Impact of Student Background Characteristics on Performance in an Introductory Forage Crops Management Course[1]

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Abstract

Traditional student performance indicators such as age, gender, and socioeconomic status are important to understanding how students' background characteristics impact success at the collegiate level. However, student success in courses related to agriculture sciences and/or natural resource sciences may be related to both traditional and non-traditional performance indicators, including background in agriculture. The objective of this study was to determine the impact of academic major, class rank, gender, rural or urban background, and agricultural field experience on performance in an undergraduate level introductory forage crop management course. The study was conducted over five semesters from 2002-2004 at the University of Nebraska Lincoln. Juniors and seniors scored 5% higher ($P<0.1$) than sophomores and 15% higher ($P<0.1$) than freshmen in both the lecture and laboratory sections of the course. Students majoring in Mechanized Systems Management and Agricultural Economics had a 5% and 7% lower ($P<0.1$) score, respectively, in the lecture and laboratory sections of the class. Students from a rural background with field experience in agriculture had 10% higher ($P<0.1$) scores in lecture than did students with no field experience in agriculture. Developing prerequisite coursework to familiarize inexperienced students with basic agricultural production systems may help improve overall performance in these introductory courses.

Introduction

Understanding the impact student background has on performance in college is a key topic for improving teaching methods and educational curricula. Most studies emphasize age, gender, socioeconomic status, past studies, aptitude, and high school performance as predictors of course performance (Seigfried 1979, Heath 1989, Tay 1994, Lage and Traglia 1996, and Dynan and Rouse 1997). However, in agricultural and natural resource education, performance may be better predicted by using other student background characteristics as performance indicators (Cole and Fanno 1999, Wildman and Torres 2002). In addition to personal characteristics, students of agriculture and natural resources that lived on a farm or ranch may have a perceived advantage over students that lived in an urban setting in courses related to these topics (Greene and Byler 2004). Similarly, students that may not have been raised in a rural setting, but spent considerable time working on a grandparent's or other relative's farm or ranch may have an edge over students with no practical farm or ranch experience in agriculture production-related courses.

Demographics of enrollment in the College of Agriculture and Natural Resource Sciences at the University of Nebraska are changing from students with a rural background to an increasing number of students from an urban background (Diechert 2004). This change may render some current introductory curricula as too advanced for students from urban backgrounds with no concept of agricultural production systems (Dyer et al. 1999). Understanding what impact a student's background has on their performance in agricultural production courses may be important for future academic planning and restructuring of academic curriculum in the College of Agriculture and Natural Resources to meet the needs of students with little understanding of agricultural systems. The objective of this study was to determine the relative impact and the importance of having a rural background or practical field experience in agriculture on performance in an introductory forage crops and range management course.

Methods

Course Description

The prerequisite coursework for AGRO/RNGE 240, Forage Crops and Range Management course at the University of Nebraska - Lincoln is a course in introductory plant science or a course in general biology. The Forage Crops and Range Management course is divided into a lecture section and three laboratory sections ranging in size from 10 to 20 students in each of two semesters per year. The lecture section is composed of nine lesson units and specific objectives are supplied to students for each unit and assessment testing is based on these objec-

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tives. Assessment of the lecture portion of the course is accomplished by three, one-hour examinations and a final comprehensive examination at the end of the semester. Hour exams consist of one-half multiple-choice questions and one-half essay questions (equally weighted) pertaining to material in unit lessons previously covered. Subsequent hour exams are based on material covered since the previous hour exam. The final examination is comprehensive and covers all material discussed over the course of the semester. The final exam also is composed of one-half multiple-choice questions and one-half essay questions. No laboratory material is assessed by examinations in the lecture portion of the class.

