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The Influence of Campus Ecological Environment on Student Ecological Citizenship: ANCOVA's Nonparametric Quade Analysis in Three Cities in Indonesia

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Abstract

This study aims to analyze the influence of campus ecological environmental conditions on students' ecological citizenship and test the differences between regions in three cities, namely Blitar, Sumenep, and Surabaya. The method used is a comparative quantitative approach with an ex post facto design. Data were collected through questionnaires of 190 college students and analyzed using ANCOVA's Nonparametric Quade to control for covariate variables under unnormally distributed data conditions. This approach is carried out to maintain the authenticity of the data obtained because it is not normally distributed. The results of the study show that the ecological environment condition of the campus has a significant effect on the ecological citizenship of students contribution of 47.9%. However, after covariate control, there was no significant difference in the level of ecological citizenship between cities. In addition, the influence of the campus ecological environment has proven to be consistent across various regional contexts. ANCOVA's Quade Nonparametric approach also shows that ranking adjustments result in more stable estimates in the analysis of nonparametric data. The conclusion of this study confirms that the ecological environment of the campus is the main factor in forming student ecological citizenship, while geographical factors do not show a significant role after being controlled. This research makes an empirical and methodological contribution to the study of sustainability education in higher education.

Keywords: Nonparametric, Robust Analysis, Comparative Study, Higher Education, Ecological Citizenship

1. INTRODUCTION

The issue of the global environmental crisis in recent decades has become a major concern in various disciplines, especially in the field of education, due to the increasing complexity of problems such as climate change, ecosystem degradation, and unsustainable exploitation of natural resources. This condition demands a transformation of the educational paradigm that is not only oriented to knowledge transfer, but also to the formation of awareness, values, and behaviors that support environmental sustainability. In this context, the concept of *ecological citizenship* is very important because it emphasizes the responsibility of individuals and collectives in maintaining environmental sustainability through tangible actions in daily life. In line with that, the university is strategically positioned in shaping students' ecological citizenship through the integration of sustainability education in sustainability-oriented

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curriculum, institutional policies, and social practices (Arbues et al., 2025). In addition, learning experiences that are integrated with real practices have been proven to be able to improve the civic behavior of students' environments, although there are variations based on demographic factors and social context (Cederqvist et al., 2025). This shows that ecological citizenship is a multidimensional construct that is influenced by various factors, including education, experience, and environmental context (Van Harskamp et al., 2024). Thus, it is important to examine how the ecological environment of the campus as a real context can affect the formation of student ecological citizenship empirically.

Furthermore, various studies show that the formation of ecological citizenship is influenced not only by formal education, but also by broader social, cultural, and structural factors. Community participation in sustainability practices, including in the context of energy, is an important part of ecological citizenship that reflects the involvement of individuals in daily life (Solbu et al., 2025). In addition, environmental leadership and psychological empowerment in organizations have been shown to be able to improve environmental civic behavior through the formation of a supportive institutional culture (Jing et al., 2026). In the context of higher education, the ecological environment conditions of the campus not only function as a physical setting, but also as a value system and norms that affect student behavior. However, research shows that there is a gap between awareness and action in students' environmental citizenship practices, where high motivation is not always followed by real action (Hajj-Hassan et al., 2024). This shows that knowledge alone is not enough to produce behavior change without adequate environmental support. Therefore, the condition of the campus ecological environment is an important factor in bridging the gap between knowledge and action in student ecological citizenship.

On the other hand, the study of ecological citizenship also develops in the perspective of global education and the formation of civic values. The integration of the concept of Sustainable Development Goals (SDGs) in the curriculum has been proven to increase students' understanding and awareness of global sustainability issues (Monzó-Martínez et al., 2024). A multi-perspective approach in civics education can also improve students' critical thinking skills and social participation in dealing with complex issues (Bombardelli, 2024). In addition, environment-based learning experiences have been shown to be able to increase ecological awareness through direct interaction with nature (Pérez et al., 2021). In the broader social context, ecological citizenship also has a political and participatory dimension that can be realized through social activities and environmental movements (Cruz et al., 2025). This shows that the formation of ecological citizenship does not only occur in the classroom, but also through social interactions and contextual experiences experienced by individuals in daily life.

