectified. Replacement of worn, broken, and obsolete equipment hampers the speed at which NRG is able to “duplicate” RGC equipment.

Currently, ACC does not have an easily accessible multi-media classroom available in any of the labs or classrooms used. Overhead projectors and VCR/televisions are available in most classrooms. Dedicated computer, CD, DVD, web-based, 35 mm, and opaque readers are not in the classrooms. The inconvenience of borrowing, transporting, setting up, and returning loaner computer/projectors dramatically reduces the use of these type of materials in the classroom.

The physics library collection (excluding e-books) has 966 total volumes from a source of 682 total titles. The circulating titles are distributed at all six main campuses. The majority of titles (94%) are at RGC, NRG, and RVS campuses: 52% of titles at

RGC, 24% of titles at NRG, and 18% of titles at RVS. The ACC Learning Resource Center appears to have adequate materials for students and instructors. A more complete analysis of ACC holdings is shown in Appendix 1.

4.7e) Course Syllabi.

All syllabi are on file in the Math/Science division offices. In addition, all courses have template-syllabi on file at the departmental web site:

http://www2.austincc.edu/physci_tf/PAECurriculum/GuidelinesPAE.html, except SCIT 1418, which should be published soon.

4.8 Program Effectiveness: Technology

4.8a) Technology Assessment

i) Extent to which technology impacts mode of instruction.

Technology greatly affects how laboratories are carried out and many times what can be measured. Keeping up to date with new measurement methodologies is an essential argument for maintaining laboratory budgets at adequate levels to purchase new equipment as well as to maintain and repair old equipment.

The close proximity of laboratory equipment to the classroom is essential if students are to get the most out of the demonstration equipment which ACC has purchased. Ideally, the classroom and laboratory would directly share access to the lab and demo equipment.

The need for multi-media technology in the classroom is increasing rapidly and will continue to do so a rapid pace. Most textbooks are now packaged with demonstration DVDs for students and instructors. In addition, most textbooks have web based material that can be used in the classroom. Many instructors have old textbooks and photos that can only be displayed with an opaque reader. Finally, some teaching styles require the use of computers in the classroom. The use of these technologies in the classroom can allow or facilitate a change in the mode of instruction, or simply allow a more efficient and effective presentation of the material.

ii) Number of courses/sections taught via distance learning.

No physics classes are taught by distance learning. There are at least three reasons why distance learning will have limited utility for physics. One factor is the laboratory element of the course, which would cause students to come to campus twice a week for the standard community college instructional methodology. Even if the university mode of once a week laboratory instruction were applied most of the advantages of distance learning would be negated. Another factor is the live demonstrations which are done in class, followed by question and answer sessions. Finally, students who take physics

frequently visit the learning lab and the instructor's office hours for individualized help. This help is complex and involves writing equations which cannot be written in standard email packages. For these reasons, and others, distance learning sections are not recommended.

4.8b) Equipment Assessment

i) Program use of instructional equipment.

The physics program heavily utilizes its instructional equipment which is primarily laboratory and demonstration equipment. The needs for equipment are numerous. A single phenomenon may have several different demonstration devices. Many times a piece of equipment will be used from morning till night. Consequently, frequent costly and time consuming repairs need to be made. An example of how high instructional use is compared to funds available at the college is the laboratory chairs in the physics lab at NRG. The laboratory personnel have had to repair the chairs continuously in order to keep them from falling apart.

ii) Extent to which courses rely on specific equipment.

Physics classes rely heavily on specialized educational laboratory equipment. Almost all of our classes are lecture lab combinations. For example, all physics I classes of any kind will require the use of an air-track or a dynamics track, an Atwood's machine, photogates, timers, etc. The list of equipment is too long to consider here even if restricted to so-called "essential" equipment. As mentioned previously, maintaining, repairing, and replacing the equipment is a necessary part of running the Physics program, and must be budgeted for.

4.9 Program Effectiveness: Faculty

4.9a) Faculty Credentials

Full-Time Faculty

Bechtold, Jeff	PhD Physics	University of Houston
Cise, John	PhD Physics & Physics Education	University of Texas
Eways, Saad	PhD Physics	University of Texas
Friedrichsen, James	PhD Physics	University of Texas
Heath, James	MA Astronomy	University of Texas
Tacheny, Laura	MS Physics	University of Oregon
Underwood, John	PhD Physics	University of Texas

Adjunct Faculty

Avram, Mihai	MS Physics	University of Bucharest
Becker, Dean	MA Physics	University of Texas
Beston, William	MS	Clarkson College

Biggs, Dale	MA	University of Texas
Campbell, David	BS Chemistry	University of Georgia
Cavalli, Christina	PhD Physics	Dartmouth
Fulton, John	MS Physics	Southwest Texas State University
Jordan, Timothy	MS Electrical Engineering	Texas A&M
Kostelecky, Ronald	MS Physics	South Dakota
		School of Mines and Technology
Narayanan, Virek	PhD Physics	University of Texas
Nelson, Helen	PhD Physics	University of Texas
Pirnia, Mostafa	MS Nuclear Physics	Tehran University
Potter, David	MS	Louisiana State University
Prahovic, Martin	PhD	University of Texas
Rao, Chandragiri	PhD Chemical Engineering	University of Texas
Richards, Ronald		
Riley, Steven	PhD Physics	University of California - Irvin
Toomire, Bruce	PhD Physics	Virginia Polytechnic Institute
Tsai, Ching-Long	PhD	Louisiana State University
Waite, Jeff	MS Electrical Engineering	University of California - Berkeley
Weise, Jeanne	MS Electrical Engineering	Stephens Institute of Technology
Woods, David	PhD	Clarkson University

4.9b) Number of Faculty Adequate to Teach Courses

Staffing by instructor type is broken down in Tables 4.9a and 4.9b below. In FY2001, as of 1/30/02, 45% of physics sections and contact hours were taught by full-time faculty. As of this writing, it is believed that one additional full-time faculty person will be hired in FY2002. The addition of this full-time faculty member would put the percent of sections and contact-hours taught by full-time faculty at about 52%, and the number of full-time faculty would be 8 with this addition.

Presumably the new faculty member would be teaching at the NRG campus. Two full-time faculty members at NRG is desirable and sufficient. The remaining full-time faculty are currently at RGC (5) and RVS (1). At RGC, one faculty member teaches approximately 50% in Astronomy, and another faculty member teaches approximately 20% in Engineering. The number of full-time faculty teaching at RGC and RVS is sufficient for the current level of student enrollments.

Table 4.9a. Percent of Sections Taught by Type of Instructor.

	FY1997	FY1998	FY1999	FY2000	FY2001*	Average
Full	42%	48%	49%	43%	46%	45%
Adjunct	50%	43%	46%	56%	42%	48%
Other	8%	9%	5%	1%	12%	7%

* as of 1/30/02

Table 4.9b. Percent of Contact Hours by Type of Instructor.

	FY1997	FY1998	FY1999	FY2000	FY2001*	Average
Full	41%	47%	48%	46%	44%	45%
Adjunct	51%	45%	46%	53%	45%	48%
Other	8%	8%	6%	1%	12%	7%

* as of 1/30/02

4.9c) Faculty Professional Development

i) Description of professional development activities.

All faculty are required to pursue faculty development in order to receive their step increases in pay. Most faculty members meet or exceed the minimum required faculty development hours, 12 hours per year for full-time faculty, and 4 hours per year for adjunct faculty. These faculty development hours can occur through development offered by the Faculty Development Office, by outside professional organizations, by taking classes, and by departmental discipline specific training.

ii) Number involved in formal professional development activities.

For FY2002 5 out of six full-time faculty completed 12 or more hours of faculty development. Some had considerably more hours, e.g., John Underwood had over 80 hours due to his involvement with the Microgravity project. For the same time period, 12 out of 18 currently active adjunct physics instructors completed 4 or more hours of faculty development training.

iii) Types of discipline-related professional development activities offered.

Discipline related professional development is either offered by ACC faculty members, or by a professional organization such as the American Association of Physics Teachers, or by taking classes. Within the last year at least three professional development opportunities were offered by ACC faculty members. One involved the use of Tutorials in physics education. Another demonstrated the use of Computer Simulations in physics education. And one more was an outside faculty member brought in to speak on Superstrings.

