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The factors affecting students' knowledge about sustainability

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Abstract

Environmental sustainability is arguably the most pivotal issue of the twenty-first century. This paper examines the factors that influence students' knowledge of sustainability. Using a survey of 123 university students, the research examines how gender, academic performance, college affiliation, class standing, and political interest affect students' knowledge about sustainability. Students in the survey were asked ten questions about environmental sustainability and received a score from zero to ten based on the number of questions they answered correctly. The research does not find evidence that gender affects knowledge about sustainability. However, science students, upperclassmen, high-performing students, and those with political interests demonstrated more knowledge about sustainability. The paper contributes to the literature by examining how gender, academic performance, and political interest affect students' understanding of sustainability. It shows that universities can help students become more knowledgeable about sustainability by requiring more science courses and having upperclassmen mentor underclassmen.

This research was approved by the Institutional Review Board at Coastal Carolina University. Participants were not paid to participate, participation was voluntary, and no funds were received for this research.
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1. Introduction

In 1987, the United Nations Brundtland Commission stated, "Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life" (Brundtland, 1987, p. 42). Sustainability requires considering environmental, social, and economic factors to ensure humanity preserves the natural environment. It is arguably the most important issue of the twenty-first century.

Young people are our future consumers, producers, and policymakers. Universities can help them make informed personal and political decisions by teaching them about sustainability. This paper examines whether there are statistically significant differences in students' knowledge about sustainability based on their gender, academic performance, college affiliation, class standing, and political interest. It tests these hypotheses.

H_{o1}: Females and males exhibit the same level of knowledge about sustainability.
H_{a1}: Females and males exhibit a different level of knowledge about sustainability.

H_{o2}: Academic performance does not affect students' knowledge about sustainability.
H_{a2}: Students with a higher cumulative GPA exhibit more knowledge about sustainability.

H_{o3}: Science students exhibit the same level of knowledge about sustainability as other students.
H_{a3}: Science students exhibit more knowledge about sustainability than other students.

H_{o4}: Upperclassmen exhibit the same level of knowledge about sustainability as underclassmen.
H_{a4}: Upperclassmen exhibit a higher level of knowledge about sustainability than underclassmen.

H_{o5}: Students with political interests exhibit the same level of knowledge about sustainability as students who do not care about politics.
H_{a5}: Students with political interests exhibit a higher level of knowledge about sustainability than students who do not care about politics.

Hypothesis 1 is non-directional because there is no theoretical reason to believe one gender is more knowledgeable about sustainability. Hypotheses two through five are directional because there are reasons to hypothesize which group is more knowledgeable about sustainability.

Other papers investigate how culture, wealth, and curriculum designs affect students' understanding of sustainability. However, this is the first paper to examine how gender, academic performance, college affiliation, class standing, and political interest affect students' knowledge about sustainability. The research finds that science students are more knowledgeable about sustainability, that upperclassmen are more knowledgeable than underclassmen, and that those who exhibit political affiliation are more knowledgeable than those with no political interest. The paper cannot reject the hypothesis that females and males demonstrate the same level of knowledge about sustainability.

Understanding how gender, academic performance, major, class rank, and political interest affect students' knowledge can help universities teach about sustainability. The paper shows that upperclassmen can mentor younger students. It also suggests that universities can develop students' sustainability knowledge by requiring more natural science courses and encouraging political activism.

2. Literature Review

Vlek and Steg (2007) argued that environmental sustainability is crucial to human life and well-being. They claimed sustainability is a pivotal issue, but awareness of sustainability among young people is limited. Msengi et al. (2019) found that most students did not know what sustainability is and were unaware of their university's sustainability initiatives. Gienger et al. (2024) argued that most young people are disconnected from nature due to urbanization and technology. Yet, they have eco-anxiety about environmental issues they do not fully understand.

There is a growing effort to teach about sustainability in higher education. Wright (2002) declared that universities must take a leading role in guiding society toward a sustainable future. Brundiers et al. (2021) had university students complete integrated problems related to sustainability. They found that developing students' sustainable thinking requires ongoing, targeted efforts for students and faculty members.

