

A Preliminary Assessment of the Value of Prerequisites in a Horticulture Curriculum

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Abstract

Final grades and student GPAs in 4 horticulture courses at Montana State University were examined for the previous 3 or 6 years. Each course had 2 prerequisites. Of the 391 student records examined, 308 showed all prerequisites had been met prior to enrollment. In 3 out of the 4 courses mean grades for students that had met all prerequisites were not significantly different from those of students that hadn't ($P = 0.05$). Those that had all prerequisites received significantly higher grades in 1 course. In half the courses the trend was for higher GPAs among students that had met prerequisites. These also tended to have higher grades, regardless of whether they had met all prerequisites. In the other classes, students having significantly higher GPAs also had higher grades and were more apt to have taken all prerequisites. The preliminary results suggest that completion of prerequisites is not a reliable indicator of class performance and that GPAs provided a more effective method of determining a student's potential to complete a course successfully.

Introduction

At many colleges and universities a student must have completed one or more prerequisite courses before being allowed to enroll in most upper division courses (Martin, 1989). The Montana State University Horticulture Department implemented a system of prerequisites for its upper level courses in the Fall of 1911 (Nineteenth Course Catalog, 1911-1912), following the practice of other departments such as civil engineering that had a system of prerequisites in place by 1906 (Fourteenth Course Catalog, 1906-1907). This practice continues today under the same assumption that a systematic vertical integration of fundamental courses is required for successful completion of advanced upper level courses. This assumption is supported by the work of Doctor (1996), who reported that students who had completed prerequisites for general education

courses received significantly better grades in those courses than students that had not completed the prerequisites.

Other researchers have shown that criteria other than completion of prerequisites are better predictors of a student's successful completion of a course. For example, a student's grade point average (GPA) has been a known strong predictor of student success. Von Allmen (1996) found that students who received good grades in calculus and/or had high GPAs were more likely to excel in microeconomics, regardless of whether they had had all the prerequisites for the course. Royer et al. (1987) also reported that GPA and reading comprehension were useful predictors of performance for successful completion of courses. Krockover et al. (1987) reported that SAT scores, high school rank, and freshman GPA were all highly correlated with final grade point average of graduating college seniors. In a study designed to correlate completion of prerequisites with final grade in a senior-level elective course on agricultural price analysis, Martin (1989), after finding that 80% of the students had completed the prerequisite courses (which clouded the initial objective of the study), reported that a student's underclass GPA was a strong indicator of subsequent performance.

Enforcement of prerequisite completion is often difficult. Students may avoid taking prerequisite courses unless a system is emplaced to assure compliance. Kangas (1989) reported that prior to enforcement of prerequisite codes at a community college, 41% of students attempted to enroll in courses without having had the necessary prerequisites. Four years of prerequisite enforcement through a computer lock-out mode reduced that number to 2%. An informal survey of the colleges of agriculture at five U.S. universities indicated that enforcement of prerequisite codes varied widely and was non-existent in most cases. The University of Rhode Island (Englander, personal communication) has no computer-generated mechanism for confirming whether a student has had the necessary course prerequisites. Instead, the responsibility of screening falls to the instructor, who has the authority to allow potentially underprepared students into the class. Screening is difficult since there is no convenient method for determining whether the student has completed the prerequisites. North Carolina

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State University (Lane, personal communication), the College of Southern Idaho (Parker, personal communication), and Montana State University have systems similar to the University of Rhode Island. Ohio State University (Golembiewski, personal communication) has a computer lock-out mode that prevents potentially underprepared students from taking upper division courses.

Although it appears a logical and familiar conclusion, there is little data to support the supposition that successful completion solely of a number of prerequisites will lead to good grades in upper level courses. There may be better indicators of course success. Additionally, substantial numbers of students may "buck the system" and avoid taking prerequisites, putting additional pressure on conscientious students to complete the heavier, vertically-integrated course load. Thirdly, a number of universities have no system in place to enforce prerequisites. So the question arises, "Is the system of prerequisites in place solely because it is traditionally entrenched?"

The objective of our study was to determine if successful completion of prerequisite courses led to significantly better grades among horticulture majors at Montana State University.

Materials and Methods

The records of students enrolled in four horticulture courses in the Department of Plant, Soil, and Environmental Sciences at Montana State University were examined and each student's course grade and grade point average (GPA) extracted. The courses included "Site Development" (PSES 335), "Soil-Plant Nutrient Cycles" (PSES 351), "Arboriculture" (PSES 431), and "Landscape Architecture" (PSES 432). Instructors and course content remained the same over the period of this study. Each course had two prerequisites. Those for PSES 335 were "Trigonometry" (MATH 110) and "Planting Design" (PSES 331); for PSES 351, "Soil Resource" (PSES 201) and "General Chemistry II" (CHEM 132); for PSES 431, "Biology of Organisms" (BIOL 101) and "Planting Design" (PSES 331), and for PSES 432, "Planting Design" (PSES 331) and "Site Development" (PSES 335).

Letter grades were transliterated into numerical functions for ease of calculation. An "A" was assigned the number 4, "B" 3, "C" 2, "D" 1, and "F" 0. A 0.33 was subtracted for a minus grade while 0.33 was added for a plus grade. So, while a "B" was assigned a 3, a B+ was a 3.33 and a B- a 2.67.

Records for PSES 335 and PSES 351 were examined for three years (1995-1997) and those for PSES 431 and PSES 432 for six years (1991-1996). Student records were accessed through the university's computer system using the Student Information System (SIS) maintained by the registrar's office.

A total of 391 student transcripts were examined for 18 course-years. Data is presented as means and standard deviations and was analyzed for significant differences using the Students t-test.