In addition, each year, several members of our department travel, as funds permit, to state and national meetings and training sessions. For example in 2000, four faculty members attended an Interactive Physics workshop in Houston offered by an NSF funded national two-year college program.

Research projects which are classroom and student related also qualify for faculty development. In FY2002, John Underwood, a full-time faculty member, was awarded 70 hours of faculty development for his leadership of the Microgravity project, which involved NASA research in space flight with several ACC students actively involved.

4.9d) Teaching Effectiveness

i) Student evaluations of instruction within acceptable range.

Students are generally satisfied with their physics instruction based on student ratings. The average rating of physics faculty is “very good” based on the discipline specific data provided to instructors.

ii) Extent to which alternative modes of instruction are incorporated into classes.

Alternative modes are not used.

iii) Extent to which focus of instruction is on problem solving, active learning, and work-based elements.

The Physics faculty at ACC are particularly energetic. A number of faculty, both adjunct and full-time, have experimented with active learning in the classroom and laboratory. These teaching elements include group problem solving, using worksheets, tutorials, and active lab demonstrations. No formal program data is available regarding the amount of this type of instruction. However, based on departmental meetings and discussions, it is estimated that on average, less than 10% of lectures are active learning, and greater than 50% of laboratories are based on active learning.

4.9e) Faculty Satisfaction

The physics department is blessed with a highly motivated faculty who enjoy teaching. In general the physics faculty appear to be satisfied with their employment. However, there does appear to be a trend over the last several years toward being less satisfied with employment. The reasons for this negative trend appear to be increasing administrative duties, less belief that these duties are effective, and seemingly less prepared and motivated students in our classes.

In the last three years 2 full-time faculty members have quit, and a third member has taken early retirement. Both full-time faculty members who quit were known to be dissatisfied with the college’s administrative direction. Both these faculty members were highly experienced and proactive in departmental affairs and leadership of the department has suffered in their absence. The exit-interviews for these faculty were not provided to the program review committee, so the extent to which faculty satisfaction played a part in their decision to terminate employment is not known.

4.10 Program Effectiveness: Diversity

4.10a) Student Diversity.

Data from Fall 1999 to Spring 2002 indicate that 58% of students taking physics courses are white and 42% are non-white. For the same time period, students taking physics classes were 63% male and 37% were female. The percentages of black, Hispanic, and Asian students remained roughly constant over this period of time as did the male/female ratio.

4.10b) Outreach Activities.

John Cise, a full-time faculty member, has been the faculty representative at ACC for the S.H.P.E. (The Society of Hispanic Professional Engineers) while the organization was active from 1995 to 1998. The student leaders of this organization left ACC for gainful employment in the technology sector in 1998. The organization is currently reorganizing on campus and Laura Tascheny, also a full-time faculty member, will be the faculty representative.

In addition, each year John Cise takes minority students to an invitational dinner sponsored by the Equal Opportunity Engineering Office at the University of Texas. This is another way in which students are encouraged to continue development of their Engineering careers and are offered specific advice and told about programs that can help them to succeed.

4.11 Program Effectiveness: Student Satisfaction

Student course evaluations of faculty teaching physics courses consistently rate as “very good” based on summary reports . In the last five years, only two faculty members have been asked to alter their teaching practices due to student evaluations. In both these cases the instructors involved voluntarily decided to move on to other employment.

4.12 Program Effectiveness: Transfer Institutional Satisfaction

4.12a) Transfer Articulation Agreements and Course Transfer

Austin Community College has academic transfer agreements with 21 different universities and colleges. Most physics courses offered at ACC transfer to other institutions without problems. All of these courses have Texas Common Course Numbers. These courses include: PHYS 1401 & 1402, PHYS 1405 & 1407, and PHYS 2425 & 2426. Very few student complaints about transferring courses are encountered, perhaps one per year or less.

4.12b) Satisfaction of Transfer institutions

The Physics program at Austin Community College is currently working on a collaborative effort to study the success of its students after transferring to the University of Texas. This initiative began in the fall of 2002, and the Physics department formed a committee to handle the work. This committee forwarded the requested information to UT. Unfortunately, UT has reportedly not been able to form a corresponding committee to work with us on this issue. Hopefully, this effort will start up in 2003.

Therefore, specific tracking data for ACC student performance at transfer institutions is currently only available from Texas A&M University (TAMU). Although

this data is very valuable, better statistical evidence would be provided if the same data were available from the University of Texas since more ACC students transfer to UT.

Since the total number of students in each target course at TAMU is generally less than 10 students, total student performance will only be discussed based on all target courses which are based on the same foundation course taken by the students at ACC.

Two foundation courses are tracked: PHYS 1401 (General College Physics I) and PHYS 2425 (Engineering Physics I). All ACC students in this data took one of these two classes. The target courses at TAMU tracked include: COSC 329, PHYS 202, MEEN 212, PHYS 208, PHYS 219, and ARCH 331.

The tracking data for these Foundation/Target course pairs are summarized in Table 4.12a for students who took PHYS 1401 at ACC, and in Table 4.12b for students who took PHYS 2425 at ACC.

Table 4.12a. Comparison of students who took PHYS 1401 at ACC who are taking target courses at TAMU with all other students taking the same target course.

PHYS 1401 Foundation	TAMU Native Students	GPA of TAMU Natives	All Transfer Students	GPA of All Transfers	ACC Transfer Students	GPA of ACC Transfers
1999	63	2.5	92	2.7	2	2.5
1999	675	2.8	62	2.3	2	2.0
1997	203	2.6	199	2.6	11	2.4
1996	149	2.7	160	2.5	10	2.9
1996	1232	2.6	73	2.0	6	1.5
1995	115	2.9	110	2.5	6	3.3
1995	1134	2.6	54	1.9	6	1.5
Totals/Avg	3571	2.65	750	2.44	43	2.38

The group of students who took PHYS 1401 at ACC scored on average 0.06 grade points lower than all transfer students and 0.27 grade points lower than TAMU natives. The group of students who took PHYS 2425 at ACC scored on average 0.22 grade points lower than all transfer students and 0.47 grade points lower than TAMU natives.

In short, ACC transfer students scored about $\frac{1}{4}$ to $\frac{1}{2}$ of a grade point lower than TAMU native students and scored about the same to $\frac{1}{4}$ grade point less than all other transfer students based on statistics on two groups of students numbered 43 and 35 over a 5 year period. The number of students is not very large since TAMU is not the target school for most ACC students. Nevertheless, the data is interesting and definitely begs for more data, especially from UT. Since this data is new to the program and the Program Review Committee no action plans have previously been created to deal with the apparent lower performance of this cohort of students.

Table 4.12b. Comparison of students who took PHYS 2425 at ACC who are taking target courses at TAMU with all other students taking the same target course.

PHYS 2425 Foundation	TAMU Native Students	GPA of TAMU Natives	All Transfer Students	GPA of All Transfers	ACC Transfer Students	GPA of ACC Transfers
1999	1587	2.6	117	2.2	3	1.3
1997	662	2.7	148	2.6	1	4.0
1997	143	2.5	181	2.2	7	2.3
1997	229	2.4	25	1.8	2	3.0
1996	884	2.4	127	2.1	3	1.0
1996	1613	2.5	169	2.3	5	2.2
1996	565	2.3	64	2.2	4	2.3
1995	698	2.3	98	2.0	3	1.0
1995	1202	2.5	112	2.2	5	2.2
1995	494	2.4	55	2.2	2	1.5
Totals/Avg	8077	2.48	1096	2.23	35	2.01

Section 5. Institutional Effectiveness Measures

5.1 Summary of Institutional Effectiveness Measures and Results

The institutional effectiveness measure used by the physics program over the last few years assesses the effectiveness of PHY 1653 in preparing students to succeed in Engineering Physics I. PHY 1653 Elementary Physics Methods, is a 3 hour prerequisite for PHYS 2425. PHY 1653 is designed to prepare engineering students in a time and cost effective way for PHYS 2425 (it saves them 5 credit hours and 1 semester compared to using the General Physics sequence). The measure used compares the grade distribution in PHYS 2425 for students who took PHY 1653 as a prerequisite to the grade distribution for students who satisfied the prerequisite in some other way.

