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Transforming Entrepreneurship Education: Connecting Green Education, Personality, and Green Entrepreneurial Orientation

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A B S T R A C T

Global warming has become an environmental issue that requires serious attention. Schools play a strategic role in fostering environmental awareness through green education, which aims to develop students' adaptive and environmentally conscious character. This study analyzes the influence of green education, personality traits, and green entrepreneurship practices on students' green entrepreneurial orientation. A quantitative approach was employed in this study, using purposive sampling, involving 157 ninth-grade students from SMP Negeri 22 Semarang. Data were processed using multiple linear regression analysis and path analysis with SPSS version 30. The results indicate that green education and green entrepreneurship practices significantly influence green entrepreneurial orientation, whereas personality traits do not have a direct effect. However, the findings also reveal that personality traits can serve as a mediating variable, particularly in the relationship between green entrepreneurship practices and green entrepreneurial orientation.

1. Introduction

Environmental issues such as ozone layer depletion, global warming, and environmental pollution have become critical concerns that threaten the sustainability of living beings (Meishanti et al., 2023). One of the largest contributors to environmental pollution is organic waste produced by human activities without proper management. This waste undergoes decomposition and releases methane gas, which exacerbates the greenhouse effect and intensifies global warming (Pranata et al., 2021). These conditions necessitate innovative solutions that can balance economic growth with ecological sustainability.

In response to the environmental crisis, the concept of green entrepreneurship has emerged, offering a business approach that emphasizes environmental sustainability and social responsibility while generating economic value (Ediagbonya et al., 2024) . Within this framework, green entrepreneurial orientation (GEO) serves as a strategic initiative that integrates green economic principles into competitive market practices (Li et al., 2022). GEO reflects the tendency of individuals or organizations to adopt innovative and environmentally friendly business practices (Rofiaty et al., 2024).

Implementing green entrepreneurial orientation within educational settings requires a holistic approach, encompassing the reinforcement of green education and the development of personality traits that support green entrepreneurship practices (Muangmee et al., 2021). Green education plays a critical role in shaping entrepreneurial mindsets and skills aligned with environmental stewardship (Navarathinam & Amutha, 2021). Meanwhile, personality traits such as innovativeness, proactiveness, and risk-taking tendencies are vital for strengthening students' intentions toward engaging in green entrepreneurship (Santika et al., 2022).

In addition to education, personality traits significantly influence students' propensity to engage in green entrepreneurship practices. Traits such as need for achievement, proactiveness, risk-taking, and entrepreneurial self-efficacy contribute positively to students' intentions to develop environmentally sustainable businesses (Puspita et al., 2021; Nurhayati et al., 2024). Students with a high need for achievement are more inclined to explore green entrepreneurial opportunities as a means of creating a positive social impact, while proactive individuals are better equipped to identify opportunities for sustainable ventures.

These conditions underscore the need for an educational approach that not only focuses on cognitive and academic aspects but also on shaping character and environmental awareness among students. In this context, the Education for Sustainable Development (ESD) theory provides a relevant conceptual framework to address sustainability challenges through education. This theory supports efforts to integrate sustainability values into educational systems, including fostering green entrepreneurial orientation among the younger generation. The ESD theory was introduced by Prof. Dr. Hans J.A. Van Ginkel, former Rector of the United Nations University and advisor to the UN Secretary-General. He proposed the idea of education for sustainable development in response to the increasingly uncontrolled human population growth, which is disproportionate to the productivity of the surrounding natural environment, as well as the advancement of science and technology that has increasingly disrupted ecological balance.

The ESD theory focuses on developing individuals who possess the knowledge, skills, values, and attitudes necessary to contribute to sustainable development. In this context, ESD serves as a critical foundation for building students' environmental awareness and responsibility by embedding sustainability values into formal education. Its implementation not only nurtures environmentally

conscious generations but also encourages the transformation of personality traits and green entrepreneurial skills in response to future ecological challenges. This study reinforces the application of ESD by exploring the interconnections between green education, personality traits, and the tendency to engage in sustainable entrepreneurial practices in the education sector.

