JURNAL DIDAKTIKA
https://didaktika.lombokinstitute.com/index.php/JPTK

Vol.4, No.2 (October – 2026)
E-ISSN: 2987-4343
pp. 163-173

Effects of Sociodemographic and Academic Factors on University Students' Green Character

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Abstract
Developing university students' green character requires an understanding of its relationships with sociodemographic backgrounds and academic experiences. This study aimed to examine the relationships of gender, parental occupation, study program, semester, and grade point average (GPA) with university students' green character in Indonesia. A quantitative cross-sectional design was employed, involving 1,363 students from various study programs at universities in western, central, and eastern Indonesia. Data were collected using an online questionnaire comprising 36 Likert-scale statements covering environmental knowledge, values, attitudes, behaviors, and habits. The data were analyzed using partial least squares structural equation modeling with WarpPLS software. The results showed that gender, parental occupation, study program, and GPA had significant direct relationships with green character, whereas semester did not. Examination of the indirect paths through GPA indicated that GPA did not significantly mediate the relationships of study program, semester, and parental occupation with green character. The direct-effects model yielded a Tenenhaus goodness-of-fit value of 0.268. These findings imply that educational institutions should design environmentally oriented learning programs that consider students' demographic characteristics, including gender and study program.

Article History
Received: 03-08-2026
Reviewed: 07-09-2026
Accepted: 11-10-2026
Published: 30-10-2026

Key Words
green character, sociodemographic factors, academic factors, university students, cross-sectional study.

How to Cite: Cortez, A. O., Lukitasari, M., del Pino-Brunet, N., Sukri, A., & Rizka, M. A. (2026). Effects of Sociodemographic and Academic Factors on University Students' Green Character. *Jurnal DIDAKTIKA,* 4(2). 163-173.

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Introduction

Environmental challenges in Indonesian higher education concern not only the availability of waste management facilities but also students' engagement in behaviors that support environmental sustainability (Yusuf & Fajri, 2022). One aspect that supports this sustainability is green character. Green character encompasses the environmental knowledge, values, attitudes, behaviors, and habits involved in environmental protection (Sukri et al., 2022a). However, commitment to promoting environmentally friendly behavior remains a challenge. Destrinanda et al. (2022) highlighted this issue in a study involving 428 students, which found negative Net Promoter Scores in the study settings even though subjective knowledge was positively associated with green behavior. Other findings indicate that environmental intelligence is related to environmental behavior through knowledge and attitudes (Torroba Diaz et al., 2023). Another study identified a positive relationship between moral character and environmental conservation behavior, providing further support for the importance of character in ecological action

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(Bøhlerengen & Wiium, 2022). Thus, environmental education that emphasizes knowledge acquisition alone may fail to address the values, attitudes, behaviors, and habits required to develop green character comprehensively (Sukri et al., 2022).

The relationships of sociodemographic and academic factors with green character warrant investigation because student characteristics may be associated with differences in environmental attitudes; however, the direction and strength of these relationships cannot be established solely on the basis of assumptions about particular groups (Rahardjanto et al., 2022; Sukri et al., 2022c). Sociodemographic factors, particularly age and gender, are relevant because previous research has reported higher conservation behavior among older participants and stronger conservation intentions among females than males (Bøhlerengen & Wiium, 2022). However, other research has found no significant differences in pro-environmental behavior by gender or educational background, indicating that patterns of group differences should be examined within their population contexts (Phang & Ilham, 2023). Academically, study programs may be associated with differences in exposure to environmental content and opportunities to participate in environmental activities, as illustrated by Yusuf and Fajri (2022), who found a difference in waste management engagement between science and social science students ($p = .010$). In contrast, research involving prospective biology teachers in Indonesia found no significant differences in environmental attitudes by GPA, although students who had completed environment-related courses demonstrated more positive environmental attitudes (Rahardjanto et al., 2022). Evidence from Bangladesh extends this understanding by identifying differences in pro-environmental behavior according to co-curricular engagement after controlling for GPA, although the effect size was relatively small (partial $\eta^2 = .02$; Shahrier et al., 2025). Therefore, sociodemographic and academic factors should be analyzed jointly so that the relationship between educational experiences and environmental character is not reduced to differences in academic achievement alone (Shahrier et al., 2025).

