Factors Associated with Student Success in an Introductory Plant Science Course

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Abstract

It is important to understand those factors that determine whether a student will excel or struggle in their university studies. A study was conducted to determine the characteristics that influence students' course performance and how student study habits change during the semester in order to facilitate better course performance in a plant science course at Oklahoma State University. The descriptive-correlational study was based on data collected from students enrolled in a plant science course at the beginning and end of the semester as part of a larger study. A total of 107 students participated in the study. Most students were freshmen animal science majors enrolled in the course as part of their degree requirements. Student study and exam preparation time increased over the course of a semester, while course attendance decreased. Student characteristics associated with a high grade in the course were: ACT score, semester GPA, sex, class attendance, and age. Recommendations for future students based on these observations include attending class regularly and studying course content at least three hours each week.

Introduction

For many institutions, high standards on college entry examinations ensure, to a degree, that only the best and brightest students are accepted. As such, it is important to determine why some students thrive and succeed in college and others struggle and eventually drop out of college altogether (Zusho et al., 2003). One reason may be that, in general, "Many students seem to be poor judges of their likely performance on pending examinations" (Stinson and Zhao, 2008, p. 33). Another reason students fall short of their potential intellectually is because of a lack of self-discipline (Duckworth and Seligman, 2005). Students must have initiative and persistence regarding their coursework in order to succeed academically. Past studies have shown that self-discipline is a major factor related to academic performance. Specifically, Wolfe and Johnson (1995) noted that self-discipline was a strong predictor of students' grade point average (GPA). Tangney et al. (2004) found that a strong relationship existed between college students' self-discipline and their final grades in the course.

Further, McKenzie and Schweitzer (2001) found that students' prior academic performance, level of self-efficacy, and employment status were predictive of grades attained at the university. Pantages and Creedon (1975) supported the notion that past academic performance (i.e., high school GPA; high school rank) is the best predictor of future success. Additionally, the authors noted that students' study habits, or lack thereof, can be predictive of academic success or failure in college. Further, Remer (1993) concluded that large, required courses likely have higher rates of absenteeism than smaller, upper-level courses.

At Oklahoma State University (OSU) PLNT 1213 is a course offered to students as part of the core curriculum of the college and therefore is a required or controlled-elective course for students in many majors. However, not all students within the College are expected to take PLNT 1213. In some majors, this course is listed as an elective. Wachtel (1988) noted that the "electivity" of a course can influence students' perceptions regarding the utility of the course. In fact, Wachtel hypothesized that students have a lower inherent interest in "required" courses and therefore rate the course and instructor more poorly than "elective" courses.

Conceptually, this study was framed on the self-determination theory of motivation (Ryan and Deci, 2000). Self-determination is based upon an individual's motivation, personality, and level of self-regulation (Ryan and Deci, 2000). People who are internally motivated have higher levels of self-efficacy and are more interested, passionate, and resilient about achieving a particular task, which leads to better persistence and performance overall (Deci and Ryan, 1991). In contrast, people who are extrinsically motivated are urged by fear and the thought of being exposed if they do not perform up to standard (Ryan and Deci, 2000). Therefore, self-determination (i.e., study habits and attendance) may contribute to students' performance and end-of-semester grades.

The purpose of this study was to determine the characteristics that influence students' course performance and how study habits of students change during the semester in order to facilitate better course performance by students in a plant science course at OSU. The following objectives guided the study.

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1. Describe the personal characteristics of students enrolled in PLNT 1213.

2. Describe the academic characteristics of students enrolled in PLNT 1213.

3. Describe participants' final grades and semester GPAs based upon taking PLNT 1213.

4. Describe class attendance and study habits of students enrolled in PLNT 1213.

5. Describe changes on time students spent studying throughout the semester in PLNT 1213.

6. Describe the relationship between reported participant characteristics and final grades in PLNT 1213.

Methods

This descriptive-correlational study relied on data collected from students enrolled in a plant science course (PLNT 1213) in the College of Agricultural Sciences and Natural Resources (CASNR) at Oklahoma State University (OSU) in spring 2010. Data presented in this manuscript were collected at the beginning and end of the semester as part of a larger study to assess students' academic characteristics, motivation related to the course, and involvement (Institutional Review Board project AG-10-7). The instrument used for the study was adopted from the Expectancy-Value measurement originally developed by Wigfield and Eccles (2000) and later adapted by Eklöf (2006). Because this research is part of a larger study, only portions of the Expectancy-Value measurement were used. The questions presented in this manuscript included questions with open-ended responses (e.g., "How many hours do you study each week?") and categorical responses (e.g., "Have you taken this course previously?"). Prior to its administration, the instrument was evaluated by a panel of teaching faculty to ensure face and content validity. The questionnaire was administered twice during the spring 2010 semester – once by an undergraduate assistant at the beginning of a lecture period in February and later by a departmental staff member in April. Only those students who remained enrolled throughout the semester were considered for the study. In all, 107 students participated in the study with 56 students responding during both evaluations.