Previous studies reinforce the critical role of green education and personality traits in fostering green entrepreneurship practices. Research by Widodo et al., (2024) demonstrated that integrating sustainability principles into the curriculum enhances environmental awareness and fosters students' intentions toward green entrepreneurship. Aisyah et al., (2023) emphasized that creativity and risk-taking significantly influence students' adoption of sustainable entrepreneurial behaviors. Moreover, Andriyati et al., (2024) found that entrepreneurial self-efficacy positively correlates with the adoption of environmentally friendly business practices among young people. These findings highlight the need for further research into the interaction between green education, personality traits, and green entrepreneurship practices.

Simultaneously, implementing green entrepreneurship practices within schools supports the achievement of Adiwiyata School status, a national program aimed at fostering environmentally conscious and cultured educational institutions (Bragelien & Voldsund, 2024). In Semarang City, 17 schools, including SMP Negeri 22 Semarang, were recognized with the Adiwiyata School award at the provincial level ini Central Java in 2024 (SMPN22). Integrating green entrepreneurship principles into educational activities can enchance environmental awareness while cultivating students entrepreneurial spirit.

The Adiwiyata School program is a national initiative by the Indonesian Ministry of Environment and Forestry aimed at creating environmentally responsible and culturally aware schools. Schools participating in the Adiwiyata program are encouraged to integrate environmental values into their curriculum, promote sustainability practices, and raise awareness about environmental conservation (Nizaar, 2022). The program focuses on fostering a school culture that emphasizes environmental stewardship, aiming to instill a sense of responsibility for the environment among students, educators, and the school community as a whole. Schools that successfully implement these principles are awarded the Adiwiyata School status, which recognizes their commitment to sustainable practices and environmental education (Tuncer & Korchagina, 2024).

Based on the aforementioned issues and previous research findings, this study aims to analyze the influence of green education, personality traits, and green entrepreneurship practices on the green entrepreneurial orientation of ninth-grade students at SMP Negeri 22 Semarang. This research seeks to develop students' potential through school-based environmental entrepreneurship projects and to expand the body of research on green entrepreneurship education at the secondary school level.

Accordingly, the research questions formulated for this study are: (1) what is the effect of green education on personality traits? (2) what is the effect on green entrepreneurship practices on personality traits? (3) what is the effect of green education on green entrepreneurial orientation? (4) what is the effect of green entrepreneurship practices on green entrepreneurial orientation? (5) what is the effect of personality traits on green entrepreneurial orientation? (6) what is the effect of green education on green entrepreneurial orientation through personality traits? (7) what is the effect of green entrepreneurship practices on green entrepreneurial orientation through personality traits?

2. Methodology

This study employs a quantitative approach to analyze the influence of green education, personality traits, and green entrepreneurship practices on the green entrepreneurial orientation of ninth-grade students at SMP Negeri 22 Semarang, while also examining the indirect effects mediated by personality. Conducted in a school actively implementing the Project to Strengthen the Profile of Pancasila Students (P5) under entrepreneurship and sustainable lifestyle themes, the research uses a structured questionnaire based on a five-point Likert scale, with validated items developed from established theories: four items on green education (Papageorgiou et al., 2023), five on personality traits such as proactiveness, risk-taking, and self-efficacy (Triana et al., 2021), four on green entrepreneurship practices (Etni, M et al., 2021), and five on green entrepreneurial orientation (Rahmanto et al., 2024), all showing Cronbach's Alpha values above 0.70 (Rustamana et al., 2024). Data were collected purposively from 157 ninth-grade students in January 2025 during class hours using printed questionnaires distributed with homeroom teacher supervision. Analysis through SPSS version 30.0 included descriptive statistics, validity and reliability testing, classical assumption tests (normality, multicollinearity, F-test, t-test, R^2), multiple linear regression, and path analysis, offering a comprehensive understanding of the direct and indirect relationships among variables and the predictive role of education and personality in fostering students' environmentally responsible entrepreneurial behavior.