Furthermore, various studies emphasize the importance of a multidimensional approach in understanding ecological citizenship as part of social transformation towards sustainability. The concept of ecological citizenship encompasses intercultural and transnational dimensions that place individuals as part of a global ecological system (Alves et al., 2024). Additionally, normative values such as ecological religiosity can strengthen an individual's commitment to pro-environmental behavior (Yoo & Kim, 2023). Environmental literacy also has an important role to play in increasing individual participation in sustainability actions, regardless of differences in political orientation (Poškus, 2024). Meanwhile, a multi-level educational

approach that integrates global and local dimensions has been proven to strengthen students' ecological awareness (Simon et al., 2023). Thus, the formation of ecological citizenship requires a holistic approach that considers the interaction between cognitive, affective, social, and contextual factors.

Although various studies have made important contributions to understanding ecological citizenship, there are still significant research gaps, especially related to the influence of campus ecological environmental conditions as a contextual variable in shaping student behavior quantitatively and comparatively across regions. Most previous studies have focused more on education or value aspects separately, so not many have examined the interaction between contextual factors and ecological citizenship behavior simultaneously. In addition, the methodological approach used is generally still parametric, so it is less able to capture the complexity of social data that does not meet classical statistical assumptions. Therefore, this study uses *the ANCOVA Nonparametric Quade approach* to provide a more robust analysis in examining the influence of campus ecological environmental conditions on students' ecological citizenship. This approach allows for nonparametric control of covariate variables so that the results of the analysis become more accurate in the context of heterogeneous social data.

Based on this description, this study aims to analyze the influence of campus ecological environmental conditions on students' ecological citizenship by considering the differences in regional contexts in three cities, namely Blitar, Surabaya, and Sumenep. In particular, this study aims to examine the difference in the level of ecological citizenship of students between cities after controlling for campus ecological environmental conditions, analyze the influence of campus ecological environmental conditions on ecological citizenship, and test the consistency of these influences in various regional contexts. In addition, this study also aims to test the effectiveness of *ANCOVA's Quade Nonparametric approach* in identifying differences in the effects of campus ecological environment on students' ecological citizenship. The formulation of the problem in this study includes: (1) whether there is a difference in the level of ecological citizenship of students in the three cities after controlling the ecological environmental conditions of the campus as a covariate; (2) the extent to which the ecological environment conditions of the campus affect the level of ecological citizenship of students; (3) whether the influence is consistent in various regional contexts; and (4) whether there is a difference in the ecological effects of the campus environment after adjusting the rating through the ANCOVA Nonparametric Quade approach. Thus, this research is expected to make an empirical and methodological contribution to the development of ecological citizenship studies in higher education.

2. METHOD

This study uses a comparative quantitative design with *an ex post facto* approach that aims to analyze the influence of campus ecological environmental conditions on *students' ecological citizenship* in three regional contexts, namely Blitar, Surabaya, and Sumenep. The Campus Ecological Environment Condition measured includes the academic ecosystem, institutional culture, sustainability policies of the institution, social support, and sustainability-oriented campus governance. This design was chosen because it allows empirical testing of relationships between variables without direct manipulation, as well as being relevant for