Birdsall (2013) argued that teachers' education is essential for realizing sustainability. Figueiró and Raufflet (2015) recognized the progress made in sustainability education and encouraged educators to use a backward design by focusing first on the desired outcomes. They noted that applied experience helps students understand our impact on the environment. Hayles and de la Harpe (2007) had students analyze innovative green buildings. They showed that students articulated their views on sustainability better after the project. Cogut et al. (2019) found that increased awareness of waste-prevention measures on campus led to students wasting less.

Kyridis et al. (2005) encouraged universities to develop an interdisciplinary approach to environmental sustainability. Hamid et al. (2017) argued that universities should utilize social media to convey university ecological policy and promote sustainable initiatives. Simionescu et al. (2020) showed that social media helps shape people's awareness of the environment.

Sammalisto et al. (2016) demonstrated that education about sustainability affects students' knowledge and understanding. Redman and Redman (2016) showed that even stand-alone university courses on sustainability lead students to behave more sustainably. Qureshi (2020) concluded that participatory sustainability education leads to positive outcomes for students in their personal lives.

Knowledge about sustainability varies across cultures. Andic and Vorkapic (2017) compared students' knowledge about sustainability in Croatia, Slovenia, and Bosnia and Herzegovina. They showed that environmental awareness is influenced by cultural constraints. Students from different cultures not only vary in their knowledge of sustainability but also in how they view their responsibility. Hsu and Pivec (2021) examined cross-cultural differences between Austrians and Taiwanese. Taiwanese students preferred individual responsibility, while Austrian students focused on the impact of industry and government on sustainability.

Awan and Abbasi (2013) used survey data to show that students from high-income families are more environmentally knowledgeable. Knowledge about sustainability also varies by discipline. Tarabuła-Fiertak, Gajuś-Lankamer, and Wójcik (2004) find that students studying environmental conservation or engineering learn the most about the environment. They also find that students who study life science learn a lot about the natural environment. Using survey data, Al Balushi and Ambusaidi (2022) discovered that knowledge about the environment positively contributes to environmental attitudes and behaviors among students.

3. Methodology

This research utilized a survey sent to 200 randomly selected students. 123 students completed the survey, and those who took it answered all the questions. Participation was voluntary and not awarded. No funding was received for conducting this study. A pilot study with 30 students yielded a mean score of 5.94 with a standard deviation of 1.72. A power test with an expected difference of at least .50 points, a .05 level of significance, and an 80% level of power, yields a minimum sample size of 93. Table 1 shows the characteristics of the sample.

Table 1 – Characteristics of the Sample

Variable	Characteristic	N	% Of Respondents	% Of Population
Gender	Female	67	43.9	54.6
	Male	54	54.5	44.6
	Other	2	1.6	.8
Year	Freshman	36	29.3	32.9
	Sophomore	33	26.8	24.8
	Junior	30	24.4	21.2
	Senior	24	19.5	21.1
	Other	0	0	-
College	Business	36	29.3	29.0
	Education	23	18.7	14.2
	Humanities	28	22.8	23.5
	Sciences	36	29.3	32.7
	Other	0	0	.6
Number of	0	43	35.0	-
Sustainability	1	37	30.1	-
Courses	2	24	19.5	-
	3+	19	15.4	-
Political	Democrat	37	30.1	-
Interest	Republican	46	37.4	-
	Independent	22	17.9	-
	Another	0	0	-
	None	18	14.6	-
GPA	3.50-4.00	48	39.0	-
	3.00-3.49	38	30.9	-
	2.50-2.99	23	18.7	-
	2.00-2.49	10	8.1	-
	< 2.00	4	3.3	-
	No GPA	0	0	-

n = 123 respondents. 200 students were surveyed.

The survey asked students five demographic questions and ten questions to test their knowledge about sustainability. A link to the survey is available in the appendix. Participants received a score from zero to ten on their sustainability knowledge based on how many questions they answered correctly. The questions got progressively harder. Table 2 shows the mean score and standard deviation for each group. The research analyzed the data using a linear regression.