3. Result and Discussion

The characteristics of respondents in this study are described based on gender, age, and their status as twelfth-grade students at a Junior High School in Semarang. The descriptive results of the respondents for each characteristic are as follows:

Table 1. Characteristics of Respondents in Grade IX at SMP Negeri 22 Semarang

Gender	Frequency	Age Range	Percentage (%)
Male	56	14 – 15 years	35.67
Female	101		64.33
Total	157	157	100

The description of respondent characteristic serves to provide an initial overview of the demographic profile of ninth-grade students, particularly in terms of average class size and gender distribution. This information is essential to ensure proportional sample representation and to support a more accurate interpretation of the data analysis results.

Table 1 presents the demographic distribution of respondents based on gender. Of the 157 students surveyed, 56 (35.67%) were male, and 101 (64.33%) were female. The respondents were aged between fourteen and fifteen years. This distribution reflects adequate gender representation in the study sample.

Table 2. Validity Test based on Pearson Correlation

Information	R Calculate	R Table	Result
Green Education			
GE1	0.242	0.156	Valid
GE2	0.256	0.156	Valid
GE3	0.236	0.156	Valid
GE4	0.248	0.156	Valid
Personality Traits			
PT1	0.352	0.156	Valid
PT2	0.284	0.156	Valid
PT3	0.324	0.156	Valid
PT4	0.417	0.156	Valid
PT5	0.481	0.156	Valid
Green Entrepreneurship Practices			
GEP1	0.448	0.156	Valid
GEP2	0.504	0.156	Valid
GEP3	0.522	0.156	Valid
GEP4	0.604	0.156	Valid
Green Entrepreneurial Orientation			
GEO1	0.610	0.156	Valid
GEO2	0.404	0.156	Valid
GEO3	0.601	0.156	Valid
GEO4	0.445	0.156	Valid
GEO5	0.394	0.156	Valid

The validity test is conducted to determine whether each item in the research instrument accurately reflects the constructs being measured, thereby ensuring the instrument's suitability for use in data collection. Validity is a crucial step in the instrument development process to confirm that each item contributes meaningfully to the variable it represents. The results of the validity testing indicate that the correlation coefficient (r count) for each statement item exceeds the critical r value of 0.156 ($n = 157$, $\alpha = 0.05$), confirming the validity and appropriateness of all items for this study. The validity test was performed using SPSS version 30, applying the Pearson Product Moment correlation technique. According to Sugiyono, (2021) an item is deemed valid if the obtained r value surpasses the critical threshold at a predetermined significance level, reflecting that the item effectively measures the intended variable.

Table 2 presents the results of the item validity testing, showing that all indicators across the four measured constructs—green education, personality traits, green

entrepreneurship practices, and green entrepreneurial orientation—achieved r values higher than the critical threshold. This finding confirms that the questionnaire items used in this study are statistically valid and can be used to collect reliable data for further analysis.

Table 3. Construct Reliability and Validity

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.773	0.774	18

Following the validity testing, a reliability analysis was conducted to evaluate the internal consistency of the questionnaire items. Instrument reliability refers to the extent to which the instrument produces consistent results when administered under similar conditions. The reliability test was conducted using Cronbach's Alpha coefficient, a commonly used measure for assessing the internal consistency of scale-based instruments. According to Sugiyono, (2021), a Cronbach's Alpha value greater than 0.70 is considered acceptable, indicating that the items within a construct are consistently measuring the same underlying variable.