examining social phenomena in the context of complex higher education. The study population was college students in all three cities, with sampling techniques using *proportionate stratified random sampling* to ensure representation based on location and institutional characteristics. The number of samples was proportionally determined from each city to maintain a balance of data distribution and improve the external validity of the study. The research instrument consists of two main scales, namely the scale of campus ecological environmental conditions as a covariate variable and *the ecological citizenship scale* as a dependent variable, which is developed based on the dimensions of awareness, responsibility, participation, and sustainability practices (Van Harskamp et al., 2024). The development of the instrument also considers the integration of aspects of learning experience and real practice that have been shown to influence the civic behavior of the student environment (Cederqvist et al., 2025). The data collection procedure was carried out through the distribution of online questionnaires to respondents who had met the inclusion criteria, by ensuring research ethics such as consent to participation and data confidentiality. The collected data were then analyzed using *the ANCOVA Nonparametric Quade approach*, which began with the process of transforming the rating of dependent and covariate variables, followed by regression analysis to obtain residuals as adjustment scores, and ended with a difference test between groups using the Kruskal-Wallis test on the residuals. This approach was chosen because it is able to control covariate variables in a nonparametric manner so that it is more robust in handling data that does not meet normality assumptions, and allows for more accurate cross-regional comparative analysis. In addition, additional analysis was conducted to test the consistency of covariate influences through a model of interaction between variables to understand contextual dynamics in the formation of *students' ecological citizenship*, in line with the findings that structural factors and institutional environment play an important role in shaping pro-environmental behavior (Jing et al., 2026). With this systematic and structured procedure, research can be replicated by other researchers in different contexts with a high level of reliability.

3. RESULTS AND DISCUSSION

Results

1. *Data Distribution of Campus Ecological Environmental Conditions and Student Ecological Citizenship*

The survey data shows that there are variations in the value of campus ecological environmental conditions and the level of *student ecological citizenship* in three cities, namely Blitar, Sumenep, and Surabaya. Based on Table 1, the ecological citizenship score of students is in the range of 57 to 100 in Blitar, 64 to 100 in Sumenep, and 60 to 100 in Surabaya. The number of respondents analyzed consisted of 69 students in Blitar, 68 students in Sumenep, and 53 students in Surabaya with no missing data. The median value in the three cities showed the same number, which was 80, which indicated the consistency of the middle value of data distribution in each region. In addition, the average score showed variation, namely 78.28 for Blitar, 82.29 for Sumenep, and 83.66 for Surabaya. The distribution of data is shown through a standard deviation of 8.79 in Blitar, 8.00 in Sumenep, and 10.44 in Surabaya, which shows a relatively different level of variation between cities. The data also shows that the value of the interquartile range is different, namely 5.50 in Blitar, 8.25 in Sumenep, and 11.50 in Surabaya.

Table 1. Description of the data from the Campus Ecological Environment Survey and the Student Ecological Citizenship Level

Descriptives					
Kota			Statistic	Std. Error	
Ecological_Citizenship	Blitar	Mean		78.2899	1.05822
		95% Confidence Interval for Mean	Lower Bound	76.1782	
			Upper Bound	80.4015	
		5% Trimmed Mean		78.1659	
		Median		80.0000	
		Variance		77.268	
		Std. Deviation		8.79020	
		Minimum		57.00	
		Maximum		100.00	
		Range		43.00	
		Interquartile Range		5.50	
		Skewness		.167	.289
		Kurtosis		1.264	.570
	Sumenep	Mean		82.2941	.97061
		95% Confidence Interval for Mean	Lower Bound	80.3568	
			Upper Bound	84.2315	
		5% Trimmed Mean		82.0065	
		Median		80.0000	
		Variance		64.061	
		Std. Deviation		8.00384	
		Minimum		64.00	
		Maximum		100.00	
		Range		36.00	
		Interquartile Range		8.25	
		Skewness		.927	.291
		Kurtosis		.453	.574
	Surabaya	Mean		83.6604	1.43458
		95% Confidence Interval for Mean	Lower Bound	80.7817	
			Upper Bound	86.5391	
		5% Trimmed Mean		83.9644	
		Median		80.0000	
		Variance		109.075	
		Std. Deviation		10.44389	
		Minimum		60.00	
		Maximum		100.00	
		Range		40.00	
		Interquartile Range		11.50	
		Skewness		.126	.327
		Kurtosis		-.293	.644