Table 2 – Means and Standard Deviations by Characteristic

Variable	Characteristic	N	Mean Score	Standard Deviation
Gender	Female	67	5.88	2.18
	Male	54	5.83	1.96
	Other	2	6.00	0.00
Year	Freshman	36	4.81	1.75
	Sophomore	33	6.27	1.93
	Junior	30	6.53	2.21
	Senior	24	6.04	1.83
	Other	0	-	-
College	Business	36	4.83	1.48
	Education	23	5.13	1.52
	Humanities	28	5.54	1.95
	Sciences	36	7.61	1.78
	Other	0	-	
Courses	0 Course	43	5.47	1.72
	1 Courses	37	5.84	2.13
	2 Courses	24	6.08	2.22
	3+ Courses	19	6.47	2.20
Political	Democrat	37	6.49	1.97
Interest	Republican	46	5.83	2.05
	Independent	22	6.23	1.85
	Another	0	-	-
	None	18	4.22	1.52
GPA	3.50-4.00	48	6.31	1.98
	3.00-3.49	38	6.55	1.88
	2.50-2.99	23	4.70	1.66
	2.00-2.49	10	4.90	1.66
	< 2.00	4	3.00	0.82

4. Results

This paper examines how various factors affect students' knowledge of sustainability. Tables 3, 4, and 5 present the regression analysis. The appendix has a link for the full results.

Table 3 – Model Summary

R	R Square	Adjusted R Square	Standard Dev
.737	0.543	0.479	1.493

Table 4 – ANOVA Analysis

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	283.538	15	18.903	8.479	<.001
Residual	238.527	107	2.229		
Total	522.065	122			

Table 5 – Coefficients

Model	Unstandardized Coeff.		Standardized Coeff.	t	Sig.
	Beta	Std. Error	Beta		
(Constant)	5.665***	0.537		10.541	0.000
Sophomore (class)	0.701*	0.383	0.151	1.830	0.070
Junior (class)	1.012**	0.417	0.211	2.426	*0.017*
Senior (class)	0.926**	0.432	0.178	2.143	0.034
Education (college)	-0.904*	0.465	-0.171	-1.943	0.055
Humanities (college)	-0.301	0.433	-0.061	-0.695	0.489
Sciences (college)	1.757***	0.412	0.388	4.263	0.000
Number of Courses	0.095	0.140	0.049	0.676	0.500
Female (gender)	0.410	0.301	0.099	1.363	0.176
Other (gender)	0.298	1.111	0.018	0.268	0.789
Republican (party)	-1.056***	0.376	-0.248	-2.806	0.006
Independent (party)	-0.407	0.434	-0.076	-0.937	0.351
None (party)	-1.456***	0.487	-0.250	-2.989	0.003
3.00-2.49 (GPA)	0.383	0.347	0.086	1.105	0.272
2.50-2.99 (GPA)	-1.053**	0.409	-0.199	-2.574	0.011
2.00-2.49 (GPA)	-1.358**	0.567	-0.180	-2.393	0.018
< 2.00 (GPA)	-2.153***	0.811	-0.185	-2.655	0.009

* Significant at the .10 level. ** Significant at the .05 level. *** Significant at the .01 level

All the independent variables in the model, except the number of courses, are categorical and were analyzed using dummy variables. The analysis used freshmen, the College of Business, Democrats, and a GPA of 3.50 or more as the reference categories. The regression has an R Square of 0.543 and an Adjusted R Square of 0.497, which means roughly half of the variation in the dependent variable is explained by the independent variables. An ANOVA analysis yields a highly significant F statistic of 8.479.

The correlations between the independent variables are low and none exceed 0.60. Additionally, all the Variance Inflation Factors are below 2.00, indicating no multicollinearity. Plotting the standardized residuals against standardized predicted values shows a random pattern, indicating no heteroscedasticity. The maximum Cook distance is 0.371, indicating that no data point is overly influential. The p-value for a Shapiro-Wilk test is .147, indicating a normally distributed dependent variable. The model yields a Durbin-Watson statistic of 1.975, indicating there is no autocorrelation in the residuals. These tests support the validity of the results.