The results of the instrument reliability test, as presented in Table 3, indicate that the Cronbach's Alpha value is 0.773, while the Cronbach's Alpha based on standardized items is 0.774. These values are closely aligned, suggesting that standardizing the items did not significantly impact the reliability level of the instrument. This indicates that the scale items are stable and reliable across the constructs measured. Therefore, the instrument used in this study is considered to have good internal consistency and can be relied upon to accurately measure the variables of green education, personality traits, green entrepreneurship practices, and green entrepreneurial orientation.

Descriptive analysis is employed to provide an overview of respondents' perceptions toward each research variable, enabling the identification of general trends and response patterns that support further interpretation of the study findings.

Table 4. Results of Descriptive Analysis of Variables

Variable	Respondent	Minimum Value	Maximum Value	Total Score	Category
GE	157	157	785	576	High
PT	157	785	3295	2854	High
GEP	157	628	3140	2244	High
GEO	157	785	3925	2639	High

Table 4 presents evidence that, in accordance with the principles of Education for Sustainable Development (ESD), green education significantly contributes to fostering students' environmental awareness and competencies necessary to address ecological issues within schools while promoting long-term sustainability.

The study's results demonstrate that respondents perceive green education positively, as it enables them to harness their potential and actively engage in developing environmentally-oriented entrepreneurial ideas within the school context through exposure to sustainability-focused learning.

Furthermore, analysis using the Big Five Personality Traits model reveals that students with high openness to experience exhibit greater creativity and responsiveness toward eco-friendly business initiatives, whereas those with strong conscientiousness show greater discipline in executing sustainable entrepreneurial activities. These results are consistent with findings from Muhid et al., (2021) which emphasize that institutional support—particularly in terms of infrastructure and educational facilitation—plays a vital role in enhancing the success of green entrepreneurship programs in schools.

Table 5. Test of the Coefficient of Determination

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.516[a]	0,266	0,252	2,20134
a. Predictors: (Constant), SQ_GEP, SQ_PT, SQ_GE				

The coefficient of determination test assesses how well the independent variables explain the dependent variable. As shown in Table 5, the Adjusted R Square value of 25.2% indicates that green education, personality traits, and green entrepreneurship practices collectively explain 25.2% of the variation in green entrepreneurial orientation, while the remaining 74.8% is influenced by other factors outside the model. This supports findings by Alissa et al., (2022), emphasizing that the effectiveness of Education for Sustainable Development (ESD) is also shaped by external elements like educational policies, institutional readiness, and student characteristics.

Table 6. Simultaneous Test (F)

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
1	Regression	268,848	3	89,616	18,493	.000[b]
	Residual	741,419	153	4,846		
	Total	1010,268	156			
a. Dependent Variable: VAR_GEO						
b. Predictors: (Constant), VAR_PT_M, VAR_GE, VAR_GEP						

The F-test is used to assess the joint significance of all independent variables in explaining the variation in the dependent variable, providing insight into the overall model fit. The F-test results (p = 0.000) indicate that green education, personality traits, and green entrepreneurial practices simultaneously have a highly significant effect on green entrepreneurial orientation, supporting the ESD framework that integrates environmental education, character development, and sustainable entrepreneurship. These findings highlight the necessity of an integrative educational strategy in preparing future entrepreneurs with a strong

orientation toward sustainability (Mawardi et al., 2025; Balaguera et al., 2022; Purnama et al., 2023).

Table 7. Partial Test (T-Test)

Linear Regression Model 1

Coefficients[a]						
Model		Unstrandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.330	1.477		7.670	.000
	VAR_GE	.259	.083	.237	3.117	.002
	VAR_GEP	.203	.064	.241	3.179	.002
a. Dependent Variable: SQ_GEO						

The t-test in this study was employed to examine the significance of the partial effect of each independent variable on the dependent variable. The primary purpose of the t-test is to determine whether there is a statistically significant relationship between an individual independent variable and the dependent variable within the regression model. In this context, the t-test was used to evaluate the extent to which green education and green entrepreneurship practices individually influence green entrepreneurial orientation, thereby providing a deeper understanding of the contribution of each variable to the research objectives.