The results for Fall 2001 and Spring 2002 are shown in Table 5.1a. The analysis indicates that the PHY 1653 path is essentially identical to all other paths to PHYS 2425. The required learning outcome of the institutional effectiveness measure is that PHY 1653 prepares students for success in PHYS 2425. The grade distribution comparison suggests that PHY 1653 is equally effective in preparing students for success as all other paths and thus satisfies the intended outcome of the course.

Table 5.1a. Fall 2001-Spring 2002 PHYS-2425 grades for students using PHY 1653 as a prerequisite compared to students satisfying the prerequisite some other way.

2425 grades: Took PHY-1653			2425 grades: Did not take PHY-1653		
Students	%	Grades	Students	%	
6	31.6%	A	96	32.4%	
3	15.8%	B	56	18.9%	
1	5.3%	C	20	6.8%	
1	5.3%	D	7	2.4%	
1	5.3%	F	12	4.1%	

7	36.8%	W	105	35.5%
19^A		Total	296^B	

^A The student total adds up to 19 (and not 17) because 2 students took the course twice. Thus, there are 17 students that account for 19 student grades.

^B The student total adds up to 296 (and not 281) because 15 students took the course twice. Thus, there are 281 students that account for 298 student grades.

5.2 Recommended Modifications to Current Measures

The current assessment instrument is a valuable tool which assess the effectiveness of an ACC class in preparing students for one of the most challenging classes they will have likely taken at this point in their academic careers. If this class remains an effective way to prepare students for Engineering Physics I it is a great benefit to those seeking to become engineers. As such, no modifications of this instrument are recommended at this time.

5.3 Identification of New Institutional Effectiveness Measures

The following three items are suggested for new measures of the effectiveness of the Physics program at ACC.

- 1) Measure the success rate of students taking specified target courses at the University of Texas who had a foundation course of PHYS 2425 at ACC. Compare the success rate of this group with all other transfers and University of Texas native students.
- 2) Measure the success rate of students taking specified target courses at the University of Texas who had a foundation course of PHYS 1401 at ACC. Compare the success rate of this group with all other transfers and University of Texas native students.
- 3) Measure the graduation rates of students entering the College of Engineering at the University of Texas for students who took both PHYS 2425 and 2426 at ACC. Compare the success rate of this group with all other transfers and University of Texas native students.

Section 6. Recommendations

6.1 Northridge Laboratory

Construct, or find, dedicated lab space at the Northridge campus for physics labs. Physics and Geology are sharing one laboratory, and thus neither program is able to optimize scheduling of lecture/lab classes. Not having enough lab space prevents adding much needed sections.

6.2 Riverside Laboratory

Construct, or find, adequate sized lab space at the Riverside campus for physics labs. The current lab room at Riverside is inadequate in size and in storage size. Adequate space is needed in order to properly serve its current enrollment. The current space is also too small to allow for any future growth of the program.

6.3 Technology in the Classroom

Install dedicated multimedia systems in classrooms and labs. Multimedia systems are becoming standard features at many schools, for example, about 60% of the classrooms at the University of Texas have such systems. These systems will allow instructors to effectively present various types of media to students. A preliminary specification of such a system is shown in Appendix 2.

6.4 Optimize Northridge Class Schedule

Adjust class schedules at Northridge to maximize prime-time offerings and the number of day time classes that can be staffed by full time faculty. Contingent upon completion of dedicated lab facilities.

6.5 Optimize RioGrande Class Schedule

Adjust class schedules at RioGrande to maximize prime-time offerings and the number of day time classes that can be staffed by full time faculty.

6.6 Faculty Hiring/Northridge Campus

Hire a full time faculty member to be assigned to the Northridge campus. Due to resignations and reassignments, Northridge currently has one full time instructor. If dedicated lab space is found and the Physics schedule at Northridge can be modified appropriately, there will be sufficient prime-time offerings to warrant another full time instructor.

6.7 Mathematics Web Site for Physics Students

Create a web site to help students with basic math. Math deficiencies are a main cause of student difficulty with physics. This web site will offer another important resource for students to bring their math abilities in line with the requirements of their physics class.

6.8 Laboratory Computers

Purchase twelve laptop computers for all labs. This will allow two students to share one computer and thereby allow instructors to use computer-based instruction in the lab. The use of laptops will also free up space on the laboratory benches which are currently occupied by computers and monitors.

Section 7. Action Plan

7.1 Northridge Laboratory.

Year	Actions	Cost	Target Date	Responsible
1	Draw plans, estimate costs, seek funding	none	Fall	EVP
3	Construction	\$110,000	Fall	EVP
3	Outfit new lab with current equipment	none	Summer	Department
3	Purchase new furniture/office equip.	\$30,000	Summer	EVP
3	Begin normal use	none	Fall	Department

7.2 Riverside Laboratory.

Year	Actions	Cost	Target Date	Responsible
1	Draw plans, estimate costs, seek funding	none	Fall	EVP
2	Construction	?	Fall	EVP
3	Order new lab equipment	\$30,000	Fall	Department
3	Outfit new lab with current equipment	none	Summer	Department
3	Begin normal use	none	Fall	Department

7.3 Technology in the Classroom.

Year	Actions	Cost	Target Date	Responsible
1	Determine multi-media system requirements	none	Spring	Department
1	Obtain funding from college	none	Spring	EVP
2	Order (7) systems	\$172,253*	Fall	EVP
2	Install system	none	Spring	Vendor
2	Learn system and implement	none	Spring	Department
	* See Appendix 2.			

7.4 Optimize Northridge Class Schedule

Year	Actions	Cost	Target Date	Responsible
1	Waiting for Lab construction	none	--	--
2	Optimize schedule for year three (date new lab facilities ready). Implement changes to Fall schedule.	none	Spring	Department
3	Classes begin with new schedules.	none	Fall	Department

7.5 Optimize Rio Grande Class Schedule

Year	Actions	Cost	Target Date	Responsible
0	Optimize schedule to increase prime-time offerings.	none	Spring	Department
1	Begin classes under new schedule	none	Fall	Department

7.6 Faculty Hiring/Northridge Campus

Year	Actions	Cost	Target Date	Responsible
0	Form committee, interview, and recommend new candidates.	none	Spring	Department
0	Final candidate hired.	75,000/yr*	Summer	EVP
1	New hire is mentored and begins teaching.	none	Fall	Department
	*Cost: estimated total cost with benefits			

7.7 Mathematics Web Site for Physics Students

Year	Actions	Cost	Target Date	Responsible
0	Seek load reduction.	none	Spring	Department
0	Begin making web site.	3 LEH	Summer	Department
1	Finish first version of web site.	3 LEH	Fall	Department
2	Revise and maintain web site.	none	Fall	Department
3	Revise and maintain web site.	none	Fall	Department
4	Revise and maintain web site.	none	Fall	Department

7.8 Laboratory Computers

Year	Actions	Cost	Target Date	Responsible
1	Seek funding for purchase of laptops	none	Fall	Department
2	Purchase (12) laptop computers.	26,500	Fall	Department
3	Purchase (12) laptop computers.	26,500	Fall	Department
4	Implement use of software on laptops.	none	Fall	Department

Appendix 1. Library Resources

Physics Collection - Austin Community College Libraries

The collection data was compiled by searching various databases. Books and media in the library collection were searched by ICODE, a unique identifier for each discipline /area for which funds are expended. ICODE and location or material codes searched together provide information for campus collections. NOTE: interdisciplinary titles may not be retrieved with the ICODE for physics, so there may be a slight undercount of materials that could be useful for this discipline. Paper and microform periodical titles were searched by subject in the library catalog. Many interdisciplinary science titles were included in this count. Electronic journal title counts were estimated from resources provided by database vendors.

Physics Books (excluding e-books)

Total volumes = 966

Total number of titles = 682

521 unique circulating titles (excluding duplicates)

23 reference titles (reference titles which include several sciences, such as the *CRC Handbook of Physics and Chemistry* may not be included in this count)

<u>Campus</u>	<u>Circulating titles</u>	<u>Reference titles</u>
CYP	11	1
EVC	8	3
NRG	165	12
PIN	21	2
RGC	352	9
RVS	125	5

Electronic Resources for Physics

Databases and indexes = 12

Periodical Indexes and Full Text Databases

Academic Search Premier

MasterFile Premier

OCLC FirstSearch

Applied Science and Technology Full Text

Reference Resources (full text articles from dictionaries, encyclopedias, etc.)