Females scored slightly higher than males. However, the level of significance is only 0.176. Therefore, we accept the first null hypothesis, H_{o1}, that females and males exhibit the same level of knowledge about sustainability. A t-test comparing the average score of males and females, below, lends further support to the first H_{o1}. Table 6 shows the t-tests.

Students with a GPA below 3.00 have significantly lower awareness of sustainability than those with a GPA above 3.50. Students with a GPA between 3.00 and 3.49 demonstrate a slightly higher awareness than students with a GPA above 3.50, but this result is not significant. Therefore, the research rejects H_{02} and accepts H_{a2}, which states that students with a higher cumulative GPA exhibit more knowledge about sustainability.

The analysis also shows that science students scored significantly higher than business students. Education and humanities students scored slightly lower than business students, but

these results are not significant at the .05 level. A t-test comparing science students to all other students also shows that science students scored significantly higher than other students. Therefore, the research rejects H_{o3} and accepts H_{a3}, which states that science students exhibit more knowledge about sustainability than other students.

Sophomores, juniors, and seniors all demonstrated more knowledge about sustainability than Freshmen. Furthermore, a t-test comparing underclassmen (freshmen and sophomores) and upperclassmen (juniors and seniors) finds that upperclassmen have a significantly higher score. Therefore, the research rejects H_{o4} and accepts H_{a4}, which claims that upperclassmen exhibit a higher level of knowledge about sustainability than underclassmen. Table 6 summarizes the results of the t-tests. Republicans and those with no political affiliation scored significantly lower than Democrats. A t-test, shows below, also confirms that students with no political affiliation demonstrate less knowledge about sustainability than students with a political affiliation. Therefore, the research rejects H_{o5} and accepts H_{a5} that students with political interests exhibit a higher level of knowledge about sustainability than students who do not care about politics.

Table 6 – T-tests of Survey Data

Variable	Character	N	Mean	St. Dev.	T-value	d.f.	P-value
Gender	Male	54	5.88	2.18	-.124	119	.901
	Female	67	5.83	1.96			
Class Standing	Underclassmen	69	5.51	1.968	-2.220	121	.015
	Upperclassmen	54	6.31	2.045			
Political Interest	Interested	105	6.14	1.983	3.913	121	<.001
	No Interested	18	4.22	1.517			
College	Science	36	7.61	1.665	7.349	121	< .001
	Non-science	87	5.14	1.777			

The number of sustainability courses taken did not significantly affect the students' knowledge about sustainability. This may be because the students were unsure which courses to count as sustainability courses and since sustainability is taught throughout the curriculum in various disciplines.

5. Conclusion

This study examined the factors influencing university students' knowledge about environmental sustainability through a survey of 123 participants. It reveals that gender does not significantly affect sustainability knowledge. However, science students exhibited significantly higher sustainability knowledge than their peers, while upperclassmen demonstrated superior understanding relative to underclassmen. Additionally, students with higher GPAs and those with political interests showed greater awareness about sustainability. These results suggest that universities can enhance sustainability education by requiring more natural science courses, encouraging political activism, and having upperclassmen mentor underclassmen.

Future research can investigate whether a mentorship program or more required science courses increase students' awareness. Additionally, cross-cultural comparative studies could also illuminate whether these patterns hold across different educational systems and cultural contexts. By better educating students about sustainability, we can help raise more aware consumers, producers, and policymakers.

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Appendix

The survey is available using the following link –
https://drive.google.com/file/d/14aDPYOI1O8x-Fc7kzZwr5zpMlY9nGZS_/view?usp=sharing

The data for this study is available using the following link –
https://docs.google.com/spreadsheets/d/1lTXSa6-0FtnOF4z20zpmU6AzuYC05dCD/edit?usp=sharing&ouid=113962065110276195053&rtpof=true&sd=true

The Regression Analysis are available using the following link –
https://drive.google.com/file/d/13nmVqm3Jc1Wg_EWICFKCrd391RMG15JQ/view?usp=sharing

The T-tests are available using the following link –
https://drive.google.com/file/d/13xYNGuWB5bH_Yra39MSy_g4VKfLZCkSy/view?usp=sharing