A CORRESPONDENCE COURSE IN ASTRONOMY

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1. Introduction

As do most universities in the United States, the University of New Mexico (UNM) offers a one-semester introductory course in astronomy aimed at the vast audience of non-science majors. UNM is a non-selective, minimally-funded state research university with an undergraduate enrollment of about 20,000 students — with a median age of 26. Many of the students have jobs and families and attend on a part-time basis. The Physics and Astronomy Department usually offers three sections of Astronomy 101 to accommodate students' schedules: in the morning, afternoon, and evening. Total enrollments per semester range between 400 to 600; the course is also regularly taught during the summer. The class has *no* prerequisites of any kind, is advertised as "non-mathematical," and does *not* have a required lab for observations. (A related lab course, Astronomy 111, *is* available, and is taken by about 100 students per semester.) The course attempts to cover "all" of astronomy with a special emphasis on the theme of cosmic evolution. Instructors tend to use visual aids (slides, videos, films, laser disks, and microcomputers) heavily. Students usually rate the instructors and the course in the top 10 to 30% of all instructors who choose to use a university-wide class evaluation instrument, compared to a group of other lower-division courses.

When I teach the course, I use my textbook (*Astronomy: The Evolving Universe*, 5th edition, 1988, John Wiley and Sons) and typically cover, in all or part, 18 out of 22 chapters. I require four one-hour-long tests plus a two-hour-long final exam and also provide 8 practice tests during the semester (Folland *et al.*, 1983). All tests are in a multiple-choice format; my reliability coefficients are greater than 0.8, and the standard error of measurement averages 2%. Students are given reading assignments but no homework as such. The four term tests count 80% of the final course grade; the final exam is worth 20%.

The characteristics of the students in Astronomy 101 are typical of those found in the United States in non-selective state universities in science courses with no prerequisites: about 1/3 of the students are formal reasoners in the Piaget sense and the other 2/3 transitional or concrete. Their fear of math is so strong that arithmetic and graphs mystify many of them. Some 90% or more have never had a physics or astronomy course; 50% have never had algebra/trig/geometry. Astronomy 101 is probably the only science course most of them will take at the university. One redeeming point: 2/3 say that they are taking the course to satisfy their curiosity about astronomy rather than only to satisfy a science requirement for graduation.

2. Correspondence Course Description and Operation

I developed the correspondence course from a Personalized System of Instruction format of a Harvard University astronomy course (Zeilik, 1974; Bieniek and Zeilik, 1976), which also formed the basis for my textbook. (I have also used this PSI format for upper-division undergraduate courses; see Zeilik, 1981.) These materials were revised and used with a special PSI section of Astronomy 101 at UNM; these were streamlined into the correspondence course materials and the study guide to my textbook (by John Gaustad and me) that was available with the second and third editions. (It is no longer published.) The correspondence course, called Astronomy 101C, is offered for academic credit through UNM's Division of Continuing Education at the same cost as a regular in-state tuition for a 3-credit hour course. Continuing Education handles all logistics and records; the course can follow me around by mail.

The student has 22 written lessons to complete (one for each chapter of the book); each lesson asks the students to answer *in writing* three to six questions per chapter in an open-book environment. In addition, the students have a Lesson 0 that requires naked-eye observations. The complete lessons are mailed to me via Continuing Education, and I grade each individually with comments, usually within a few days after I receive them. The lessons are then returned to the students; turn-around is typically one week. The grades on the lessons count 80% of the final grade for the course. The final exam counts for the other 20%; it is the *same* final given by me to the Astronomy 101 students in the most recent term. It consists of 100+ multiple-choice questions given in 2 hours with a proctor (provided or paid for by Continuing Education). I grade it with the same scaling as the regular term exam. Because the correspondence students have not seen multiple-choice questions on their lessons, I provide them with sample tests upon request (the same sample tests given to the lecture students).

Officially, the students are given 12 months in which to complete the course. If they have not finished in that time, they can request two 90-day extensions for a total completion time of 18 months. Students are formally not supposed to complete more than one lesson a week; in fact, some do; I have never seen this rule enforced. I have noticed that students who rush through the material simply do not give in-depth answers on the lessons and tend to do poorly on the final exam. I announce to students that I am available by telephone, but have received very few calls from them.

Since 1976, 73 students have enrolled in Astronomy 101C for an average of 6.1 per year. They included 31 residents of New Mexico; the rest tended to reside in the western part of the United States, though one student lived in France and another in Hong Kong. Occupations ranged from "student" to "housewife," and "alcohol counselor" to "airplane pilot." Of those *enrolled*, 55 had *completed* the course before Fall 1988 for an average of 4.6 per year; 31 were women and 24 were men. The average completion time was 10.3 ± 5.3 months; note the large standard deviation. The fastest completion was 2 months (by three students); the slowest,

22 months. Of these students who did complete the course, the average age was 32.3 years; the average grade on the lessons was 89.8%; and the average final exam grade 75.3%. Of the students who did *not* complete the course by not doing all the lessons, the average number of lessons completed was 9. They started out well but could not keep up their motivation.

3. Results

First, I compare in Table 1 the final grades of the Astronomy 101C students to those in Astronomy 101 in Fall 1980, Spring 1982, and Fall 1984, which I also taught:

Table 1

Grade	Astro 101	Astro 101C
A	23%	33%
B	28%	33%
C	33%	10%
D	4%	0%
F	9%	0%
Other[a]	3%	25%

[a]Note: "Other" includes incompletes and *recorded* withdrawals; term-time students have six weeks to unilaterally withdraw from a course and leave no record of having been enrolled. For Astronomy 101C, the "other" category includes all students who failed to complete the course.

The trend is clear: term-time students who had to finish the course by a deadline either withdrew early or stuck it out after six weeks had passed. In contrast, Astronomy 101C students who finished the course tended to do well, as shown by the lack of D's and F's. In a sense, the correspondence students had more control over their destiny with a flexible, extendable deadline; the course was student-paced to a much greater extent than the regular one. (The grading scales were the same for both courses: 90% and above for an "A"; 80 to 89% for a "B"; 65 to 79% for a "C"; 50 to 64% for a "D"; below 50% for an "F.")

Another basis of comparison is the final-exam scores. The average for the term time students was 69%; correspondence students, 75%, for a statistically-significant difference (about three standard errors). You might argue that this comparison is biased, because the correspondence students who would score low simply did not take the final. That is true; however, it is also the case that most of the students who received "D's" and "F's" in the regular course did so because they did not take the final exam, which is the main reason their final grades are so low. So the comparison is apt.

From my twelve years of experience with Astronomy 101C, I conclude the following:

1. A correspondence course is an effective means to deliver an introductory astronomy course to students far from the instructor and home university; a "plus" for New Mexico, which has a low population density and a wide geographic spread.
2. Such a course helps wheelchair-confined students who still find it a great effort to attend classes on campus.
3. It is a low-cost instructional process relying mostly on the textbook; the lack of a rich visual classroom environment and a live instructor does not hinder the learning of the key concepts for mature, motivated students.

4. Acknowledgment

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