The laboratory portion of the course is divided into two, seven week sessions. The first session consists of seven weekly laboratory lessons related to practical forage management concepts. Assessment for each laboratory lesson is accomplished by a weekly quiz at the beginning of each lab period. The laboratory quiz covers material from the previous week's laboratory lesson and is composed primarily of identification of subject matter, short answer questions pertaining to subject matter, and/or calculations. During the second seven-week session of the laboratory, students in each section are divided into groups of three to work on the final laboratory project. The objective of the final laboratory project is for students to apply production concepts learned throughout the course to a simulated case study. The final project consists of the determination of a livestock-forage balance for forage-based livestock production simulation scenarios in Nebraska.

The livestock-forage balance acts as a model for a forage-based livestock production operation. This model is composed of three parts: 1) students are asked to inventory, calculate, and determine the amount of forage available (forage supply) for feeding livestock in the operation, 2) students calculate the number of livestock (livestock demand) that can be carried in the operation based on the forage supply, and 3) students adjust the forage supply and livestock demand to determine the appropriate supply-demand balance that results in a realistic, sustainable plan for feeding livestock that optimizes utilization of forage resources in a cost effective manner. At the completion of the project, students write a report on their forage balance project that presents each piece of the project and the effectiveness of their project in optimizing utilization of available resources. Students then present their report orally to the class. Students are graded on their written report as a group, their oral presentation as a group, and their individual participation in the oral presentation for a total of three grades for the laboratory final project. The laboratory project counts for 35% of the laboratory grade and the overall laboratory average counts for 30% of the overall course grade.

Data Collection

Student background information was collected over five semesters from fall 2002 to fall 2004. At the beginning of the semester, the entire class is given a personal information card in which they are asked to give information about themselves and their general agricultural background. Specific information taken from this card is: 1) academic major, 2) class rank, 3) gender, and 4) a description of the student's agricultural background and experiences. From the description given by students pertaining to their individual agricultural background and experiences, it is determined whether; 1) the student grew up in a rural or urban community, 2) the student is from a farm or ranch or not from a farm or ranch, and 3) whether the student has any field experience with livestock, grain crops, both, or no agricultural experience, independent of whether the student grew up in a rural or urban community. Many agricultural students from urban communities are only a generation or less removed from the farm or ranch. Therefore, they may have agricultural field experience from helping on their grandparents or other relative's farm or ranch, but did not grow up on a farm or ranch themselves. This personal background information was then matched with performance data from the described course so that student's background characteristics could be tested as an indicator of performance in different elements of an agricultural-based class.

Statistical Analysis

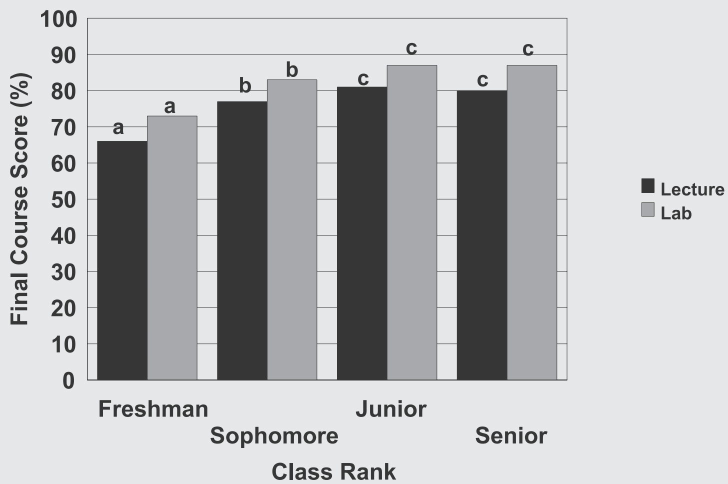
The experiment was analyzed as a completely randomized design with five replications. Class rank, academic major, gender, farm or ranch background, and farm or ranch experience were tested as main effects. Analysis of variance procedures (ANOVA) were conducted using the Statistical Analysis System with the mixed procedure (SAS Inst., 1995; Littel et al., 1996). Interactions between main effects were tested at the ($P<0.1$) level. When interaction effects were not different, main effects were tested at the ($P<0.1$) level. The (PDIFF) option in SAS was used to separate means when ANOVA showed significant ($P<0.1$) treatment effects.