Data were analyzed using Statistical Analysis Software v 9.2 using the CORR and FREQ procedures (SAS, 2008). Descriptive statistics and correlations were used by the researchers to describe and explain the population of the study more fully (Davis, 1971; Miller, 1994).

Results and Discussion

Objective one sought to describe the personal characteristics of students enrolled in the study. Because PLNT 1213 is an introductory-level course required for many students in CASNR, the student population of this course is more diverse than in other courses in the college. Almost three-fourths of these students were born between 1989-1991, indicating that they were between 19 and 21 years of age (Table 1). Of these students, a majority (92%) identified themselves as white, with the remaining 8% selecting American Indian/Alaska Native or Hispanic as their ethnicity. The 92% of white students who participated in the study were in excess of the 82% of students campus-wide (OSU Institutional Research and Information Management). Further, two-thirds (66%) of the students were female, in comparison with 50.4% in CASNR and 48.5% within OSU Intuitional Research and Information Management).

Table 1. Personal Characteristics of Students (N=107) Participating in the Study

Characteristic	Frequency	Percent
Age (year of birth)		
1991	26	24.30
1990	30	28.04
1989	23	21.50
1988	18	16.82
<1988	10	9.35
Race		
white	98	91.59
American Indian	7	6.54
Hispanic	2	1.87
Sex		
male	36	33.64
female	71	66.36
Marital status		
single	106	99.07
married	1	0.93

Objective two was to describe the academic characteristics of students participating in the study. Most of the participants (67%) were classified as either freshmen or sophomores (Table 2). The majority of participants were animal science majors (60%), many of whom also indicated they were in the pre-veterinary option (data not shown). Participants majoring in degree programs associated with the agricultural education, communications, and leadership department and the agricultural economics department each accounted for more than 10% of the respondents. Fewer than 5% of the participants were majoring in any other degree program, including plant and soil sciences. Greater than 95% of the respondents reported taking the course as a degree requirement for their academic major. Self-reported ACT scores ranged from 16 to 34. Seventy-seven

Table 2. Academic Characteristics of Students (N=107) Participating in the Study

Characteristic	Frequency	Percent
Classification		
freshman	42	40.00
sophomore	28	26.67
junior	26	24.76
senior	9	8.57
Major		
agribusiness	7	6.60
agricultural communications	12	11.32
agricultural education	7	6.6
agricultural leadership	3	2.83
agricultural economics	5	4.72
animal science	64	60.38
plant and soil sciences	3	2.83
animal sci. double major	3	2.83
other	2	1.89
Reason for taking the course		
required	101	95.28
controlled elective	3	2.83
free elective	2	1.89
Previous enrollment		
yes	5	4.67
no	102	95.33
ACT score		
>29	5	5.21
25-29	32	33.33
20-24	42	43.78
<20	17	17.17

percent self-reported scoring between a 20-29 on the ACT, while five reported scoring above a 29 (Table 2). The mean ACT score reported by participants in the study was 23.7. This score is more than one point less than the average ACT score (24.8) for all freshmen entering Oklahoma State University between 2006 and 2009 (OSU Institutional Research and Information Management).

Objective three sought to describe participants' final grades in the course and semester GPAs (taken from student records; "A" = 4.0) based upon taking PLNT 1213. Actual final grades for students participating in the study ranged from "A" to "F", with only 9% of participants earning a "D" or "F" (Table 3). Nonetheless, the most fre-quently earned grade was an "A" for students participating in the study (43%). Seventy-five percent of the participants in this study earned a grade of "B" or better. This finding is in excess of the average GPA per semester, where only 60% of the

students earned a 3.00 ("B") or higher during the spring 2010 semester. The mean final GPA of partici-pants participating in the study was 2.96 (data not shown).

Objective four sought to describe class atten-dance and study habits of students enrolled in PLNT 1213. Most students (98%) who participated in the study indicated they attended class all three days each week (Table 4). However, fewer participants (87%) indicated that their friends attended class all three days each week. Class attendance is not required; however it is rewarded with opportunities to earn points on in-class activities and assignments.