Source: SPSS data analysis, 2026

2. Data Normality Test Results

The results of the normality test using Kolmogorov-Smirnov and Shapiro-Wilk showed that all ecological citizenship data in the three cities were not distributed normally. The significance values for Blitar, Sumenep, and Surabaya in the two tests showed a value of less than 0.001. Thus, the entire data set does not meet the assumption of statistical normality. Shapiro-Wilk's statistical values are 0.906 for Blitar, 0.853 for Sumenep, and 0.885 for Surabaya, respectively, which shows a deviation from the normal distribution. In addition, the values of skewness and kurtosis showed distribution variations, with the highest skewness found in Sumenep at 0.927. This data shows that the distribution of ecological citizenship values is not perfectly symmetrical across all groups. The documentation of the results of filling out the questionnaire showed extreme variations in the answers of some respondents, which contributed to the abnormal distribution.

Table 2. Test the normality of the data

Tests of Normality

Kota		Kolmogorov-Smirnov[a]			Shapiro-Wilk			
		Statistic	df	Sig.	Statistic	df	Sig.	
Ecological_Citizenship	Blitar	.220	69	<,001	.906	69	<,001	
	Sumenep	.304	68	<,001	.853	68	<,001	
	Surabaya	.222	53	<,001	.885	53	<,001	

a. Lilliefors Significance Correction

Source: SPSS data analysis, 2026

3. Results of Regression Analysis between Campus Ecological Environment and Ecological Citizenship

The results of the regression analysis show that the variables of the campus ecological environment have a relationship with the ecological citizenship of students. The value of the determination coefficient (R Square) of 0.479 indicates that 47.9% of the variation in ecological citizenship can be explained by the ecological environmental conditions of the campus. The value of the regression coefficient (B) of 0.681 indicates the direction of the positive relationship between the two variables. An F value of 173,140 with a significance of <0.001 indicates that the regression model used has a high degree of conformity. In addition, a constant value of 24,832 indicates the basic value of ecological citizenship when the ecological environment variable is zero. The residual data showed a minimum value of -15.97 and a maximum of 31.33, which illustrates the variation in deviation from the predicted value.

Table 3. Regression Test Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.692[a]	.479	.477	6.69858

a. Predictors: (Constant), Lingkungan_Ekologis

b. Dependent Variable: Ecological_Citizenship

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	24.832	4.313		5.758	<,001
	Lingkungan_Ekologis	.681	.052	.692	13.158	<,001

a. Dependent Variable: Ecological_Citizenship

Source: SPSS data analysis, 2026

4. ANCOVA Nonparametric Quade Analysis Results

The results of ANCOVA's Nonparametric Quade analysis show that the residual mean rank value differs between cities, namely 93.40 for Blitar, 95.70 for Sumenep, and 97.98 for Surabaya. However, the results of the Kruskal-Wallis test showed an H value of 0.210 with a significance of 0.900. This data shows that there was no significant difference between groups after covariate adjustment using the Quade method. The total number of samples analyzed in this test was 190 respondents. The residual ranking distribution shows that the ranking values are relatively close to each city. The documentation of the observation results shows that although there are differences in the conditions of the campus environment, the behavior patterns of students do not show any noticeable differences. In addition, the data showed that the variation in ranking was not too far between groups, which supported the test results. These results are presented in detail in table 4.

Table 4. ANCOVA Nonparametric Quade Test Results

Ranks			
	Kota	N	Mean Rank
Rank of RES_1	Blitar	69	93.40
	Sumenep	68	95.70
	Surabaya	53	97.98
	Total	190	

Test Statistics[a,b]	
	Rank of RES_1
Kruskal-Wallis H	.210
df	2
Asymp. Sig.	.900

a. Kruskal Wallis Test

b. Grouping Variable: Kota

Source: SPSS data analysis, 2026

The findings are in line with the results of initial data analysis which shows that there is a difference in the average level of Ecological Citizenship of students between regions, where Surabaya has the highest average of 83.66, followed by Sumenep at 82.29, and Blitar at 78.29. Descriptively, there is a difference in values between cities, especially between Surabaya and Blitar with a difference of around 5.37 points. However, after controlling for the Campus Ecological Environment variables through ANCOVA's Nonparametric Quade analysis, the difference became statistically insignificant. This shows that the variation in the level of ecological citizenship of students is more influenced by the ecological environmental conditions of the campus than by the factors of the region or city itself. Thus, although there was a difference in the average score in the original data, the influence weakened after ecological environmental factors were controlled, so that differences between regions could not be statistically significant.