Various efforts have been made to strengthen students' environmental concern, including a compulsory Disaster and Environmental Knowledge course and waste bank programs that connect learning with participation in environmental management (Yusuf & Fajri, 2022). The relevance of environmental education is also supported by research identifying positive relationships of environmental education, knowledge, responsibility, and values–beliefs–norms with pro-environmental behavior (Hastuti et al., 2024). Sukri et al. (2022) also contributed to strengthening environmental concern by developing a green character instrument validated among students across universities; however, their study did not establish how sociodemographic and academic factors influence this construct. Another study by Sukri et al. (2022b) examined the effects of demographic factors on environmental habits as a component of green character, but it was limited to a single aspect and did not analyze green character comprehensively. Therefore, the present study seeks to address this gap by jointly examining the relationships of sociodemographic and academic factors with university students' green character in Indonesia. The findings are expected to inform environmental education initiatives that are better aligned with students' characteristics and academic experiences, recognizing the importance of understanding variations in students' responses to environmental education.

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Research Method

Research Design and Participants

This study adopted a quantitative approach with a cross-sectional design (Wang & Cheng, 2020) to analyze the contributions of sociodemographic and academic characteristics to university students' green character (Sukri et al., 2022a). This design allows all variables to be measured during a single data collection period to identify relationships among variables without tracking changes in respondents over time (Wang & Cheng, 2020). The study involved 1,363 students from various study programs at universities in western, central, and eastern Indonesia. Sociodemographic characteristics included gender and parental occupation, whereas academic characteristics comprised study program, semester, and grade point average (Sukri et al., 2022b).

Instrument and Data Collection Procedures

Data were collected using the green character questionnaire developed by Sukri et al. (2022a). The instrument comprised 36 statements: six items measuring environmental knowledge (EK), seven measuring environmental values (EV), two measuring environmental habits (EH), seven measuring environmental attitudes (EA), and 14 measuring environmental behaviors (EB). Participants responded to each statement on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire also collected information on gender, parental occupation, study program, semester, and GPA. It was administered through Google Forms after respondents had received information about the study objectives, voluntary participation, and data confidentiality.

Data Analysis

Relationships among variables were analyzed using partial least squares structural equation modeling with WarpPLS software (Kock, 2019). Model fit was assessed using the average path coefficient (APC), average R-squared (ARS), average adjusted R-squared (AARS), average block variance inflation factor (AVIF), average full collinearity variance inflation factor (AFVIF), Tenenhaus goodness of fit (GoF), Simpson's paradox ratio (SPR), R-squared contribution ratio (RSCR), statistical suppression ratio (SSR), and nonlinear bivariate causality direction ratio (NLBCDR) (Henseler & Sarstedt, 2013). This study examined the direct effects of sociodemographic and academic factors on green character and used moderating variables, including GPA, gender, and parental occupation, to investigate indirect effects on students' green character.

Research Findings and Discussion

Effects of Demographic Factors on Green Character

The model examining the effects of sociodemographic and academic factors on students' green character (GC) is presented in Figure 1.

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E-ISSN: 2987-4343
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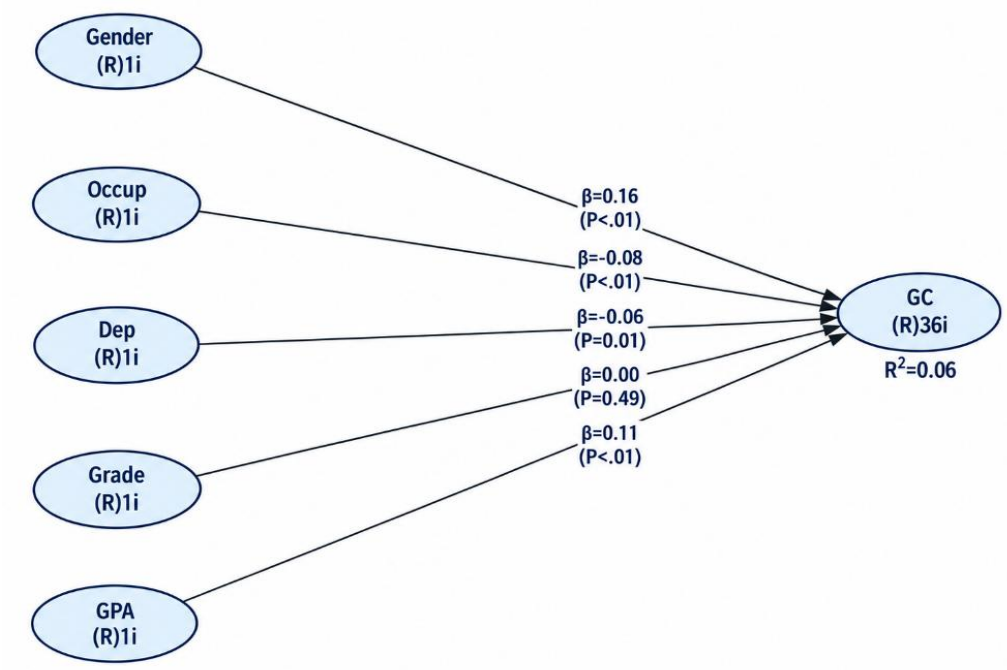