The constant value of 11.330 indicates that, in the absence of contributions from green education and green entrepreneurship practices, the baseline level of green entrepreneurial orientation would be at that figure. Green education, with a coefficient value of B = 0.259, implies that a one-unit increase in the green education score will increase the green entrepreneurial orientation score by 0.259 units, assuming other variables are held constant. The t-value of 3.117 and p = 0.002 < 0.05 indicate that the effect is statistically significant. The beta value of 0.237 suggests a relatively strong influence. Meanwhile, the coefficient B for green entrepreneurship practices is 0.203, meaning that each one-unit increase in green entrepreneurship practices will raise the green entrepreneurial orientation by 0.203 units. The t-value of 3.179 and p = 0.002 demonstrate that this effect is also statistically significant. The beta value of 0.241 indicates that its influence is slightly stronger than that of green education.

The regression table shows that the constant value is 11.330, which indicates that when all independent variables are equal to zero, the initial value of green entrepreneurial orientation is at that level. The resulting regression equation is as follows:

$$GEO = 11{,}330 + 0{,}259(GE) + 0{,}203(GEP).$$

With:

GE = Green Education, and GEP = Green Entrepreneurship Practices

The results of the t-test indicate that green education has a significance value of 0.002 < 0.05, with a t-value of 3.117. Therefore, H0 is rejected and H1 is accepted, indicating that green education has a significant effect on green

entrepreneurial orientation. Similarly, green entrepreneurship practices also show a significance value of 0.002 < 0.05, with a t-value of 3.179, suggesting that this variable also significantly influences green entrepreneurial orientation. Simultaneously, both green education and green entrepreneurship practices exert a significant influence on green entrepreneurial orientation, underscoring the importance of educational and practical approaches in promoting sustainable entrepreneurship. This finding is consistent with the concept of Education for Sustainable Development (ESD), which emphasizes the critical role of environmental education in shaping green entrepreneurial practices and orientation (Prabawani B, 2021). The significant impact of green education on green entrepreneurial orientation highlights the pivotal role of environmental education in fostering sustainable mindsets and lifestyles. This aligns with the findings of by Sulaesih et al., (2024), who state that sustainability-based education can enhance students' green entrepreneurial competencies.

Furthermore, the significant influence of green entrepreneurship practices on green entrepreneurial orientation indicates that practical experience in environmentally friendly entrepreneurial activities is a key factor in shaping green entrepreneurial orientation. This finding reinforces the study by Fariqoh, (2022) which notes that involvement in sustainable business practices can strengthen green entrepreneurial orientation. Overall, based on the results of the first regression model, both green education and green entrepreneurship practices have a significant positive effect on students' green entrepreneurial orientation. Although both variables are significant, green entrepreneurship practices contribute slightly more than green education, as reflected in the standardized beta values.

Linear Regression Model 2

Coefficients[a]

Model		Unstrandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.750	2.241		1.674	.096
	VAR GE	.061	.110	.040	.549	.584
	VAR GEP	.485	.085	.411	5.690	.000
	VAR PT	.284	.104	.203	2.733	.007

a. Dependent Variable: VAR_GEO_Y

The regression table shows that the constant value is 3.750, indicating that when all independent variables are equal to zero, the baseline value of green entrepreneurial orientation is at this level. The resulting regression equation is as follows:

$$GEO = 3{,}750 + 0{,}061(GE) + 0{,}485(GEP) + 0{,}284(PT).$$

GE = Green Education, GEP = Green Entrepreneurship Practices and PT = Personality Traits

The results indicate that the variable of green entrepreneurial practices has a positive and significant effect on green entrepreneurial orientation, with a coefficient of 0.485 and a significance value of 0.000 (< 0.05). This implies that the higher the involvement in environmentally friendly entrepreneurial practices,

the greater the increase in students' green entrepreneurial orientation. The personality variable also shows a significant effect, with a coefficient of 0.284 and a significance value of 0.007 (< 0.05), indicating that individual character contributes to the enhancement of green entrepreneurial orientation. Conversely, green education does not show a significant effect, as its significance value is 0.584 (> 0.05), suggesting that, within the context of this study, green education has yet to exert a direct impact on green entrepreneurial orientation.