5. Results of the Difference in Influence Test (GLM/ANCOVA)

The results of the analysis using the General Linear Model showed that the campus ecological environment variable had an F value of 151,491 with a significance of <0.001. Meanwhile, the city variable showed an F value of 0.539 with a significance of 0.584. An R-Square value of 0.482 indicates that the model is able to explain 48.2% of the variation in ecological citizenship. The corrected value of the model is 57,790 with a significance of <0.001 indicating that the model as a whole is significant. This data shows that the contribution of campus ecological environment variables is more dominant than regional variables. The data also showed that variation between cities did not provide significant differences in the model. These results are presented in Table 5 as part of an analysis of differences in influence between regions.

Table 5. Results of the analysis of the difference test Influence between regions

Tests of Between-Subjects Effects					
Dependent Variable:Ecological_Citizenship					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7817.576[a]	3	2605.859	57.790	<,001
Intercept	1496.555	1	1496.555	33.189	<,001
Lingkungan_Ekologis	6831.067	1	6831.067	151.491	<,001
Kota	48.615	2	24.307	.539	.584
Error	8387.140	186	45.092		
Total	1269608.000	190			
Corrected Total	16204.716	189			
a. R Squared = .482 (Adjusted R Squared = .474)					

Source: SPSS data analysis, 2026

Discussion

Is there a difference in the level of ecological citizenship of students in the three cities after controlling for the ecological environment of the campus as a covariate?

The findings of the study showed that there was no significant difference in the level of ecological citizenship of students in Blitar, Sumenep, and Surabaya after controlling the ecological environmental conditions of the campus through the ANCOVA Nonparametric Quade approach. These results indicate that regional variation does not directly determine the difference in students' ecological citizenship behavior when campus environmental factors have been controlled. These findings are in line with the view that ecological citizenship is a multidimensional construct that is not only influenced by geographical factors, but is more determined by educational experience and institutional context (Jing et al., 2026)(Arbues et al., 2025). Thus, the difference in cities as a macro context is not the main determinant in shaping students' ecological behavior. This strengthens the argument that the formation of ecological citizenship is more contextual and experience-based than regional structural factors.

Furthermore, the absence of significant differences between cities shows that students have a relatively homogeneous level of ecological awareness, regardless of differences in urban and semi-urban contexts. This is in line with the findings of Cederqvist who stated that an integrated learning experience has a consistent influence on the civic behavior of students' environments (Cederqvist et al., 2025). In addition, these results also show that the higher education process has succeeded in creating relatively uniform ecological awareness standards

across different regions. In this context, universities serve as homogenizing agents of sustainability values that transcend geographical boundaries (Arbues et al., 2025). This shows that the education system has an important role in forming consistent ecological awareness in various regions.

On the other hand, these findings can also be explained through the perspective of social participation in ecological citizenship. Solbu affirm that ecological citizenship is formed through social practices that involve the participation of the community at large (Solbu et al., 2025). As such, students in different cities are likely to have access to relatively similar social practices, such as environmental campaigns or community activities. This causes no significant difference in the level of ecological citizenship. In addition, the role of media and information globalization can also contribute to the uniformity of ecological values of students in various regions.

Furthermore, these findings can also be attributed to the concept of a gap between knowledge and action. Hajj-Hasan show that although students have a high level of awareness, it is not always followed by real action (Hajj-Hassan et al., 2024) . In the context of this study, the uniformity of ecological citizenship values can reflect uniformity at the level of awareness, but not necessarily at the level of behavior. This suggests that other factors, such as campus culture or institutional support, have an important role in actualizing these values.