AccessScience (McGraw-Hill Encyclopedia of Science and Technology online)

CRC Handbook of Chemistry and Physics (online)

General works that would include physics information

Encyclopedia Americana Online

Encyclopedia Britannica Online

Funk & Wagnalls New World Encyclopedia
Grolier Multimedia Encyclopedia
PapersFirst (citation index of conference papers)
ProceedingsFirst (citation index)

Computer files = 6 (computer software; tutorials)

Electronic Periodicals

Only rough estimates can be given for "physics" periodicals. Physics topics are likely to be treated in the general science periodicals. Keyword searches of the journal lists in various databases for the term "physics" resulted as shown:

Academic Search Premier - 127 titles relevant to the search "physics," many offering full text. Range from very scholarly to accessible to the general public

Applied Science and Technology Abstracts - 560 English-language, scientific and technical publications; 14 with the word "physics" in the title, some full text

FirstSearch - 222 with the word "physics" in the title; citations only

MasterFILE Premier -11 with the word "physics" in the title; full text and citations

Paper and Microform Periodicals

2 discipline specific titles (*Quantum* and *Physics Today*); 7 interdisciplinary science titles.

NOTE: There will be duplications of titles in paper, microform and electronic format; there will be also be duplications of titles in various databases.

It is important, when looking at the collection data, to consider the various campus library collections as parts of one large collection. Students have access to library materials at any campus, and can ask to have materials from specific campus collections sent to one where they are attending class. Articles from paper or microform periodicals can be photocopied and sent to their "home" campus via document delivery. Finally, access to electronic resources makes information accessible to distance learning students as well as those who prefer to use resources away from the libraries.

E-books, for instance, are a new and growing collection that has not been added to this report.

Appendix 2. Multi-Media System: Preliminary Cost Specifications

Texas Media Systems
1700 South Lamar, Ste. 200
Austin, TX 78704-3361
Ph: 512-440-1400 Fax: 512-440-1490

QTY	ITEM CODE	DESCRIPTION	UNIT PRICE	EXTENDED
7	ic6	Van San Multi-Median Lectern	3,474.00	24,318.00
7	pc	computer (pc)	2,000.00	14,000.00
7	mac	computer (mac)	2,000.00	14,000.00
7	DVD Player	Toshiba SD3800 DVD Player	180.00	1260.00
7	vplpx40	Sony LCD Projector 3400 ANSI Lumen	5,760.00	40,320.00
7	RPA020	Chief Manufacturing Mount for Sony Projector VPL-Px21	192.00	1344.00
7	SVP6000	Samsung SVP6000 Visual Presenter	4,080.00	28,560.00
7	VCR	Sony SLV-N77	120.00	840.00
7	Axcent 3	AMX Access system- Remote Control	4,416.00	30,912.00
7	A/V Switcher	Comprehensive CVG-21C Switcher	330.00	2,310.00
7	VGA DA	Extron P/2 DA2 Plus	144.00	1,008.00
7	SCM 262	Shure Stereo Mixer	217.67	1,523.00
7	CT210	Crown Duel Channel Rack Mount Power Amplifier	642.84	4,499.88
14	Control 25T-WH	JBL Speaker	133.92	1,874.88
14	Speaker Mount	JBL MTC-28/25CM-WH	13.68	191.52
7	MISC	Materials, Cable, Hardware	96.00	672.00
84	Installation Labor	Labor to install above items	55.00	4,620.00
		Sales Tax	0.00	0.00

Total \$172,253.96

Appendix 3. Cost of Running a Lab Class

1. Faculty salary – At the maximum pay rate for an adjunct (according to the ACC Website) in FY02, this would amount to $(5.25 \times \$1107)$ \$5811.75. The maximum pay rate is assumed because, although some adjuncts teaching astronomy are not at this maximum rate, higher-paid full-time faculty do teach many sections of physics.
2. Other salaries – It is difficult to estimate how much each section of physics costs in terms of Administrative, Classified, etc. In FY01, the Physics program accounted for 197,072 of the College's contact hours, so a full section of physics would be $(2304 / 197,072)$ 1.17 % of that total. According to data from the Office of Institutional Effectiveness, the Physics program spent \$144,092 in other salaries in FY01. Assuming that 1.17% of the contact hours accounts for a like percentage of other salaries, a full section of physics costs \$1684.60 in other salaries, or \$842.30 for a class with the minimum of 12 students.
3. Supplies – According to data from the Office of Institutional Effectiveness, the Physics program spent \$6801 on supplies in FY01. Using the same argument as above for other salaries, a full section of physics costs \$79.57 in supplies, or \$39.78 if there are only 12 students.
4. Travel – This expense varies with the instructor, and so is impossible to assign to a single section. This is considered one of the “fixed costs” any surplus from the Program must pay for.
5. Departmental expenses – According to data from the Office of Institutional Effectiveness, the Physics program spent \$43,382 on duplication, postage, memberships, etc., in FY01. Using the same argument as above for other salaries, a full section of physics costs \$507.57 in departmental expenses. A section with the bare minimum of 12 costs \$253.78.
6. Capital outlay – It is impossible to estimate how much of the capital outlay expenses could be assigned to an individual section of physics. This will be included with the “fixed costs” that any surplus must pay for.
7. Indirect costs – According to the Office of Institutional Effectiveness, these are expenses outside the program, such as administration, advising, library services, etc. There is absolutely no way of estimate how much each section of physics contributes to these indirect costs. As stated above, the practice of assigning direct costs by contact hours is unfair to programs with lots of laboratory courses. Assigning indirect costs by enrollment is a little better, but still seems arbitrary, since there is no way to make a connection between these indirect costs and physics students. Because of these difficulties, this analysis will not include indirect costs, with the idea that any extra money the Program makes can be applied to the indirect costs of the College as a whole, yet another fixed cost.

Summary of Costs – An average section of astronomy costs the College a total of \$8083.49 for a section with the full enrollment of 24. If the section has only 12 students, the cost would be \$6947.62.

Benefits

1. Tuition – A student paying in-district tuition and fees will spend \$179 on a four-hour course (source: ACC Website). Physics labs charge a \$20 lab fee, bringing the total to \$199. Therefore, the tuition generated by an physics class with the full contingent of 24 people is ($\$199 \times 24$) \$4776. The minimum potential tuition (for a section of 12) is \$2388.
2. State Funding – According to data from the Office of Institutional Effectiveness, in FY01 the College received \$3.67 per contact hour in state funding. Students in an physics lab-lecture combination have 6 contact hours per week, for a total of (6 x 16) 96 contact hours per student per semester. This leads to a total of (96 x 24) 2304 contact hours for a physics class with 24 students. Thus this section of physics will generate (2304 x \$3.67) \$8455.68 for the College. If the class is only 12 students, \$4227.84 is generated

Summary of Benefits – A full section of physics generates a total of \$13231.68 in tuition, fees, and state reimbursement. Even if a section would have had only 12 students (the minimum to “make”) the funds generated would still be \$6615.84.

The conclusion of this analysis is that an average section of physics costs the College \$8083.49 in salary and other expenses. Note that this is an almost worst-case scenario, assuming maximum adjunct faculty pay and very liberal estimates of costs on supplies and other expenses. On the other hand, that same section generates a total of \$13321.68 in tuition, fees, and state reimbursement. This is also a worst-case scenario, assuming that all students are paying the absolute lowest tuition.

Therefore, it is the conclusion of this study that an average section of astronomy generates a net amount of \$5148.19 in revenue in the worst-case scenario. The revenue will be even greater if many students pay out-of-district tuition (which many astronomy students do) and if the faculty member is paid less than the maximum (which is also frequently the case).