Table 8. Influence Values

Path Relationship	Direct Effect	Indirect Effect	Total Effect
GE => PT => GEO	0.040	0.048	0.088
GEP => PT => GEO	0.411	0.049	0.459

The calculation results indicate that the direct effect of green education on green entrepreneurial orientation is 0.040, while the indirect effect through the personality variable is 0.048. Consequently, the total effect amounts to 0.088. This demonstrates that although the direct influence of green education on green entrepreneurial orientation is relatively small, the presence of personality as a mediating variable significantly strengthens this relationship.

The direct effect of green entrepreneurial practices on green entrepreneurial orientation is 0.411. Meanwhile, the indirect effect through the personality variable is 0.049, resulting in a total effect of 0.460. These findings suggest that green entrepreneurial practices not only have a direct impact but also exert an indirect influence through the development of students' personality traits, which ultimately reinforces their tendency toward green entrepreneurial orientation.

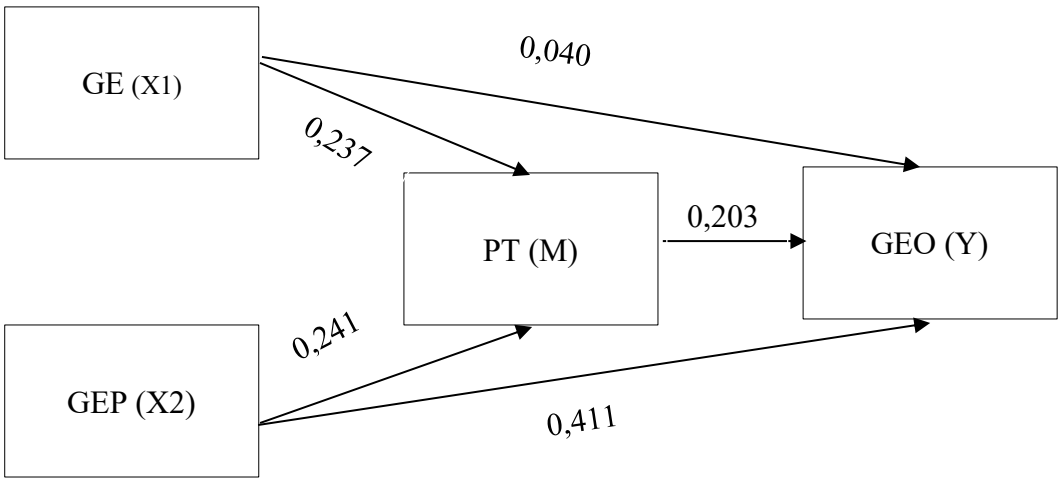

Figure 1. Path Analysis Result

Table 9. Sobel Test Result

The Effect of GE on GEO through PT	The Effect of GEP on GEO through PT
A : 0.237	A : 0.241
B : 0.203	B : 0.203
SE_A : 0.083	SE_A : 0.064
SE_B : 0.104	SE_B : 0.104

Sobel test statistic : 1.61140599	Sobel test statistic : 1.73294574
One – tailed probability : 0.05354363	One – tailed probability : 0.04155266
Two – tailed probability : 0.10709126	Two – tailed probability : 0.08310531