Table 3. Participants' (N=107) Final Course Grades and Semester Grade Point Averages

Characteristic	Frequency	Percent
Grade Earned in course[z]		
A	46	43.40
B	33	31.13
C	18	16.98
D	7	6.60
F	2	1.89
Grade point average in semester		
3.60-4.0	24	22.64
3.0-3.59	40	37.74
2.60-2.99	16	15.09
2.0-2.59	14	13.32
<2.0	12	11.32

[z]Two participants withdrew from the course before the end of the semester

Table 4. Class Attendance and Study Habits Reported by Students (N = 107) Participating in the Study

Characteristic	Frequency	Percent	Mean	Standard Deviation
Weekly class attendance			2.98	0.14
1 day	0			
2 days	2	1.87		
3 days	105	98.13		
Friends' weekly class attendance			2.85	0.41
1 day	2	1.92		
2 days	12	11.54		
3 days	90	86.54		
Weekly study time			2.45	1.65
<1 hour	11	10.38		
1 – 2.9 hours	54	50.94		
3 – 6 hours	40	37.74		
> 6 hours	1	0.94		
Friends' weekly study time			2.27	1.72
<1 hour	16	16.16		
1 – 2.9 hours	48	48.48		
3 – 6 hours	35	35.35		
> 6 hours	0	0		
Time preparing for exams			3.90	2.68
<1 hour	3	2.80		
1 – 2.9 hours	35	32.71		
3 – 6 hours	55	51.40		
> 6 hours	14	13.08		
Friends' time preparing for exams			3.44	2.14
<1 hour	5	5.38		
1 – 2.9 hours	33	35.48		
3 – 6 hours	47	50.54		
> 6 hours		8.60		
Read syllabus			-	-
yes	93	87.74		
no	13	12.26		

Over half (51%) of the respondents reported spending between one and 2.9 hours studying each week. Thirty-eight percent of the participants reported that they spent between three to six hours studying each week. Similar to the responses for attendance, participants reported that they generally spent slightly more time studying each week and preparing for examinations than their friends. When considering the duration of the semester, we found that students increased their study and examination preparation time; yet, their course attendance decreased.

Objective five sought to describe changes in time students spent studying throughout the semester. When comparing responses of the same participants early (February) and late (April) in the semester, participants' mean self-reported attendance was similar in April and February, although the number of participants who said they attend class all three days decreased from 100% to 97% (Table 5). Perceived attendance of friends showed a similar pattern, with the number of participants who said their friends attended class all three days decreasing from February to April. Even though attendance dropped, most participants still reported that they and their friends attended class all three days each week. Data revealed a slight decline in student attendance from February to April. Similarly, the data revealed a larger decline in students' perceptions regarding their friends' attendance throughout the semester.

Mean time spent studying by participants and their friends was unchanged from February to April (Table 5). However, the distribution of student responses varied. Both the number of participants who spent less than three hours studying at the beginning of the semester decreased, while the number of participants studying three to six hours increased. When asked about their friends' weekly study time, more participants reported that their friends studied three or more hours in April than in February. The number of participants spending in excess of six hours preparing for exams also increased from February to April. The responses for friends' examination preparation time were similar to responses for friends' weekly study time. More students believed their friends spent three or more hours preparing for examinations in April than in February.

Objective six sought to describe the relationship between reported participant characteristics and their final grades in the course. The characteristic most highly associated with final grade in PLNT 1213 was semester GPA (Table 6). Specifically, according to Davis (1971), semester GPA had a very high and positive (.81) relationship to students' final grade. Also, ACT score was found to have a moderate and

Table 5. Changes in Reported Attendance and Study Habits Reported by Students (N = 59) Early (February) and Late (April) in the Semester

Characteristic	Frequency		Percent		Mean		Standard Deviation	
	February	April	February	April	February	April	February	April
Weekly class attendance					3.0	2.97	0	0.18
1 day	0	0	0	0				
2 days	0	2	0	3.39				
3 days	59	57	100	96.61				
Friends' weekly class attendance					2.93	2.74	0.26	0.55
1 day	0	3	0	5.17				
2 days	4	9	7.14	15.52				
3 days	52	46	92.86	79.31				
Weekly study time					2.41	2.52	1.66	1.69
<1 hour	5	6	8.62	10.17				
1 – 2.9 hours	34	27	58.62	45.76				
3 – 6 hours	18	25	31.03	42.24				
> 6 hours	1	1	1	1.69				
Friends' weekly study time					2.07	2.45	1.64	1.93
<1 hour	10	8	18.52	14.55				
1 – 2.9 hours	30	26	55.56	47.27				
3 – 6 hours	14	18	25.93	32.73				
> 6 hours	0	3	0	5.46				
Time preparing for exams					3.81	4.60	2.00	2.73
<1 hour	2	1	3.39	1.72				
1 – 2.9 hours	17	14	28.81	24.14				
3 – 6 hours	33	33	55.93	56.90				
> 6 hours	7	10	11.86	17.24				
Friends' time preparing for exams					3.49	4.14	1.93	2.44
<1 hour	2	1	3.92	1.82				
1 – 2.9 hours	25	14	49.02	25.46				
3 – 6 hours	19	32	37.25	58.18				
> 6 hours	5	8	9.62	14.55				