Even if the class has only 12 students, the College will only lose \$331.78 by eliminating the section. If the section only has one or two more students, or if many students pay out-of-district tuition, or if the instructor is paid even one step below the maximum, the section will quickly become “profitable.” For example, note that in the Fall 2002 semester, all but two physics classes had more than 13 students enrolled. Therefore, even if all students paid minimum tuition, and even if all adjunct instructors were paid the maximum salary, every section of astronomy offered by ACC in the Fall 2002 semester more than paid for itself. This revenue can be allocated to pay for the indirect expenses of the College and other “sunk costs.”

**Austin Community College
Astronomy Program Review
Self-study Report**

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Submitted February 19, 2003

Appendix A

Raw data from astronomy program review SWOT session

Compiled by John Caporusso

SWOT Exercise

Astronomy

October 19, 2002

Attendees

Christina Cavalli	Astronomy Instructor
Denise McClendon	Student
Ron Johns	Physical Science Task Force Chair
John Fulton	Adjunct Faculty Physics
James Friedrichsen	Assistant Instructor Physics
Dean Becker	Adjunct Faculty
Jim Heath	Associate Professor
Mary Kay Hemenway	Research Associate – UT
Kenneth Hood	Student
Elliot Richmond	Adjunct Faculty
David Fonken	Dean, Math/Sciences
Eric Ebner	Austin Astronomical Society

Strengths

Sub-Group 1	7 dots
Skilled faculty	
Wonderful interested faculty	
Good professor	
Emphasis on teaching	
Demanding faculty	
Faculty well educated in pedagogy	
Hard working faculty	
Excellent faculty	
Most faculty are good	
Faculty well educated in Astronomy	
Strong dedicated faculty	
Highly motivated and dedicated faculty	
Faculty dedication	
 Sub Group 2	 2 dots
Availability of technology	
Good classroom facilities	
Good library	
Uses technology available on campus	
Computer resources	
Star parties	
Good interaction with outside facilities – St. Stevens Observatory and Austin Astronomical Society	
Integration of information tech	
Good set of telescopes for observing	
 Sub Group 3	
Excellent textbook	
Good textbook, for the most part	
Good textbook	
Same book used by all instructors	
Good textbook	
 Sub Group 4	 4 dots
Collaborative learning	
Makes course “real” – applicable to world around us	
Student talent pool	
 Sub Group 5	
Group work teaching style	
Fun to teach	
Diverse teaching methods	
Good teaching methods	

Sub Group 6

Taught college-wide
Diverse student body
High enrollments

Sub Group 7

Individual attention for students
Small class size
Faculty availability
Personal attention from instructors
Small classes
Small class sizes
Accessibility to students
Very small classes (22 – 30 students)

5 dots

Sub Group 8

Low cost

Sub Group 9

Good, meaningful faculty development activities
Good faculty interaction at monthly task force meetings
Academic freedom
Good faculty evaluation system
Astronomy taught at a number of campuses
Good support at dean level
Emphasis on teaching
Good support from task force leadership and dean

3 dots

Sub Group 10

Anyone can be successful
Students are mostly interested in the subject (not required subject)
Inspire student participation

1 dot

Sub Group 10

Division of material stellar/so far
Interesting subject matter
Separate laboratory class available
Two-semester sequence
Three astronomy courses, vs. one at most community colleges

7 dots

Sub group 11

Courses taught at university level, i.e. demanding
All classes use one textbook
Generate high science interest with low math content
New lab course
Lab course

Sub Group 12

Transferability of courses
Course easily transfers to other institutions

Weaknesses

Sub Group 1	9 dots
Lack of equipment storage space	
Availability of laboratory equipment telescopes	
No campus owned equipment	
Access to visuals: slides, software, and videos...	
Not enough technology in classrooms	
Physics demonstrations not available at all campus	
Advertisement of available teacher aids	
Do we know what we have	
Source for more lecture demonstrations and activities – supplies	
Not enough sharing of resources between larger and smaller campuses	
Lack of availability of audio-visual equipment	
Sub Group 2	8 dots
No observatory	
No dedicated observatory facilities	
Lack of observational opportunities on campus	
No physical observatory	
No observatory	
Lack of observatory that students from all campuses could use	
Availability of permanent, safe, convenient observing location	
Sub Group 3	5 dots
Unpredictable weather	
No planetarium	
No planetarium	
Sub Group 4	9 dots
Interference from high-level administration, e.g. cutting classes	
Campus managers inhibit decoration of classrooms	
Administrative busy work distracts instructors	
Limit in number of sections/turning students away	
Upper level administration/board confusion leads to morale problems	
Fiscal mismanagement by upper administration	
Astronomy budget – low – how allocated	
Cut classes (due to budget?)	
Budget cuts	
ACC financial problems don't allow for growth	
Sub Group 5	1 dot
No intensive astronomy course	
Transferability of course numbers to local university	
No degree plan	
Degree plan problems	
Sub Group 6	2 dots
Little advertisement of our program	
Advertisement	

Sub Group 7	1 dot
No formal full time faculty	
No full time faculty devoted to just astronomy	
Most sections of astronomy are taught by part time faculty	
No designated full time faculty	
Difficulty finding new qualified faculty	
Lack of full time faculty	
Sub Group 8	8 dots
Confusion about new safety guidelines	
Lack of dark sky observing site	
No dark sky site	
Need for capped lights near any observing location	
Dark sky site needed	
Outside field trips should be required (at least one)	
Star parties not required	
Should require star parties at least once a month	
Need coordination of star parties, etc., for student opportunities	
Field trip regulations – too many	
Lack of coordination of star parties	
Sub Group 9	9 dots
Lack of storage space for equipment	
Not enough dedicated classroom space. Cannot offer more classes	
Limited classroom space at high demand sites	
Facilities lack of parking at RGC	
Lack of teaching space at NRG	
More classes need to be offered	
Lack of space to offer additional sections at certain times and places	
Sub Group 10	3 dots
Some faculty not very good and still teaching	
Astronomy department review continuing	
More astronomy related faculty development needed	
Lack cross poll... faculty	
Faculty do not use scopes available	
Sub Group 11	
Non-motivated students	
Retention of students	
Many students poorly prepared	

Opportunities

Sub Group 1	10 dots
Cross college collaboration for a planetarium	
Austin needs a planetarium – build one (instructional use and marketing)	
Collaborate with other colleges on building planetarium	
Leadership in planetarium acquisition`	
Work with local businesses and schools to build planetarium	
Opportunity for ACC planetarium	
New planetarium	
Sub Group 2	7 dots
Build an observatory on the acquired dark site	
Purchase of dark sky site	
Buying land for dark site	
Acquire a dark sky site	
Sub Group 3	2 dots
Conferences on astronomy education	
Professional development AAPT	
ASP will sponsor a meeting on teaching intro. Astronomy in summer 2004 – send some one to it	
Sub Group 4	4 dots
Plans for Pinnacle Campus	
Seek outside (established) storage for equipment	
Plans for South Austin Campus	
More classroom space – especially at CYP, NRG and PIN	
New facilities at CYP	
Proposed expansion of ACC facilities	
Where are Austin growth areas?	
Sub Group 5	8 dots
Doing research work in astronomy with students in our classes	
Every student gets – Messier logbook, Edmund sky guide, Sidereal times for labs	
Established transferability leads to higher enrollments	
Expansion of the program	
Offer higher-level astronomy class	
Offer variety of astronomy electives (UT style)	
CCN system aids in transfers	
Use of remote observation facilities with students	
Take advantage of any and all televised astronomy events	
SWT – RRHEC currently offers degree plans in coordination with ACC	
Sub Group 6	5 dots
Encourage teacher assistants to apply (volunteering)	
Hire a full time astronomy person	
Hiring new full time faculty	
Interaction with UT astronomy department as a source of potential part time instructors	
Hire full time faculty	

Sub Group 7 7 dots

Cooperation of Austin Astronomical Society
Outreach with community organizations, i.e. Girl Scouts
Collaboration with Austin Astronomical Society observing sites
More interaction with AAS and St. Stevens
Have ACC do talks at high schools about their program

Su Group 8

People love astronomy
Build community support for science
Collaborate with UT, AHS, Southwestern, etc. for star parties
Community outreach programs
Outreach to local high schools – opportunities for students
Collaborate with other colleges for star parties
Outside star parties (UT, AAS, wild basin)
Talk to high schools about star parties and field trips