The one-tailed p-value slightly above the 0.05 significance threshold indicates that the mediating role of personality in the relationship between green education and green entrepreneurial orientation is categorized as approaching significance or weakly significant. This suggests that although the mediation effect does not reach strong statistical significance, there is an indication that personality partially mediates the relationship. This finding reinforces the argument that green education impacts green entrepreneurial orientation not only directly but also indirectly through shaping students' character. This aligns with the theoretical framework of Education for Sustainable Development (ESD), which emphasizes a holistic educational approach that not only imparts environmental knowledge but also cultivates students' values, attitudes, and behaviors through character strengthening. In this context, green education provides the conceptual foundation and sustainability values, while personality acts as an internal filter determining the extent to which students respond to and internalize these values into sustainable entrepreneurial actions. Therefore, strategies to enhance green education should be integrated with personality development approaches to maximize their impact on green entrepreneurial orientation.

A one-tailed p-value below 0.05 indicates that the indirect effect is statistically significant at the one-sided significance level. This demonstrates that personality plays a significant mediating role in bridging the relationship between green entrepreneurship practices and green entrepreneurial orientation. In other words, the stronger the students' experience in green entrepreneurship practices, the more likely they are to develop personalities that support sustainable entrepreneurial behavior, which ultimately fosters the formation of green entrepreneurial orientation.

This finding aligns with the principles of Education for Sustainable Development (ESD), which highlights the importance of developing individual capacities through real and reflective experiences in education. ESD not only emphasizes the transfer of sustainability knowledge but also nurtures social competencies and personalities that support environmentally responsible decision-making. In this context, green entrepreneurship practices serve as part of experiential learning that promotes the internalization of values and the formation of pro-environmental character in students.

Thus, these results reinforce the notion that the transformation of green entrepreneurship education can be achieved not only through cognitive material delivery but also through the active involvement of students in contextualized practical activities. The mediating role of personality indicates that practice-based learning can shape environmentally conscious entrepreneurial character, in line with the holistic and transformative spirit of ESD.

The path analysis (Figure 1) is used to examine both the direct and indirect effects of the independent variables—green education, personality traits, and green entrepreneurship practices—on green entrepreneurial orientation (GEO). This method helps to understand how these variables influence GEO directly and through mediating factors, providing insights into the underlying mechanisms driving students' entrepreneurial attitudes toward sustainability.

The findings also suggest that practical experience in environment-based entrepreneurship has a stronger influence on shaping students' sustainable business orientation. The strength of the influence of green entrepreneurship practices (GEP) shows that students' direct involvement in green business initiatives not only enhances technical skills but also internalizes environmental values that shape their entrepreneurial mindset. This is consistent with the findings of Purnamasari & Hanifah, (2021) who demonstrated that student involvement in direct entrepreneurial activities can improve competencies oriented toward sustainability. This supports the argument of (Kioupi & Voulvoulis, 2022), who asserted that education for sustainable development should be designed to strengthen core competencies, rather than merely impart knowledge.

The mediating role of personality in the pathway from green education to green entrepreneurial orientation provides insight into how students' internal characteristics serve as a bridge between knowledge and action. Elrayah & Tufail, (2024) stated that without adequate character development, environmental education will not produce meaningful behavioral transformation, particularly in the context of entrepreneurship among young learners. Overall, these findings emphasize the importance of integrating environmental education with personality development and direct entrepreneurial practice. These three components synergistically support the goals of Education for Sustainable Development (ESD) by encompassing cognitive, affective, and behavioral domains within the learning process. The presented model can be adapted in other schools seeking to foster green entrepreneurial orientation, especially at primary and secondary education levels. As Alwasi, (2023), emphasized, integrating sustainability into school curricula through a combination of theoretical knowledge, practical application, and character building is key to cultivating future generations of green entrepreneurs.

Path analysis results in this study reveal that green education and green entrepreneurship practices contribute differently to strengthening students' personality traits and green entrepreneurial orientation. First, green education was found to have a positive and significant effect on students' personality traits ($p = 0.002$), thus supporting hypothesis H1. This confirms that education focused on sustainability values can shape students' characters to be more environmentally conscious, responsible, and proactive. Furthermore, green entrepreneurship practices also significantly influenced personality traits ($p = 0.002$), indicating that direct involvement in environmental entrepreneurship activities provides concrete experiences in developing entrepreneurial values and attitudes; therefore, hypothesis H2 is supported.