Table 6. Correlation of Student Characteristics with Final Grade		
Characteristic	Spearman's Correlation Coefficient (ρ)	Probability > ρ (p)
ACT score	0.407	<0.0001
Semester GPA	0.811	<0.0001
Sex	0.222	0.022
Weekly attendance	0.199	0.041
Age	0.169	0.08
Previous enrollment in course	0.132	0.176
Time spent preparing for exams	0.109	0.266
Marital status	0.102	0.299
Race	-0.010	0.309
Major	0.092	0.354
Friends' weekly attendance	0.089	0.373
Classification	-0.085	0.389
Friends' time spent preparing for exams	0.086	0.414
Weekly study time	-0.029	0.468
Read syllabus	-0.053	0.590
Friends' weekly study time	-0.041	0.687
Reason for enrolling	-0.012	0.903

Tangney et al. (2004) who found that a strong relationship existed between college students' self-discipline and their final grades in the course.

Specifically, overall semester GPA was the characteristic that had the highest relationship with final grades. In fact, it had a "very high" association to final grades. This finding closely aligns with previous research by Park and Kerr (1990) who found that students' performance on college entrance examinations and performance in other courses are the key determinants in predicting a student's course grade.

positive correlation with students' final grade. Other characteristics correlated with final grade were sex, attendance, and age.

In terms of sex, female participants were more likely to earn a higher grade than male students. This finding contradicts a study by Wilson (2002) who found that, gender was not associated with course performance in a computer science course. Weekly attendance and age were both positively correlated with students' final grade. Low course attendance has been associated with low course grades in previous research (Romer, 1993). The current findings for student age are also supported by previous research (Tucker, 2009) who suggested that age may be a determining factor of student success in introductory courses with older students earning higher grades.

Conclusions

The data suggest that most of the factors associated with student achievement are factors the student cannot control, i.e., past performance on college entrance examinations, sex, and age. However, these data also suggest that students who attend class regularly are more likely to succeed than those students who do not. Additionally, the students who earned high grades in this course were also more likely to excel in their other courses. This finding could be a testament to these students' having higher expectations and values related to their education than those students who perform consistently worse in their coursework. Further, this conclusion is consistent with the findings of Pantages and Creedon (1975) who found that past academic performance (i.e., high school GPA; high school rank) is the best predictor of future success. This finding also resonates with previous research by Wolfe and Johnson (1995) who found that self-discipline was a strong predictor of students' grade point average and

Tangney et al. (2004) found that a strong relationship existed between college students' self-discipline and their final grades in the course. However, when accounting for self-discipline (i.e., time spent studying for exams) on students' final grade in PLNT 1213, it was noted that a low, positive relationship existed. This may be because students are poor at describing their efforts accurately (Stinson and Zhao, 2008). Or, it may be that they are not being taught good study habits prior to enrolling in college. Further research is needed to answer this question.

This study further revealed that students invested more time studying course materials but less time actually attending class as the semester progressed. Perhaps this was because students were motivated externally rather than intrinsically (Ryan and Deci, 2000) and therefore did not have a deep affinity for the course. Or, perhaps students failed to recognize the meaning and relevance of the course to their future careers. Future research should investigate this phenomenon.

Wachtel (1988) found that the type of course can have an influence on students' perceptions of how useful the course is to them. Specifically, Wachtel hypothesized that students are less interested in "required" courses and more interested in "elective" courses. However, this study found no support for that claim. In fact, "reason for enrolling" in the course was negligible regarding its association with final grade in the course. Therefore, this study should be replicated in other course settings and in other states to determine if study habits, examination preparation time, and performance vary between "required" and "elective" courses.

Finally, these results provide the course instructor with practical information that may help future students excel in the course. Although generalizing

the results beyond the scope of this study is cautioned, data now exists that can inform future PLNT 1213 students that if they desire a high grade in the course, they need to attend class regularly and study course content at least three hours each week.

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