Results and Discussion

Over the five semesters included in this experiment, a total of 165 students completed the course. Students from twelve different academic majors enrolled in the course including: Agricultural Economics (n=23), Agricultural Education (n=14), Animal Science (n=14), Agronomy (n=39), Diversified Agricultural Studies (n=23), Grazing Livestock Systems (n=14), Mechanized Systems Management (n=20), and Natural Resource Sciences (n=18). All class ranks (Freshman (n=21), Sophomore (n=24), Junior (n=67), Senior (n=53)) were present in the course.

Final grades for the lecture and laboratory portions of the class increased (P<0.1) as class rank increased from freshmen to juniors (Figure 1). Final lecture and laboratory scores were not different (P>0.1) between juniors and seniors. Burger and Seif (1975) also reported freshman to have the lower course scores than sophomores, juniors, and seniors in a beginning crop science course. Overall, most studies indicate that the impact of class rank on course performance suggests more mature students are generally more successful; or that there is a positive relationship between age, used as a proxy for maturity, and performance (Watts and Lynch 1989, Tay 1994, Douglas and Sulock 1995).

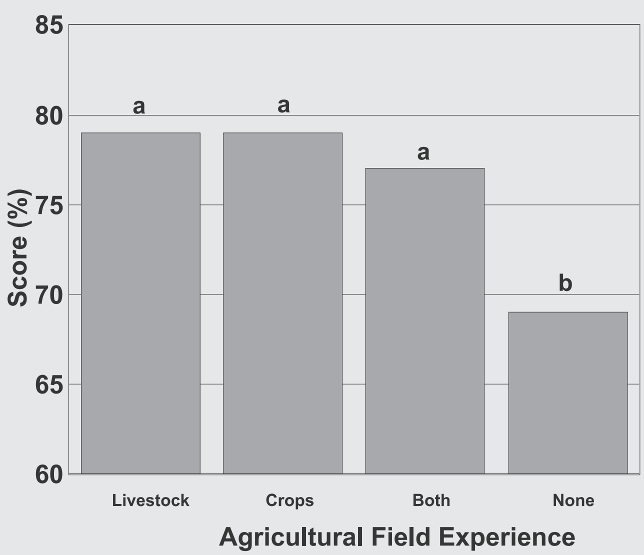
Figure 1. Impact of class rank on final lecture section scores and final laboratory section scores over five semesters from 2002-2004.



[ab] Different letters within class rank indicate differences at the (P<0.1) level.

Number of students in each class are: Freshman = 21, Sophomore = 24, Junior = 67, Senior = 53.
SEM for Lecture: Freshman = 2.6, Sophomore = 1.6, Junior = 2.2, Senior = 1.7. SEM for Lab: Freshman = 2.5, Sophomore = 1.2, Junior = 1.7, Senior = 1.3.

Figure 2. Impact of agricultural field experience on final lecture section scores over five semesters from 2002-2004.



[ab] Different letters indicate differences at the (P<0.1) level.

Number of students in each category are: Livestock = 24, Crops = 57, Both = 49, and None = 35.
SEM: Livestock = 3.4, Crops = 3.1, Both = 3.1, None = 3.1