Sub Group 9

1 dot

Develop resource center from externally available software, activities/demos
Internet access to remote observing sites
Lots of astronomy on the Web
New technology for display/demonstration

Sub Group 10

3 dots

Funding services
Grant funding
Seek outside funding (for equipment, planetarium, observatory etc.)
Grants or other opportunities (Allan's physics/NASA collaboration)
Working with NSF and NASA on student research
Working with four-year institutions

Sub Group 11

Collaboration with UT
Collaboration with UT astronomy department

Sub Group 12

Economic downturn
More people return to school

Threats

Sub Group 1	8 dots
Fundraising for planetarium at festivals (booth)	
Facilities (or lack of)	
Difficulty in locating accessible dark sky site	
Expansion space for current buildings	
Lack of UT support for planetarium	
No growth in facilities	
Sub Group 2	1 dot
Light pollution 5 times	
Austin Urban sprawl (lights)	
Sub Group 3	
Unpredictable weather	
Wretched weather	
Sub Group 4	2 dots
Dumb administrative rules and/or reshufflings	
Inattention to professor's needs	
Students get tired of dealing with ACC problems and quit coming	
More section cuts	
Sub Group 5	6 dots
Even more poorly prepared students (public school's preparation)	
Sub Group 6	
Terrorism	
Sub Group 7	1 dot
Lack of transferability of new astronomy courses	
Sub Group 8	3 dots
Lack of diversity in hiring pool	
Lowered standards for hiring	
Discouragement of graduate students teaching at ACC	
Lack of qualified faculty	
Sub Group 9	1 dot
Safety issues (field trips)	
Accidents or field trips	
Lack of student accessibility for star parties	

Sub Group 10 13 dots
Failure to pass tax increase
More budget cuts
Economic problems in community
Failure of tax increase
Money
Budget cuts
Budget – downturn of local and national economy
Economy – budget
Money
Expand tax base to other communities
Tight public purse strings
ACC Administration/Board problems. What will they cut next?
Declining state funding for higher education

Sub Group 11 5 dots
Religious objections to science
Misconceptions about astronomy
Lack of community support (i.e., no planetarium)
Science (especially physical) devalued in public schools
De-emphasis of need for science education
Low opinion of ACC at 4-year schools
Public confusion of astronomy and astrology

Sub Group 12
Competing community colleges for out-of-tax base areas
Distance learning (other institutions)

Sub Group 13 7 dots
Failure of administration to realize that sections bring in more money than they cost
Cost-benefit ratio (text book cost, lab fee, etc.)
Bad accounting calculations affecting administrative decisions

Appendix B

**Promotional flyer distributed to astronomy
students advertising new astronomy lab course,
PHYS 1111**

Front illustration by

Gabrielle Faust

ACC Graphic Design student

Back text by

James E. Heath

Flyer not available in electronic form

Appendix C

**Sample syllabi and lists of required topics for ACC
astronomy courses,**

PHYS 1311 (Stellar Astronomy)

and

PHYS 1312 (Solar System Astronomy)

Syllabi by Dr. Christina Cavalli

Topics lists determined by faculty vote

PHYS 1311 - Stellar Astronomy

Required Topics

Topics marked with * may also be covered in PHYS 1312

I. Fundamentals

- a. Celestial coordinate system *
- b. Newton's Laws of Motion and Gravity
- c. Light and Matter *
 - i. Wave-particle duality of light
 - ii. Electromagnetic spectrum
 - iii. Luminosity and Brightness
 - iv. Kirchoff's Laws
 - v. The Bohr Model of the atom
 - vi. Astronomical Spectroscopy
- d. Telescopes *

II. Properties of Stars

- a. The Sun *
- b. Nuclear fusion
- c. Magnitude system
- d. Spectral types
- e. The Hertzsprung-Russell Diagram
- f. Binary stars and stellar mass
- g. Star clusters

III. Process of stellar evolution

- a. High-mass vs. low-mass stars
- b. Stellar remnants
 - i. white dwarfs
 - ii. novae and supernovae
 - iii. neutron stars and pulsars
 - iv. black holes

IV. Galaxies

- a. Structure of the Milky Way
- b. Types of galaxies
- c. Theories of galaxy formation
- d. Quasars and active galaxies

V. Cosmology

- a. The expansion of the universe
- b. The Big Bang Theory

PHYS 1312 - Solar System Astronomy

Required Topics

Topics marked with * may also be covered in PHYS 1311

I. Fundamentals

- a. Angle measure *
- b. The origin of the seasons
- c. Apparent retrograde motion
- d. Solar System Models
 - i. Geocentric models
 - ii. Heliocentric models
- e. The Renaissance
 - i. Discoveries of Galileo *
 - ii. Kepler's Laws of Planetary Motion *
 - iii. Newton's Laws of Motion and Gravity*
- f. Solar System Exploration

II. The Inner Planets (emphasis on comparison and contrast)

- a. Earth
- b. the Moon
- c. Mercury
- d. Venus
- e. Mars

III. The Outer Planets (with emphasis on comparison and contrast)

- a. Jupiter
- b. Saturn
- c. Uranus
- d. Neptune
- e. The satellites of the outer planets
- f. Ring systems

IV. Minor bodies

- a. Pluto
- b. Asteroids
- c. Comets
- d. Meteors

V. Summative topics

- a. The origin of the solar system, including the Earth and the Moon
- b. The search for extrasolar planets *
- c. Possibilities for extraterrestrial life *

PHYS 1311: Stellar Astronomy

Instructor: (Instructor name)

Section number and Synonym. Example:

(Fall 2001, Monday/Wednesday, 1:25-2:40pm, 42104 Physics 1311 Lec 002, Cypress Campus)

Office Hours and Location: (Instructor Office Hours and location)

Email: (Instructor email) **Web Page:** (Instructor webpage address) **Phone:** (Instructor telephone number)

COURSE DESCRIPTION: *(This is modified from the description in the course catalog. Instructor may add as desired.)*

Welcome! Stellar astronomy is a study of stars, galaxies, and the universe. It includes discussion of atomic spectra, nuclear energy, and astronomical tools (such as optical, radio, and other telescopes and image enhancers) as they provide knowledge about distant objects. Recent discoveries about quasars, black holes, and cosmology will be emphasized.

TEXT: We will be using Astronomy Today, 4th Edition- Chaisson & McMillan. You can obtain it in the ACC bookstore.

INSTRUCTIONAL METHODOLOGY and COURSE RATIONALE: *(This is partially from the catalog and partially based on how the instructor plans to teach. Instructor may add as desired.)*

This course is a lecture-based course which includes time for class discussions, demonstrations and student projects. It is an introduction to Stellar Astronomy, providing students with a college-level science course. The course prerequisites are MATD 0370 (Elementary Algebra) or one year of high school algebra or the equivalent. One year of high school science is recommended, but not required.

OBJECTIVES and OUTCOMES: *(An example is given. The instructor should prepare specific objectives and outcomes of their own.)*

I hope you are taking this course because you are interested in astronomy. When you have finished this course, I hope you have a life-long interest in astronomy and a deeper understanding of it and of science in general which will be an asset to you, individually, and to our society. These objectives will result in the stated outcomes if you do the required work, take part in class activities, and get help when you need it. (Please talk to me if you are having problems with the material.)

Objectives

Introduce students to scientific reasoning and current astronomy through investigations of:

- Changing views of astronomy in history
- Properties, evolutionary histories, and varied fates of stars
- Galaxies, SETI (Search for extraterrestrial intelligence), cosmology, and the universe as a whole

Develop student interest in and understanding of current astronomical news and events.

Outcomes

Students demonstrate basic understanding of Stellar Astronomy and cosmology through discussions, homework and tests.

Students demonstrate ability to make informed decisions about scientific programs and information in their daily lives through class discussions and test questions.

GRADING: *(See "Course Guidelines for Astronomy". Three to five exams are recommended, including a final, not required to be comprehensive. The exams must count at least 60% of the total grade. At least 20% of the total grade should come from other assessment instruments such as homework, projects, papers, and quizzes. No more than 10% of the grade may come from participation, attendance, or extra credit work.)*

Exams		<i>(At least 60% of grade)</i>
Quizzes	<i>(?%), Homework (?%), Project (?%)</i>	<i>(At least 20% of grade)</i>
Participation & Extra Credit Work		<i>(No more than 10% of grade)</i>

A = 90-100, B = 80-89, C = 70-79, D = 60-69, F < 60

COURSE OUTLINE and CALENDAR: *(An example is given. Instructor should develop his/her own description.)*

The calendar we will follow is on the following page. Please try to read the material before coming to class so you can ask questions and take part in classroom discussions. Reading and homework assignments (including extra credit opportunities) will be given for each section. Homework for the section is due the day of the corresponding test.

