

Relation of Ethnicity and Gender to Academic Performance in an Introductory Soils Course



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Abstract

On a national scale, college success levels differ between Hispanics and non-Hispanics and between males and females. I conducted a study to determine if such disparity exists within a course taught primarily to agriculture students at a dominantly Hispanic university, and if so, what components of course performance contributed most to the disparity. I analyzed student performance data from an introductory soils course by factorial ANOVA with gender and ethnicity as factors. Through a 10-year period Hispanic students earned significantly ($P < 0.01$) lower course scores than non-Hispanic students. Gender differences for this period were marginal ($P = 0.06$). Considering student performance in the course format in use for the last four years, Hispanic students scored significantly ($P < 0.01$) lower in the course and on most components comprising the overall course grade. Differences related to gender were not significant. The highest performing student group, by all measures of performance, was non-Hispanic females, followed by non-Hispanic males, then Hispanic females, and lastly Hispanic males. Correlation analysis indicated that course scores were more sensitive to points earned on assignments than to other factors. Non-Hispanics, and especially non-Hispanic females had higher rates of assignment submission than other groups. Strategies to improve student engagement in assignments and other components of learning may improve student performance in courses such as the course described here.

Introduction

Hispanics are the largest minority in the U.S., and their numbers are growing rapidly (US Census Bureau, 2007). In many regions Hispanics comprise a majority of the population, as is the case in south Texas where the student body at Texas A&M University-Kingsville was 60% Hispanic in Fall Semester of 2006 (TAMUK, 2007). The six-year graduation rate for Hispanic students was 30.4% in 2005-2006, as compared to 37.4% for white non-Hispanics (TAMUK, 2007). Nationwide, Hispanic graduation rates from four-year college programs fall far below those of white students. Even well prepared Hispanics attending the same kind of schools as their white peers have lower graduation rates (Fry, 2004). As policymakers search for remedies to this education gap, Hispanic students fall still further behind white students by some performance measures (Fry, 2005).

Unlike Texas A&M-Kingsville as a whole, a majority of the students enrolled in the agriculture

programs at the university are non-Hispanic. A study intended to identify major differences between Hispanic and white non-Hispanic agriculture students at the university unexpectedly demonstrated striking similarities. Family backgrounds were similar, as were personality traits and values. Of an array of traits comparing Hispanic and white student populations, the higher value placed by whites on sense of humor was the only significant difference between groups (Perez, 1999). To further explore any ethnic disparity in course performance, the primary objective of the present study was to determine whether or not performance in an introductory soils class differs for Hispanic and non-Hispanic students, and if so, to determine which components of course performance accounted for the difference. The course studied here is unique in that it serves a predominantly white clientele in a predominantly Hispanic university and region.

In the United States the gender difference in student performance is enigmatic. Although males tend to earn higher SAT and ACT scores before college and higher salaries after college, females tend to earn higher grades in college and to graduate in greater numbers than males (FairTest, undated; Peter and Horn, 2005). Consistent with the national norm, Texas A&M-Kingsville awards more degrees to females than to males. To evaluate any gender disparity, a second objective of the present study was to determine whether or not performance in the introductory soils class differs for male and female students, and if so, to determine which components of course performance accounted for the difference.

Methods

The course studied was Principles of Soil Science (PLSS 3410) offered each Fall Semester at Texas A&M-Kingsville. The course is required for most agriculture majors; and students of the various natural sciences may take the course as an elective. This junior-level course includes three hours of lecture per week plus multiple sections of two hour labs. As the course instructor, I evaluate all exams and miscellaneous projects. The lab instructor, either a graduate student or myself, evaluates lab assignments. Lab and lecture points are compiled into one overall percentage from which I assign a course grade for each student.

I compiled student performance data from ten years of records, collected from fall 1997 through fall 2006. For the last four years (2003 through 2006) the course format differed from the previous six years.

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The later course format includes a course website, and a daily assignment from which students can earn three extra-credit points if they choose to participate. I initiated the extra-credit program to encourage classroom attendance, which had declined with the inclusion of lecture notes on the course website, and to encourage student engagement in the lectures.

I analyzed student performance, as measured by overall course scores of 505 students, for the 10-year period as a factorial ANOVA (Statistix 8, 2003). Factors considered were gender and ethnicity (Hispanic vs. non-Hispanic), as determined in most instances by student surname. The year of course offering was treated as a block factor. I similarly analyzed student

performance for the last four-year period, including records of 244 students: 111 non-Hispanic males, 70 Hispanic males, 38 non-Hispanic females, and 25 Hispanic females. During this four-year period all non-Hispanic students enrolled in the course were white. Graded activities contributing to the overall score for

the four-year period were a final exam, three midterm exams, various class assignments, and daily extra credit tasks. The final exam was not counted for this study because graduating seniors were exempted from taking the exam. The midterm exams were combinations of objective and subjective questions, including true-false, multiple-choice, definitions, short-answer, and calculations. Most of the assignments were lab reports, but occasionally homework related to the textbook (Gardiner and Miller, 2004) was assigned. The extra-credit tasks earned points for participation, not quality. These tasks included such activities as offering opinions, writing test questions from the lecture material, and providing feedback on subject matter mastery. To provide insight to the reasons for differing performance among student groups, I conducted a separate ANOVA for each of the three major components of students' grades, i.e., extra credit, assignments, and midterm exams. I conducted regression analyses (Statistix 8, 2003) to determine which of these factors correlated most strongly to overall student performance.