In addition, these results also support a multidimensional approach in understanding ecological citizenship. Alves emphasized that ecological citizenship is part of a social transformation that involves various dimensions, including culture and global values (Alves et al., 2024). Thus, the similarity in the level of ecological citizenship between cities shows that students are in a relatively uniform global value system. This shows that the influence of globalization in sustainability education is quite strong in shaping students' ecological awareness.

From an educational perspective, these results also show that the sustainability learning approach applied in higher education has relatively consistent effectiveness in various regions. Swanson and Gamal show that the integration between global citizenship and sustainability learning is able to create broad ecological awareness (Swanson & Gamal, 2021). Thus, the absence of differences between cities can reflect the successful implementation of the approach.

Overall, the results of this study make an important contribution in showing that regional differences are not always the main factor in forming students' ecological citizenship. This has the implication that sustainability education policies can be applied widely without having to take into account geographical differences. However, this study also has limitations in terms of coverage of the area limited to three cities, so generalization of results needs to be done carefully.

To what extent does the ecological environment of the campus affect students' ecological citizenship?

The results of the study show that the ecological environment condition of the campus has a significant influence on the level of student ecological citizenship with a contribution of 47.9%. These findings suggest that nearly half of the variation in students' ecological civic

behavior can be explained by campus environmental conditions. This is in line with the findings of Arbues which show that the integration of sustainability in the campus environment can increase student awareness and engagement (Arbues et al., 2025). In addition, Cederqvist also show that learning experiences that are integrated with the real environment have a significant impact on student behavior (Cederqvist et al., 2025). Thus, the campus environment functions as an important factor in the formation of ecological citizenship.

Furthermore, these results also support the theory that learning does not only occur in the classroom, but also through interaction with the surrounding environment. Pérez show that direct experience with the environment can improve ecological awareness (Isabel & Gonz, 2024). In this context, the condition of the campus environment is an effective learning medium for students. This shows that campus environmental design has an important role in shaping student behavior.

In addition, these findings can also be explained through the concept of institutional culture. Jing show that environmental leadership and organizational culture have a significant influence on pro-environmental behavior (Jing et al., 2026). In the context of the campus, ecological environmental conditions reflect the institution's culture that supports sustainability. This shows that students tend to adapt their behavior to the norms that apply in the campus environment.

Furthermore, these results also show that the campus environment can bridge the gap between knowledge and action. Hajj-Hassan show that the gap can be reduced through adequate environmental support (Hajj-Hassan et al., 2024). Thus, good campus environment conditions can encourage students to implement the knowledge they have.

In addition, these results also support a transformational approach in sustainability learning. Gal and Gan show that transformational learning requires real experience to produce behavior change. A campus environment that supports sustainability can provide that experience for students (Gal & Gan, 2020).

Overall, the results of this study show that the condition of the campus ecological environment is the main determinant in the formation of student ecological citizenship. This has the implication that the development of green campuses must be a priority in higher education policy. However, this study has limitations in measuring other factors that may affect ecological citizenship, such as individual values or family factors.

Is the influence of campus ecological environmental conditions on student ecological citizenship consistent in various regional contexts (urban vs semi-urban/peripheral)?

The results of the study show that the influence of campus ecological environmental conditions on student ecological citizenship is consistent in various regional contexts, both in urban cities such as Surabaya and semi-urban/peripheral areas such as Blitar and Sumenep. This can be seen from the insignificance of the city variable in the GLM analysis model, while the campus ecological environment variable still shows a significant influence. These findings indicate that campus environmental factors have a relatively universal power in influencing student behavior, regardless of their geographic context. These results are in line with the view that ecological citizenship is a construction that develops within a global framework and is

not limited to specific local contexts (Alves et al., 2024) . Thus, the values of sustainability instilled in the campus environment are able to transcend geographical and social boundaries. This shows that students in different regions have a relatively uniform response to the ecological conditions of the campus. These findings reinforce the argument that higher education has a role as a global agent in shaping ecological awareness.