Current astronomy news will be discussed in each class period and it will be covered on tests and quizzes. Each student will be assigned to bring in news at least once, but anyone may share astronomy news on any day. You can find astronomy news in the newspaper, current magazines, on various TV shows, and on several Internet sites.

Everyone will do a research project. The topics and their due dates will be assigned during the first week of classes. Your research should expand on some aspect of your topic that is not

covered, or not covered fully, in the book. You will be responsible for some sort of presentation of your research--a lecture, a demonstration, an art project, a video, etc.--along with an explanation. It is also important to try to involve the class in some way. A handout with more information on what is expected on the project is included with this syllabus.

The exams will cover about three chapters each. They will occur on September 12, October 8, October 31, November 21, and December 12 (tentative dates). There will be an optional comprehensive final given near the end of the semester. If you choose to take the final and then do better on it than on one of the previous exams, it will replace the lowest test grade. You must have taken all previous exams in order to do this. The final will not replace a zero from a skipped test.

There will rarely be make-up exams. Contact me **before** the test (email or phone, if you can't find me in person) to avoid receiving a zero if there is an unavoidable emergency.

COURSE POLICIES: (Instructor should include attendance, withdrawal, incomplete and discipline procedures here. The sections on Scholastic Dishonesty and Students with Disabilities are ACC policies and must be included.)

Attendance, Withdrawals, Incompletes: Attendance is important and expected. The instructor may withdraw students for failure to meet course objectives or for excessive absences, but makes no commitment to do so. After the withdrawal date each semester, neither the student nor the instructor may initiate a withdrawal. That date is *(Add Date)* this semester. Students are responsible to initiate withdrawals if they so choose. Students who stop attending should withdraw themselves in order to avoid an F for the course. The grade of "I" (for incomplete) may be given by an instructor for a course in which a student was unable to complete all of the objectives for the passing grade. Incomplete grades will rarely be given, and only if the student has taken all exams, is passing, and has a personal tragedy occur after the last date to withdraw that prevents course completion. See the ACC catalog for more information on Incompletes.

Scholastic Dishonesty: Acts prohibited by the college for which discipline may be administered include scholastic dishonesty, including but not limited to cheating on an exam or quiz, plagiarizing, and unauthorized collaboration with another in preparing outside work. Academic work submitted by students shall be the result of their thought, research or self-expression. Academic work is defined as, but not limited to tests, quizzes, whether taken electronically or on paper; projects, either individual or group; classroom presentations, and homework.

Academic Freedom: Students are free to disagree with instructors on matters of opinion or personal philosophy, and will incur no penalty from doing so. However, instructors will judge student work based upon its relation to the current state of mainstream scientific fact and theory.

Student Discipline: Matters of student discipline will be adjudicated by the instructor on a case-by-case basis, in conjunction with the Task Force Leader or Dean. Students may consult with the Office of Student Services or the Associate Dean at their campus on these matters.

Students with Disabilities

Each ACC campus offers support services for students with documented physical or psychological disabilities. Students with disabilities must request reasonable accommodations through the Office for Students with Disabilities on the campus where they expect to take the majority of their classes. Students are encouraged to do this three weeks before the start of the semester.

(Student Services Handout and Instructional Services Handout should be given to students if they need them.)

(The following are examples of a course calendar and information about a required project. Instructors should develop the necessary documents for their class.)

PHYS 1311: STELLAR ASTRONOMY SCHEDULE

Fall 2001

August 27	Introduction, Chapter 1
August 29	Chapter 3
September 5	Chapter 4
September 10	Chapter 5 and Review
September 12	<u>Test 1</u>
September 17	Chapter 17
September 19	Chapter 17 & 18
September 24	Chapter 18
September 26	Chapter 18 & 19
October 1	Chapter 19
October 3	Chapter 19 & Review
October 8	<u>Test 2</u>
October 10	Chapter 20
October 15	Chapter 20
October 17	Chapter 21
October 22	Chapter 21
October 24	Chapter 22
October 29	Chapter 22 & Review
October 31	<u>Test 3</u>
November 5	Chapter 23
November 7	Chapter 23 & 24
November 12	Chapter 24
November 14	Chapter 25
November 19	Chapter 25 & Review
November 21	<u>Test 4</u>
November 26	Chapter 26
November 28	Chapter 26 & 27
December 3	Chapters 27
December 5	Chapter 28
December 10	Chapter 28 & Review

December 12

Test 5

PHYS 1311 PROJECT

Fall 2001

Your project should expand on what is covered by the book on your topic (new information about the subject). Possible sources of further information are new books, magazines such as "Astronomy" and the Internet (be careful about your sources, as some are more reliable than others). Make sure you credit your sources. (No plagiarism!) Talk to me if you are having trouble.

I want to leave this fairly general so that you can be creative (!!!). But here are some basic guidelines to follow:

Handouts and Presentation (33%)

Give a short (about five minutes) presentation on your topic. You may give a lecture or videotape your presentation. Summarize important information and give handouts to the class and me. Since much of this information will not be found in the book, and it is likely to be covered on the test, everyone needs at least a handout with the major points summarized. It doesn't have to be a lengthy paper, but a summary of your information. This would be a good place to list your sources.

Visual Aids (33%)

Use some visual aid(s) to help you present your topic. Possibilities:

- Power Point presentation
- poster
- model
- movie
- charts or graphs
- overheads or chalkboard work
- other visual aids

Class Participation (33%)

Try to involve the class by using one or more of the following:

- demonstrations
- leading questions
- games
- other activity

Each section (Handout, Visual Aid, and Class Participation) counts 33% of your grade. To help me determine the grade, I ask each student in the class to write three good things about your presentation, and one thing that can be improved. Generally the comments are helpful!

GOOD LUCK and HAVE FUN!!!!

Solar System Astronomy

Instructor: (**Instructor name**)

Section number and Synonym. Example:

(Spring 2002, Monday/Wednesday, 1:25-2:40pm, 12354 Physics 1311 Lec 002, Cypress Campus)

Office Hours and Location: (Instructor Office Hours and location)

Email: (Instructor email) **Web Page:** (Instructor webpage address) **Phone:** (Instructor telephone number)

COURSE DESCRIPTION: *(This is modified from the description in the course catalog. Instructor may add or delete as desired.)* Welcome! Physics 1312, Solar System Astronomy, is an introduction to the solar system. We will discuss its formation, its overall scale and structure, and the similarities and differences between the planets, the Sun, and the other constituents of the solar system, including satellites, meteors, comets, and asteroids. We will also discuss theories about the origin of the solar system, with emphasis on recent discoveries such as other solar systems and the search for extraterrestrial life.

TEXT: We will be using Astronomy Today, 4th Edition- Chaisson & McMillan. You can obtain it in the ACC bookstore.

INSTRUCTIONAL METHODOLOGY and COURSE RATIONALE: *(This is partially from the catalog and partially based on how the instructor plans to teach. Instructor may add or delete as desired.)*

This course is a lecture-based course which includes time for class discussions, demonstrations and student projects. It is an introduction to Solar System Astronomy, providing students with a college-level science course. The course prerequisites are MATD 0370 (Elementary Algebra) or one year of high school algebra or the equivalent. One year of high school science is recommended, but not required.

OBJECTIVES and OUTCOMES: *(An example is given. The instructor should prepare specific objectives and outcomes of their own.)* I hope you are taking this course because you are interested in astronomy. When you have finished this course, I hope you have a life-long interest in astronomy and a deeper understanding of it and of science in general which will be an asset to you, individually, and to our society. These objectives will result in the stated outcomes if you do the required work, take part in class activities, and get help when you need it. (Please talk to me if you are having problems with the material.)