Results and Discussion

The mean GPA in seventy five percent of the courses examined was higher for students who had completed all prerequisites than for those that lacked either one or both prerequisites (Tables 1 and 2). In two of the three courses the difference between groups was significant (Table 1). This might suggest that the more conscientious students who maintained better grades were more likely to have completed prerequisites, or that completion of the prerequisites led to better overall academic performance. Correlation and causation for this aspect cannot be deduced from this study.

The mean grades in the same seventy five percent of the courses were higher for students who had completed all prerequisites and who had the higher GPAs. The difference was significant in two out of three courses (Table 1). In the fourth course (PSES 431), neither grades nor GPA were significantly different among students who had and had not met all prerequisites (Table 2).

Students who had significantly higher GPAs also had significantly better grades in half the courses. Since those students also had met all prerequisites we were unable to conclude whether having a high GPA or having met all prerequisites was responsible for the higher grades. In the other half of the courses where there was no significant difference in grades and GPA among students who had and had not met the prerequisites, successful completion of prerequisites apparently made little difference in course grades. There was no significant difference in GPA or in grades between the two groups. We conclude that the better students (as indicated by higher GPA) generally received better grades in a course regardless of whether they had met all prerequisites.

The present system in many colleges and universities of imposing prerequisite courses upon students is difficult to enforce administratively and easily manipulated by students and faculty. Preliminary results from this study suggest that horticulture students at MSU were no more likely to receive better grades after having completed the necessary prerequisites than those that had not. In addition, students having higher GPAs were more likely to receive better grades regardless of prerequisite completion. Though more studies are needed, our preliminary findings suggest that GPA appears to be a better predictor of course performance than completion of prerequisites, which is in agreement with the findings of Von Allmen (1996), Royer et al

Table 1. Influence of pre-requisites on 300 level course performances in a horticulture curriculum at Montana State University.

Year	PSES 335				PSES 351			
	All Prereq.		0 or 1 Prereq.		All Prereq.		0 or 1 Prereq.	
	Grade	GPA	Grade	GPA	Grade	GPA	Grade	GPA
1995	2.87 N=53	2.99	2.58 N=13	2.59	3.78 N=19	3.25	2.77 N=10	2.41
1996	2.94 N=52	2.91	1.70 N=10	2.50	3.40 N=16	2.91	2.94 N=8	2.70
1997	3.10 N=19	2.93	1.67 N=6	2.62	3.51 N=22	3.06	2.85 N=8	2.34
Mean	2.97±0.12*	2.94±0.04***	1.98±0.52*	2.57±0.06***	3.56±0.20***	3.07±0.17*	2.85±0.09***	2.48±0.19*

*, **, *** Significant at the 0.05, 0.01, and 0.001 probability level, respectively. Comparisons are made between like categories within courses.

Table 2. Influence of pre-requisites on 400 level course performances in a horticulture curriculum at Montana State University.

Year	PSES 431				PSES 432			
	All		0 or 1		All		0 or 1	
	Grade	GPA	Grade	GPA	Grade	GPA	Grade	GPA
1991	3.00 N=5	2.85	3.50 N=4	3.49	-----	-----	3.25 N=8	2.95
1992	2.42 N=10	2.90	2.46 N=6	2.70	3.20 N=6	2.90	3.50 N=2	3.09
1993	3.00 N=9	2.86	-----	-----	3.28 N=5	2.92	2.00 N=1	2.73
1994	3.10 N=18	3.10	3.00 N=1	3.46	3.28 N=8	2.83	-----	-----
1995	2.80 N=18	2.94	2.00 N=2	2.45	3.52 N=12	3.00	3.00 N=2	2.19
1996	3.00 N=22	2.79	3.60 N=1	3.77	3.24 N=14	2.81	3.60 N=1	2.76
Mean	2.89±0.25 ^{NS}	2.91±0.11 ^{NS}	2.91±0.61 ^{NS}	3.17±0.51 ^{NS}	3.32±0.11 ^{NS}	2.89±0.07 ^{NS}	3.18±0.58 ^{NS}	2.83±0.31 ^{NS}

^{NS} Not significant at the 0.05 probability level. Comparisons are made between like categories within courses.

(1987), Krockover et al (1987) and others.

We suggest that, at least for horticulture classes at Montana State University, the present system of requiring prerequisites be re-evaluated. This study suggests that prerequisites for some courses in the horticulture curriculum may be unnecessary in preparing students for satisfactory performance in upper level courses. Assuming there is still some value, however, to a vertical integration of courses, we suggest that those courses now listed as "prerequisite" be redesignated as "recommended" and students strongly urged, but not required, to take them. A question that might be asked correlative to this study is "Why are prerequisites not serving the desired purpose of boosting grades?" Have we overly simplified prerequisite courses, or have we diluted our primary courses to the point where vertical course integration is no longer necessary? An indepth historical study which reviews the same courses over a very long time where course content and rigor have changed should aid in determining whether our courses have been diluted.

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Machinery Management for Agro-Ecosystems: A Non-Traditional Approach to a Traditional Topic

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Abstract

A traditional agricultural machinery management course was restructured to meet the needs of traditional and non-traditional students in the College of Agriculture and Life Sciences at Mississippi State University. The new course embraced the basic principles of a traditional agricultural machinery management course while

applying them to a broader audience. Prominent components included using computers as a problem solving tool, incorporating a class Web site for enhanced instruction, using MS PowerPoint presentations in lecture, and using hands-on problem-based laboratory exercises. The new course has been taught three times with an average enrollment of 17 students. This is three times the average enrollment for the previous eight-year period. Student Evaluation of Teaching written comments and category ratings have been exceptional with an average score of over 4

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