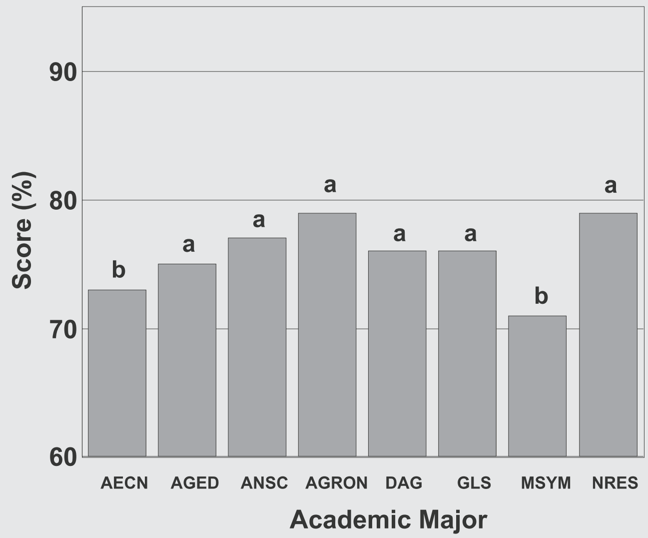
Male students composed 85% and females composed 15% of the total class enrollment over the five semesters of this study. Gender did not have an impact (P>0.1) on final lecture score or laboratory score although females scored an average of seven percentage units lower (P<0.1) than males in the oral presentation of the final laboratory project.

Students with farm/ranch field experience (n=130) had higher (P<0.1) final lecture scores than students with no field experience (n=35), regardless of whether field experience was with livestock (n=24), grain crops (n=57), or both (n=49) (Figure 2). Students with field experience in agriculture likely can put much of the conceptual information presented in the lecture portion of the course into context, giving them an advantage over students with no agricultural field experience. Students without field experience likely have to establish their conceptual framework rather than benefit from past experience. This may put them at a disadvantage when expected to apply concepts to agricultural production situations. This could have large implications for introductory agriculture classes with an increasing number of students with no practical agricultural experience. Instructors may have to include supplemental material or add sections on basic agricultural systems within their courses to provide these students with opportunities to fully understand these systems prior to introducing course materials. This certainly would come at a cost of time and efficiency within the class as basic agricultural systems lesson units would result in the deletion of lesson units already in place and would affect the depth and breadth of objectives. Students with agricultural backgrounds also may become disenfranchised as too much time is spent on basic agricultural systems.

Agricultural field experience also had an impact on students' scores for the final laboratory project group grades. Student groups in the laboratory that had field experience in agriculture had four percentage units higher (P<0.1) scores for the final laboratory project than students groups that lacked field experience in agriculture. Laboratory instructors assigned students to groups at the beginning of the laboratory final project with the intent of mixing students with agricultural field experience with students that lacked field experience. Although integrating students with different levels of field experience likely is important to optimizing learning opportunities in the classroom, apparently this alone is not sufficient. Student groups containing one or more students with no practical field experience in agriculture generally had lower group project scores than groups in which all students had agricultural field experience. When conducting group activities, attention should be focused on non-experienced students. Although supplemental materials on basic agricultural systems in Nebraska are available to students in their laboratory textbook, more help may need to be provided in terms of assessment and support to bring these student groups' performance to the level of groups containing members with field experience.

Students in Agricultural Economics and Mechanized Systems Management majors had the lowest ($P<0.1$) lecture scores of all the majors represented in the course (Figures 3 and 4). Agricultural Economics, Mechanized Systems Management, and Diversified Agricultural students had the lowest ($P<0.1$) final laboratory scores. The fact that students in Agricultural Economics and Mechanized Systems Management majors had the lowest laboratory scores is not surprising since most students (n=35) with no agricultural background are represented by these two majors. These results suggest that students from non-agriculture majors should be required to complete prerequisite materials before enrollment into introductory agriculture courses, unless the course is especially equipped to handle students with little to no background in agriculture. Diversified Agricultural majors however, had agricultural field experience and would be expected to perform well in the laboratory section of the course. Why these students score lower than other majors in the laboratory section of the course is unclear.