Objectives

Introduce students to scientific reasoning and current astronomy through investigations of:

- The planets and other constituents of the Solar System.
- The scale, structure, origin, and evolutionary history of the Solar System.
- Recent discoveries about other solar systems.

Develop student interest in and understanding of current astronomical news and events.

Outcomes

Students demonstrate basic understanding of Solar System Astronomy through discussions, homework and tests.

Students demonstrate ability to make informed decisions about scientific programs and information in their daily lives through class discussions and test questions.

GRADING: *(See “Course Guidelines for Astronomy”. Three to five exams are recommended, including a final, not required to be comprehensive. The exams must count at least 60% of the total grade. At least 20% of the total grade should come from other assessment instruments such as homework, projects, papers, and quizzes. No more than 10% of the grade may come from participation, attendance, or extra credit work.)*

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COURSE OUTLINE and CALENDAR: *(An example is given. Instructor should develop his/her own description.)*

The calendar we will follow is on the following page. Please try to read the material before coming to class so you can ask questions and take part in classroom discussions. Reading and homework assignments (including extra credit opportunities) will be given for each section. Homework for the section is due the day of the corresponding test.

Current astronomy news will be discussed in each class period and it will be covered on tests and quizzes. Each student will be assigned to bring in news at least

once, but anyone may share astronomy news on any day. You can find astronomy news in the newspaper, current magazines, on various TV shows, and on several Internet sites.

Everyone will do a research project. The topics and their due dates will be assigned during the first week of classes. Your research should expand on some aspect of your topic that is not covered, or not covered fully, in the book. You will be responsible for some sort of presentation of your research--a lecture, a demonstration, an art project, a video, etc.--along with an explanation. It is also important to try to involve the class in some way. A handout with more information on what is expected on the project is included with this syllabus.

The exams will cover about three chapters each. They will occur on February 6, March 6, April 10, and May 8 (tentative dates). There will be an optional comprehensive final given near the end of the semester. If you choose to take the final and then do better on it than on one of the previous exams, it will replace the lowest test grade. You must have taken all previous exams in order to do this. The final will not replace a zero from a skipped test.

There will rarely be make-up exams. Contact me **before** the test (email or phone, if you can't find me in person) to avoid receiving a zero if there is an unavoidable emergency.

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Academic Freedom: Students are free to disagree with instructors on matters of opinion or personal philosophy, and will incur no penalty from doing so. However,

instructors will judge student work based upon its relation to the current state of mainstream scientific fact and theory.

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Students with Disabilities

Each ACC campus offers support services for students with documented physical or psychological disabilities. Students with disabilities must request reasonable accommodations through the Office for Students with Disabilities on the campus where they expect to take the majority of their classes. Students are encouraged to do this three weeks before the start of the semester.

(Student Services Handout and Instructional Services Handout should be given to students if they need them.)

(The following are examples of a course calendar and information about a required project. Instructors should develop the necessary documents for their class.)

PHYSICS 1312: THE SOLAR SYSTEM Spring 2002 Schedule

January 14	Introduction, Chapter 1 (Part)
January 16	Chapter 2: The Copernican Revolution
January 23	Chapter 6: The Solar System
January 28	Chapter 6 and Chapter 7: Earth
January 30	Chapter 7: Earth
February 4	Review
February 6	Test
February 11	Chapter 8: The Moon and Mercury
February 13	Chapter 8
February 18	Chapter 9: Venus
February 20	Chapter 9
February 25	Chapter 10: Mars
February 27	Chapter 10
March 4	Review
March 6	Test
March 11, 13	Spring Break
March 18	Chapter 11: Jupiter
March 20	Chapter 11
March 25	Chapter 12: Saturn
March 27	Chapter 12
April 1	Chapter 13: Uranus, Neptune, and Pluto

April 3	Chapter 13
April 8	Review
April 10	Test
April 15	Chapter 14: Solar System Debris
April 17	Chapter 14
April 22	Chapter 15: Formation of the Solar System
April 24	Chapter 15
April 29	Chapter 16: The Sun
May 1	Chapter 16
May 6	Review
May 8	Test

PHYSICS 1312 PROJECT

Your project should focus on some aspect of your subject that you can expand upon. For example, if your topic is Jupiter, pick something, such as the Great Red Spot, on which to do further research. I don't want you to just tell us what is in the book. We can read that ourselves! You must find information beyond what is in the book. Possible sources of further information are **new** books (2000 or newer), magazines such as "Astronomy" or "Planetary Society" and the Internet (be careful about your sources, as some are more reliable than others). Make sure you credit your sources. (No plagiarism!) Talk to me if you are having trouble.

I want to leave this fairly general so that you can be creative (!!!). But here are some basic guidelines to follow:

Handouts and Presentation (33%)

Give about a five to ten minute presentation on your topic. You may give a lecture or videotape your presentation. **Don't just read your paper!!** Summarize important information and give handouts to the class and me. Since much of this information will not be found in the book, and it is likely to be covered on the test, everyone needs at least a handout with the major points summarized. It doesn't have to be a lengthy paper, but a summary of your information. This would be a good place to list your sources.

Visual Aids (33%)

Use some visual aid(s) to help you present your topic. Possibilities (not limited to these):

- Power Point presentation
- Poster
- Model
- Movie
- Charts or graphs
- Overheads or chalkboard work
- Other visual aids

Class Participation (33%)

Try to involve the class by using one or more of the following:

- Demonstrations
- Leading questions
- Games
- Other activity

Each section (Handout, Visual Aid, and Class Participation) counts 33% of your grade. To help me determine the grade, I ask each student in the class to write three good things about your presentation, and one thing that can be improved. Generally the comments are helpful!

GOOD LUCK and HAVE FUN!!!!

Appendix D

**Ten-question multiple-choice test used for SACS
assessment of**

PHYS 1311, Stellar Astronomy

Written by Dean Becker

SACS ASSESSMENT TEST PHYS 1311

Assessment Questions

1. Colors are perceived differently because they have different:
 - A. Speeds.
 - B. Wavelengths.
 - C. Charges.
 - D. Polarizations.
 - E. Amplitudes.
2. The most relevant characteristic of a telescope is its:
 - A. Focal length.
 - B. Magnifying power.
 - C. Whether the objective element is a lens or a mirror.
 - D. The size of the light gathering element.
3. What characteristic of a star in a binary system can be found from the distance between the stars and their orbital period?
 - A. Mass.
 - B. Radius.
 - C. Brightness.
 - D. Temperature.
 - E. Age.
4. Which event marks the birth of a star?
 - A. Fusion of hydrogen nuclei into helium nuclei.
 - B. Collapse of an interstellar cloud.
 - C. Formation of a photosphere.
 - D. Instability in an interstellar cloud.
5. What is the key factor that determines the temperature, density, radius, luminosity, and pace of evolution of a star?
 - A. Rotation.
 - B. Magnetism.
 - C. Heat.
 - D. Mass.
 - E. Chemical composition.
6. What characteristic of a star cluster is used to determine its age?
 - A. The number of red giants.
 - B. The main sequence turnoff point.
 - C. The faintest stars seen in the cluster.
 - D. The total number of stars in the cluster.

7. What is stellar nucleosynthesis?
 - A. The formation of elements inside stars.
 - B. The formation of stars from a nucleus of contracting material.
 - C. The formation of white dwarfs, neutron stars, and black holes from stars.
 - D. The process by which stars form from interstellar dust.

8. Which of the following most closely states Hubble's law?
 - A. Most galaxies belong to clusters, which in turn belong to superclusters.
 - B. The more distant a galaxy is the younger it appears.
 - C. The more distant a galaxy is the older it appears.
 - D. The more distant a galaxy is the fainter it appears.
 - E. the more distant a galaxy is the faster it is receding.

9. What does Hubble's law imply about the history of the Universe?
 - A. The Universe started expanding at some time in the past; the Universe has an age.
 - B. The Universe has been expanding forever; it is infinitely old.
 - C. The Milky Way galaxy is at the position where the Universe started to expand.
 - D. Before the Universe started to expand it had collapsed and expanded many times.

10. The cosmic background radiation is important because:
 - A. It shows that the Universe is open.
 - B. It shows that the Universe is closed.
 - C. It represented a major technological advance.
 - D. It confirmed a major prediction of the big bang theory.