Furthermore, the consistency of this influence can also be explained through a multi-level educational approach that integrates global and local dimensions. Simon show that this approach is capable of creating stable ecological awareness in various contexts (Yanniris, 2021). In this study, the condition of the campus environment serves as a medium that connects global values with local practices. This allows students in various regions to internalize the value of sustainability in a uniform manner. In addition, the integration of SDGs concepts in education also contributes to this consistency (Monzó-Martínez et al., 2024). Thus, the influence of the campus environment is not fragmented by regional differences, but is cross-context.

These findings can also be attributed to the role of environmental literacy in shaping student behavior. Poškus shows that environmental literacy has a relatively stable influence on pro-environmental behavior, regardless of social or political background (Ariza et al., 2021). In the context of this research, the campus environment can be considered as a source of environmental literacy that facilitates continuous learning. This explains why its influence has remained consistent across regions. In addition, learning experiences integrated with the real environment also contribute to the stability of this influence (Cederqvist et al., 2025).

On the other hand, this consistency also suggests that other contextual factors outside the campus may have a smaller influence than the campus environment itself. This is in line with the findings of Jing who show that institutional culture has a dominant influence on individual behavior (Jing et al., 2026). In this context, the campus as an institution is able to create a relatively homogeneous environment in shaping student behavior. This shows that interventions at the institutional level can have a broad and consistent impact.

In addition, these findings also show that ecological citizenship has a universal dimension, which can be applied in various social contexts. Jordan emphasize that the integration between citizenship education and sustainability education can produce individuals with strong ecological awareness (Jordan et al., 2023). Thus, the consistency of the influence of the campus environment reflects the success of such integration in higher education.

In terms of implications, these results show that the development of green campus policies can be carried out nationally without having to adjust significantly to the regional context. This provides an opportunity for governments and educational institutions to develop uniform sustainability standards. In addition, these results also show that investment in campus environmental infrastructure can have a consistent impact across regions.

The theoretical contribution of this finding is the strengthening of the concept that ecological citizenship is cross-contextual and influenced by strong institutional factors. This research expands the literature by showing that the influence of the campus environment is not purely contextual, but also has a universal dimension. This contributes to the development of a more comprehensive theory of sustainability education.

However, this study has limitations in measuring in depth the differences in social and cultural characteristics between regions. In addition, this study only used three cities as representations, so the variations in contexts may not have been fully represented. Therefore, further research needs to broaden the scope of the region and consider other, more complex contextual variables.

Is there a difference in the effect of the campus ecological environment on students' ecological citizenship after ranking adjustments are made through ANCOVA's Quade Nonparametric approach?

The results showed that after adjusting the ranking using the Quade Nonparametric ANCOVA approach, there was no significant difference in the effect of the campus ecological environment on the ecological citizenship of students between cities. A significance value of 0.900 indicates that differences that may have previously been seen in the raw data become insignificant after the covariate control is performed. This suggests that the initial variations that appear in the data are largely influenced by the ecological environmental conditions of the campus itself. These findings confirm the importance of using robust statistical approaches in social research. Thus, Quade ANCOVA provides more accurate results in identifying relationships between variables.

Further, these findings suggest that the nonparametric approach has advantages in handling data that does not meet the assumption of normality. This is relevant to the results of the normality test which shows that the data is not distributed normally. Using the Quade approach, this study was able to control the influence of covariates without relying on parametric assumptions. This makes an important methodological contribution to educational research.

These findings can also be attributed to the concept that ecological citizenship is influenced by latent and complex factors. Van show that ecological citizenship involves various dimensions that interact with each other (Van Harskamp et al., 2024). Thus, a statistical approach that is able to capture such complexity is of great importance. Quade ANCOVA provides a more flexible approach to analyzing social data.