Results and Discussion

In the 10-year study, Hispanic vs. non-Hispanic

Table 1. Analysis of variance for overall course scores, 10-year and 4-year studies

| Source | df | Mean Square | P Value |
|--------------------|-----|-------------|---------|
| 10-year study | | | |
| Year | 9 | 309 | |
| Ethnicity | 1 | 1920 | <0.001 |
| Gender | 1 | 546 | 0.062 |
| Ethnicity X Gender | 1 | 219 | 0.236 |
| Error | 492 | 156 | |
| 4-year study | | | |
| Year | 3 | 251 | |
| Ethnicity | 1 | 1308 | 0.005 |
| Gender | 1 | 228 | 0.241 |
| Ethnicity X Gender | 1 | 162 | 0.323 |
| Error | 237 | 165 | |

Table 2. Student course performance indicators, means of overall and individual components, 4-year study

| Student Group | 10-year overall Score (%) | Overall score (%) | Extra credit points | Midterm exam score (%) | Assignment points | Assignment submission (%) |
|---------------------|---------------------------|-------------------|---------------------|------------------------|-------------------|---------------------------|
| 4-year | | | | | | |
| Non-Hispanic | 83.7a ^z | 84.6a | 49a | 68.3a | 113a | 93a |
| Hispanic | 79.0b | 79.1b | 47a | 65.0b | 106b | 88b |
| Female | 82.6a | 83.0a | 48a | 67.3a | 112a | 92a |
| Male | 80.1b | 80.7a | 48a | 66.0a | 106a | 89a |
| Non-Hispanic Female | 85.8a | 86.7a | 50a | 69.0a | 118a | 96a |
| Non-Hispanic Male | 81.7b | 82.5ab | 48a | 67.7a | 108b | 89b |
| Hispanic Female | 79.4bc | 79.2b | 47a | 65.7a | 106b | 88b |
| Hispanic Male | 78.5c | 79.0b | 46a | 64.3a | 105b | 88b |

^zWithin a comparison group, values in a column not followed by the same letter are significantly different by LSD_{.05}.

ethnicity significantly ($P < 0.001$) affected overall course scores (Table 1). Effects of gender were marginal ($P = 0.062$) by factorial ANOVA, but gender means were significantly different ($P < 0.05$) by LSD. No interaction was observed between ethnicity and gender. Table 2 shows mean overall scores for each demographic group.

Considering only the last four years, ethnicity significantly ($P = 0.005$) affected overall course scores. Effects of gender were not significant, and no interaction was observed between ethnicity and gender (Table 1). For this time period the individual components contributing to the overall course score were analyzed separately. Results of mean comparisons from that analysis are presented in Table 2. For all components other than extra-credit points, mean comparisons of the two ethnic divisions show higher scores or points earned for non-Hispanic students. Non-Hispanics also had a significantly higher rate of assignment submission. Main effects of gender were not significant for any component. Mean comparisons for gender within ethnic groups are presented in Table 2. For every measure, the highest scores were earned by non-Hispanic females, followed in descending order by non-Hispanic males, Hispanic females, and Hispanic males.

Relation of Ethnicity

Table 3. Correlations (R^2 values) and their significance (P values) between overall course score and individual course components or demographic factors, 4-year study

| Component or factor | R^2 value | P value |
|-----------------------|-------------|---------|
| Assignment Score | 53% | <0.001 |
| Exam Score | 43% | <0.001 |
| Assignment Submission | 41% | <0.001 |
| Extra Credit Points | 27% | <0.001 |
| Ethnicity | 2% | 0.017 |
| Gender | 1% | 0.131 |

Correlating course components and demographic factors to overall course scores (Table 3) showed that the strongest indicator of overall score was assignment score ($R^2 = 53\%$), which was strongly linked ($R^2 = 74\%$) to the percentage of assignments turned in.

The gender and ethnic disparities observed here are consistent with national norms. One intriguing outcome was that course scores were more sensitive to ethnicity than to gender, as indicated by the observation that non-Hispanic males consistently performed better than Hispanic females. This explains why gender main effects were not significant. However, within each ethnic group, females outperformed males. An unexpected outcome was that Hispanic students earned fewer points than non-Hispanic students in every category contributing to the overall course grade. Although the Perez (1999) study failed to identify factors that would significantly influence an ethnic performance disparity among agriculture students, such factors appear to be present. Fry (2004) identified impediments to college success that are more frequently faced by Hispanics than whites, including financial responsibility for family members, and living with family rather than on campus. These factors may contribute to lower attendance rates, which may account for the lower assignment submission rates. Perhaps the greatest utility of these findings is that much of the ethnic disparity may be manageable. Hispanics submitted slightly less extra credit work—a problem that can be corrected by taking advantage of extra credit opportunities offered to those in attendance. More importantly and perhaps as readily correctable is that Hispanics turned in significantly fewer assignments. Teaching practices that increase student engagement typically improve overall student performance (Astin, 1993). The findings described here suggest that teaching practices that increase student engagement in in-class tasks and in lab or out-of-class assignments may be particularly beneficial for Hispanic students.

Summary

In an introductory soils course Hispanic students scored significantly lower than non-Hispanic students during a 10-year period. Considering student performance in the course format as used for the last four years, Hispanic students scored significantly lower in the course and on most components comprising the

overall course grade. The highest performing student group was non-Hispanic females, while the lowest performing group was Hispanic males. Overall course scores were most sensitive to points earned on assignments. Non-Hispanics and especially non-Hispanic females had higher rates of assignment submission than other groups. Demonstrating the impact of class assignments on overall course scores, and employing other strategies to increase student engagement, may improve student performance in courses such as the course described here.

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