Figure 1. Model of The Relationships of Gender, Parental Occupation, Study Program, Semester, and GPA with GC

The results shown in Figure 1 are supported by the goodness-of-fit analysis presented in Table 1. Of the five sociodemographic and academic factors examined, four—gender, parental occupation, study program, and grade point average (GPA)—had significant effects on students' green character (GC). In contrast, semester did not have a significant effect on GC ($p > .01$). The model met all ten model fit and quality criteria, including significant APC, ARS, and AARS values ($p < .001$) and AVIF and AFVIF values within the ideal range (≤ 3.3). With a Tenenhaus GoF of 0.268, the model demonstrated a medium level of fit. Indicators such as SPR, RSCR, and SSR also reached their ideal values, indicating the validity of the relationships among variables in the model. These findings emphasize the importance of gender, parental occupation, study program, and GPA in shaping students' green character, while the effect of semester requires further investigation.

Table 1. Model Fit Criteria

Goodness-of-fit and quality indices	Assessment
Average path coefficient (APC)= 0.081, P< 0.001	Accepted
Average R-squared (ARS)= 0.057, P≤ 0.001	Accepted
Average adjusted R-squared (AARS)= 0.054, P= 0.012	Accepted
Average block VIF (AVIF)= 1.037, acceptable if <= 5, ideally <= 3.3	Accepted
Average full collinearity VIF (AFVIF)= 1.049, acceptable if <= 5, ideally <= 3.3	Accepted
Tenenhaus GoF (GoF)=0.268, small >= 0.1, medium >= 0.25, large >= 0.36	Accepted
Simpson's paradox ratio (SPR)= 1.000, acceptable if >= 0.7, ideally = 1	Accepted
R-squared contribution ratio (RSCR)= 1.000, acceptable if >= 0.9, ideally = 1	Accepted
Statistical suppression ratio (SSR)= 1.000, acceptable if >= 0.7	Accepted
Nonlinear bivariate causality direction ratio (NLBCDR)= 0.800, acceptable if >= 0.7	Accepted

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The findings indicate that gender, parental occupation, study program, and GPA had significant effects on students' green character (GC), whereas semester did not. These results are consistent with previous research showing that demographic factors play an important role in shaping individuals' environmental behavior (Torgler & García-Valiñas, 2007). The findings also align with earlier research indicating that demographic factors, such as gender and occupation, can influence pro-environmental behavior. For example, Hadi and Ananda (2023) found a strong relationship between GPA and students' environmental concern. Regarding gender, Diamantopoulos et al. (2003) emphasized that females tend to have higher environmental awareness than males. These findings highlight the importance of considering demographic factors in curricula designed to enhance students' green character. Curricular integration should be tailored to students' demographic profiles to ensure that approaches are effective and relevant (Al-Naqbi & Alshannag, 2018). This argument is supported by research reporting a substantial influence of conservation education on students' green consumption behavior (Ramadhani et al., 2023). Furthermore, although semester did not have a significant effect, policymakers should encourage students to participate in activities that can enhance environmental awareness and pro-environmental behavior, such as student organizations focused on environmental issues. This recommendation is consistent with findings that organizational experience can influence students' character development (Husny et al., 2023).