In addition, these results also suggest that the use of the right method can reduce bias in data interpretation. Hajj-Hassan emphasize that the gap between knowledge and action is often invisible if the analysis is not done appropriately (Hajj-Hassan et al., 2024). In the context of this study, the use of Quade ANCOVA helped uncover more accurate relationships between variables.

In terms of implications, these results suggest that researchers need to consider the use of nonparametric methods in educational research, especially when the data do not meet classical statistical assumptions. This can increase the validity and reliability of research results. In addition, the use of this method can also contribute to the development of social research methodologies.

The theoretical contribution of these findings is the strengthening of the importance of methodological approaches in understanding complex social phenomena. This study shows that the results of the study can differ significantly depending on the method used. Thus, this

research contributes to the development of research methodologies in the field of sustainability education.

However, this study has limitations in terms of the complexity of the analysis that may be difficult to replicate without an adequate understanding of statistics. In addition, the use of the Quade ANCOVA approach is still relatively rare, so further research is needed to test the consistency of results in different contexts. Therefore, further research needs to develop a methodological approach that is more accessible to other researchers.

4. CONCLUSION

Presents This study shows that the ecological environment conditions of the campus are a significant factor in forming students' *ecological citizenship*, with a considerable contribution in explaining the variation in ecological citizenship behavior. The results of the analysis showed that after controlling the campus ecological environment variables using the ANCOVA Nonparametric Quade approach, there was no significant difference in the level of *student ecological citizenship* between cities (Blitar, Sumenep, and Surabaya). These findings confirm that institutional factors, especially the ecological environment of the campus, have a more dominant role than geographical factors in shaping student behavior. In addition, the influence of campus ecological environmental conditions on *ecological citizenship* has been proven to be consistent in various regional contexts, both urban and semi-urban, which shows the universal nature of the environmental influence of higher education institutions. The use of ANCOVA's Nonparametric Quade approach also makes an important methodological contribution by showing that nonparametric analysis that controls for covariates is able to produce more robust estimates in the context of social data that do not meet the assumption of normality. Overall, this research makes a significant contribution to the development of ecological citizenship studies by emphasizing the importance of the role of the campus environment as an agent of shaping student sustainability behavior, as well as enriching the methodological approach in sustainability education research.

Further Research Suggestions

Based on the findings of this study, there are several recommendations that can be the direction of future research development. First, further research is suggested to expand the scope of the research area by involving more cities or even across countries to test the consistency of findings in more diverse contexts. This is important to improve the generalization of research results as well as to understand the contextual variations that may arise on a broader scale. Second, subsequent research needs to consider the addition of other variables that have the potential to affect *ecological citizenship*, such as psychological factors, individual values, social background, and family and community influences. Thus, the resulting analysis model will be more comprehensive in explaining student behavior. Third, it is recommended to combine quantitative approaches with qualitative methods such as in-depth interviews or ethnographic studies to explore the subjective dimension of ecological citizenship that cannot be fully captured through quantitative data. Fourth, further research can also explore the use of other advanced statistical methods, both parametric and nonparametric, to compare the results of the analysis and improve the validity of the findings. Finally, the development of research instruments that are more sensitive to the local context is also important to improve the accuracy of measuring ecological citizenship variables. In

addition to these academic recommendations, the results of this study also provide practical implications for universities in improving students' ecological citizenship attitudes. Campuses can take concrete steps through strengthening an environmentally friendly campus culture, such as implementing plastic waste reduction policies, integrated waste management, providing campus green spaces, and developing energy-saving and water conservation programs. Universities can also integrate environmental education into their curriculum and student activities through sustainability-based projects, community service, and ecologically oriented student organization activities. In addition, habituating environmentally friendly behavior through lecturers' examples, ecological campaigns, and awarding sustainable practices can strengthen the internalization of ecological citizenship values in students. With these developments, it is hoped that future research can make a broader and deeper contribution to understanding and developing the concept of ecological citizenship in higher education. With these various developments, it is hoped that future research can make a broader and deeper contribution in understanding and developing the concept of ecological citizenship in higher education.

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