However, the direct effect of green education on green entrepreneurial orientation was positive but not statistically significant ($p = 0.584$), leading to the rejection of hypothesis H3. This implies that although green education is important, its influence on green entrepreneurial orientation requires support from personality traits or direct entrepreneurial practice. Conversely, green entrepreneurship practices had a highly significant positive effect on green entrepreneurial orientation ($p < 0.001$), supporting hypothesis H4. This strengthens the argument that hands-on experience in entrepreneurship encourages students to develop sustainable entrepreneurial intentions and orientation.

Moreover, personality traits significantly influenced green entrepreneurial orientation ($p = 0.007$), leading to acceptance of hypothesis H5. This means that students exhibiting personality traits such as innovativeness, proactiveness, and risk-taking tend to have a stronger inclination towards conducting environmentally oriented businesses. Meanwhile, mediation testing with the Sobel test showed that personality traits did not significantly mediate the relationship between green education and green entrepreneurial orientation ($p = 0.107$, two-tailed), thus rejecting hypothesis H6. In contrast, personality traits significantly mediated the effect of green entrepreneurship practices on green entrepreneurial orientation, with the Sobel test indicating marginal significance ($p = 0.083$, two-tailed; $p = 0.041$, one-tailed), supporting hypothesis H7.

Table 10. Hypothesis

Hypothesis Code	Hypothesis Statement	p-value/ Test Result	Conclusion
H1	Green education has a positive effect on personality traits	p = 0.002	Accepted
H2	Green entrepreneurship practices have a positive effecr on personality traits	p = 0.002	Accepted
H3	Green education has a direct effect on green entrepreneurial orientation	p = 0.584	Rejected
H4	Green entrepreneurship practices have a direct effect on green entrepreneurial orientation	p = < 0.001	Accepted
H5	Personality traits have a positive effect on green entrepreneurial orientation	p = 0.007	Accepted
H6	Personality traits mediate the effect of green education on green entrepreneurial orientation	Sobel p (two-tailed) = 0.017	Rejected
H7	Personality traits mediate the effect of green entrepreneurship practices on green entrepreneurial orientation	Sobel p (one-tailed) = 0.041	Accepted

In summary, these results underscore the importance of a hands-on approach in green entrepreneurship as the main driver of sustainable entrepreneurial orientation among students, while the role of green education appears to be more effective when combined with the development of personality traits. This finding aligns with the principles of Education for Sustainable Development (ESD), which emphasize transformative, action-based learning and character

development to produce individuals capable of making responsible decisions toward sustainability.

4. Conclusion

This study aimed to identify the factors influencing green entrepreneurial orientation and examine the mediating role of personality traits in the relationship between green education and green entrepreneurship practices with green entrepreneurial orientation. The findings reveal that both green education and green entrepreneurship practices significantly contribute to shaping students' green entrepreneurial orientation. Although personality traits did not show a significant direct effect, their mediating role remains relevant in bridging educational content with entrepreneurial behavior.

However, the integration of green education into the school curriculum has not yet achieved its full potential in fostering students' environmental awareness and sustainable entrepreneurial mindset, largely due to the diversity of individual characteristics. Extracurricular programs such as environmental ambassador initiatives and Pancasila Student Profile projects have proven effective in enhancing students' understanding and skills, particularly among those with strong personality traits. This study recommends that schools adopt a more practical and contextualized approach to environmental education to foster real behavioral change. Future research should involve a broader range of educational institutions and levels, and consider contextual factors such as family background, school policies, and community support to gain a more comprehensive understanding of the drivers of green entrepreneurship in educational settings.

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