An Intervening-Variable Model of the Effects of Sociodemographic and Academic Factors on GC through GPA

To examine the effects of sociodemographic and academic factors—study program, gender, parental occupation, and semester—on GC through GPA as a moderating variable, SEM analysis was conducted, as shown in Figure 2, and supported by the goodness-of-fit analysis presented in Table 2.

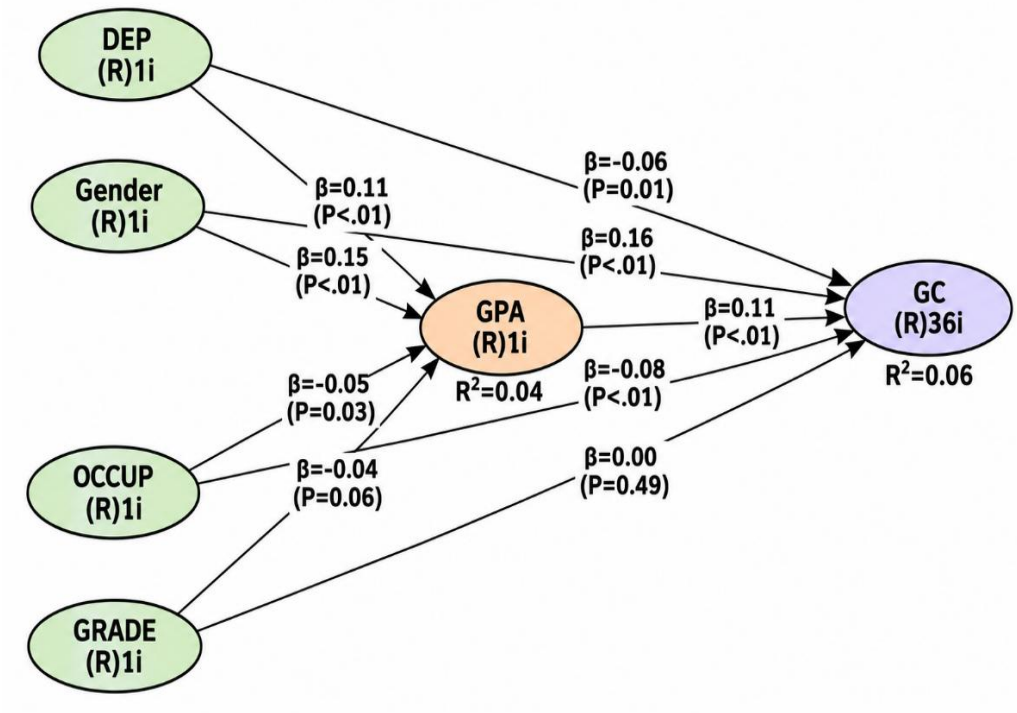


Figure 2. Effects of Demographic Factors on GC Through GPA

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Table 2. Goodness of Fit for the Model of Demographic Effects on GC through GPA

Model fit and quality indices	Assessment
Average path coefficient (APC)= 0.084, P< 0.001	Accepted
Average R-squared (ARS)= 0.048, P = 0.019	Accepted
Average adjusted R-squared (AARS)= 0.045, P = 0.025	Accepted
Average block VIF (AVIF)= 1.021, acceptable if <= 5, ideally <= 3.3	Accepted
Average full collinearity VIF (AFVIF)= 1.049, acceptable if <= 5, ideally <= 3.3	Accepted
Tenenhaus GoF (GoF)= 0.204, small >= 0.1, medium >= 0.25, large >= 0.36	Acceptable
Simpson's paradox ratio (SPR)= 1.000, acceptable if >= 0.7, ideally = 1	Accepted
R-squared contribution ratio (RSCR)= 1.000, acceptable if >= 0.9, ideally = 1	Accepted
Statistical suppression ratio (SSR)= 1.000, acceptable if >= 0.7	Accepted
Nonlinear bivariate causality direction ratio (NLBCDR)= 0.778, acceptable if >= 0.7	Accepted

Figure 2 shows that study program (Dep), semester (GRADE), and parental occupation (OCCUP) did not significantly affect green character (GC) through GPA as an intervening variable (p > .05 for the indirect effects). However, GPA had a significant direct effect on GC, with p < .05 for the total effects. Specifically, study program also had direct effects on GPA and GC, whereas semester did not directly affect either GPA or GC. Gender had a direct effect on GC, indicating that it was a stronger factor than semester or parental occupation in influencing students' green character. Overall, the combination of study program, semester, gender, and parental occupation contributed 6% to GC through GPA.