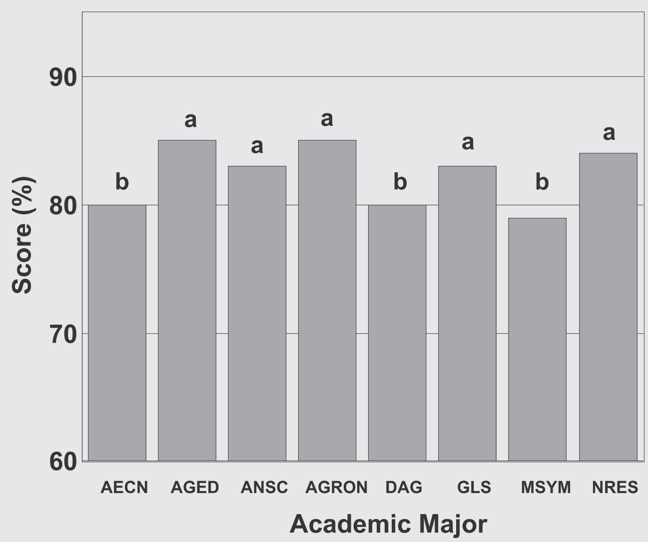
Figure 3. Impact of academic major on lecture section scores over five semesters from 2002-2004.



[ab] Different letters indicate differences at the ($P<0.1$) level.

AECN = Agricultural Economics (n=23) (SEM = 2.3), AGED = Agricultural Education (n=14) (SEM = 2.4), ANSC = Animal Science (n=14) (SEM = 2.1), AGRON = Agronomy and Horticulture (n=39) (SEM = 2.0), DAG = Diversified Agriculture (n=23) (SEM = 2.2), GLS = Grazing Livestock Systems (n=14) (SEM = 2.6), MSYM = Mechanized Systems Management (n=20) (SEM = 2.5), NRES = Natural Resource Sciences (n=18) (SEM = 4.2).

Figure 4. Impact of academic major on laboratory section scores over five semesters from 2002-2004.



[ab] Different letters indicate differences at the ($P<0.1$) level.

AECN = Agricultural Economics (n=23) (SEM = 2.4), AGED = Agricultural Education (n=14) (SEM = 2.5), ANSC = Animal Science (n=14) (SEM = 2.2), AGRON = Agronomy and Horticulture (n=39) (SEM = 2.2), DAG = Diversified Agriculture (n=23) (SEM = 2.3), GLS = Grazing Livestock Systems (n=14) (SEM = 2.5), MSYM = Mechanized Systems Management (n=20) (SEM = 2.5), NRES = Natural Resource Sciences (n=18) (SEM = 4.9).

Summary

Class rank and field experience in agriculture appeared to be associated with performance in this introductory forage crops and range management course. Students with a higher class rank or field experience in agriculture performed better in both the lecture and laboratory sections of the class than younger students or students with no agricultural background. Although gender of students did have an impact on performance in the oral presentation of the laboratory projects, gender did not appear to be associated with overall performance in this introductory forages course. Academic major of students had an impact on performance in the lecture and laboratory sections of the course because, it appeared to be related to lack of agricultural field experience.

This study may indicate that the current prerequisite courses are not adequate substitutes for understanding agricultural production systems. It appears that there is a need for the development of additional prerequisite coursework and materials for students with no agricultural field experience. Additional prerequisites likely will need to fully introduce the inexperienced student to the most basic concepts of agriculture from a production systems approach to increase the scope of instruction beyond that of which is covered in an introductory plant or animal science course. The objectives of this type of prerequisite coursework should focus on establishing the conceptual framework and providing a context of agricultural production systems into which the student can apply the more in-depth concepts and principles of the current introductory science courses. Once the student has a context in which to apply concepts and principles, interest in the subject area and subsequent performance may increase to the level of students with agricultural field experience. Requiring additional perquisite coursework, as opposed to including basic production agriculture material in the current introductory courses allows flexibility for instructors to waive the prerequisite coursework for students that are already familiar with these types of production systems and to avoid diluting current introductory course objectives.

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