An Intervening-Variable Model of the Effects of Sociodemographic and Academic Factors on GC through Gender and Parental Occupation

To examine the effects of sociodemographic and academic factors—study program, GPA, and semester—on GC through gender and parental occupation as moderating variables, SEM analysis was conducted, as shown in Figure 3, and supported by the goodness-of-fit analysis presented in Table 3.

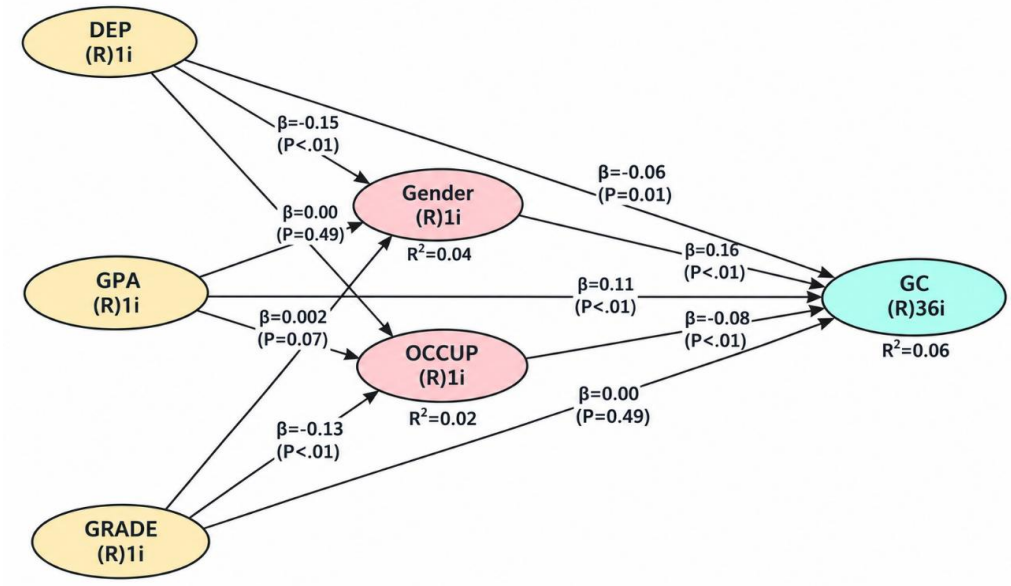


Figure 3. Effects of Sociodemographic and Academic Factors on GC Through Gender and Parental Occupation

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Table 3. Goodness of Fit for the Model of Demographic Effects on GC through Gender and Parental Occupation

Model fit and quality indices	Assessment
Average path coefficient (APC)= 0.084, P< 0.001	Accepted
Average R-squared (ARS)= 0.040, P = 0.034	Accepted
Average adjusted R-squared (AARS)= 0.038, P = 0.041	Accepted
Average block VIF (AVIF)= 1.021, acceptable if <= 5, ideally <= 3.3	Accepted
Average full collinearity VIF (AFVIF)= 1.049, acceptable if <= 5, ideally <= 3.3	Accepted
Tenenhaus GoF (GoF)= 0.187, small >= 0.1, medium >= 0.25, large >= 0.36	Acceptable
Simpson's paradox ratio (SPR)= 0.909, acceptable if >= 0.7, ideally = 1	Accepted
R-squared contribution ratio (RSCR)= 1.000, acceptable if >= 0.9, ideally = 1	Accepted
Statistical suppression ratio (SSR)= 0.909, acceptable if >= 0.7	Accepted
Nonlinear bivariate causality direction ratio (NLBCDR)= 0.818, acceptable if >= 0.7	Accepted

When the model was analyzed with gender and parental occupation (OCCUP) as intervening variables, GPA was found to have a significant effect on GC through gender and parental occupation ($p < .05$ for the indirect effects). Semester also significantly affected GC through gender and parental occupation, whereas study program showed no effect through these pathways ($p > .05$). Further analysis indicated that study program directly influenced gender but not parental occupation. Gender and parental occupation directly influenced GC, reinforcing their roles in the model. These findings identify gender as a key factor mediating the effects of GPA and semester on GC.

This study highlights the importance of gender in shaping students' green character. The significant effect of gender, both directly and through GPA, suggests that environmentally oriented education should consider gender dimensions. Chusniatun et al. (2022) identified gender stereotypes among university students, which may influence their perceptions of and participation in environmental issues. Other research has shown that females tend to hold more positive pro-environmental attitudes than males. Okumah et al. (2020) reported that females demonstrated substantially more positive environmental attitudes than males regarding water resource management in Ghana (Okumah et al., 2020). In addition, Kalkan and Demirbas (2017) highlighted that demographic factors such as gender significantly influenced environmental awareness and behavior among school managers and teachers. A similar trend was reported by Yu and Yu (2017), who showed that personality characteristics, including gender, moderated students' pro-environmental behavioral intentions. Thus, gender is a critical demographic variable in shaping students' environmental awareness and actions. These findings therefore highlight the importance of educational institutions designing programs that respond to gender-related differences in needs and tendencies. Such programs may include participatory activities that connect environmental issues with students' lived experiences to enhance engagement and the effectiveness of learning in fostering environmentally friendly behavior.

GPA, as a significant intervention pathway, provides educational institutions with an opportunity to use academic assessment as a means of developing green character. Integrating environmental education into the curriculum has been shown to enhance students' environmental awareness and pro-environmental behavior (Pertiwi, 2014). Accordingly, incorporating sustainability content into curricula, academic assignments, or assessment systems may help students internalize sustainability values. This suggests that efforts to

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improve academic achievement may influence not only academic outcomes but also students' environmental behavior, highlighting the importance of a holistic learning approach that connects academic achievement with sustainability.

Parental occupation had a direct effect on students' green character, but its moderating role was not significant. This suggests that sustainability values transmitted within families function more as intrinsic factors than as a moderating pathway. Kővári et al. (2023) found that students from lower-middle socioeconomic backgrounds exhibited environmental attitudes that differed from those of their peers from higher socioeconomic backgrounds. Furthermore, Sukri et al. (2022) highlighted that demographic factors, including socioeconomic status, significantly influenced students' environmental knowledge, indicating a complex relationship between economic factors and environmental awareness. These findings underscore the importance of parental involvement in both formal and nonformal educational programs, for example through seminars or collaborative activities that promote environmental values at home. Strengthening the connection between formal education on campus and informal learning within families may enable more effective and sustained development of green character.

Meanwhile, semester and study program played more specific roles. Semester did not have a significant effect on green character, indicating that academic level does not determine its development. Yanti et al. (2020) showed that integrating environmental education into science learning positively affected students' environmental concern, particularly at higher educational levels. Educational institutions should therefore ensure that green character is developed consistently throughout students' studies. In contrast, study program had a direct effect on green character. Integrating environmental values throughout the educational process, regardless of semester or educational level, is thus an important step toward developing students with strong environmental awareness.

Conclusion

This study shows that sociodemographic and academic factors, including gender, parental occupation, study program, and grade point average (GPA), play significant roles in shaping university students' green character (GC). Gender consistently influenced green character, both directly and through GPA mediation, with female students tending to demonstrate greater environmental awareness than male students. Parental occupation also had a direct effect on green character, indicating that environmental values cultivated within families play an important role. Although semester did not have a significant effect, study program contributed directly to green character, emphasizing that integrating sustainability values into the curriculum can strengthen students' environmental awareness. GPA emerged as a significant intervention pathway in developing green character, suggesting that strong academic achievement can promote the internalization of sustainability values. The SEM model demonstrated good validity and fit, with a Tenenhaus GoF value of 0.268. These findings imply that educational institutions should design environmentally oriented learning programs that consider students' demographic characteristics, including gender and study program. Furthermore, collaboration between educational institutions and families can strengthen students' overall character development by integrating environmental values into formal and informal educational activities.

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Recommendations

Universities should integrate sustainability into courses and activities across study programs and strengthen collaboration with families and communities. Learning programs should be inclusive and evaluated for their impact on students' green character. Further research should use longitudinal designs and broader samples to confirm these findings.

Acknowledgements

The authors thank the participating universities and students for their cooperation and contribution to this study.

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