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The Impact of College Students' Environmental Education on Green Infrastructure

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Abstract

Education is the process of assisting students in the acquisition of knowledge, skills, values, and beliefs. College environmental education allows students to understand the complex systems that make up the environment of college, as well as the impact that students' and teachers' actions have on this. Therefore, this study aims to explore the impact of college student environmental education on green infrastructure while also examining the moderating influence of student satisfaction and student learning. A close-ended questionnaire was used to collect data from college students with the help of a convenience based sampling technique. To achieve the objective of the study data was collected from 370 students from China. Data were analyzed by using smartPLS and SPSS. The SEM-based results indicated that college student environmental education has a significant and positive impact on green infrastructure. Moreover, student satisfaction and student learning moderated the relationship between college student environmental education and green infrastructure respectively. The present study implications strategically guide educational policymakers in implementing green infrastructure by focusing on environmental education, student satisfaction, and student learning.

Keywords: Green Infrastructure; College Student Environmental Education; Student Learning; Student Satisfaction; School Infrastructure

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Introduction

The education of a student is evaluated using a variety of approaches, such as tests, assignments, and projects, and the results of these evaluations can be influenced by several factors, including the student's level of motivation, the student's prior knowledge, and the student's preferred method of learning. The culmination of an individual's educational experience should be the acquisition of the skills necessary to achieve fulfillment in both their personal and professional spheres of life (Merritt, Stern, Powell, & Frensley, 2022). The educational environment plays a crucial role in the success of students. It can impact their learning, motivation, and overall well-being. A positive educational environment can foster a sense of belonging, support, and engagement, which can lead to better academic performance and overall well-being. On the other hand, a negative educational environment can hinder learning and have negative impacts on a student's mental health (Krasny, 2020).

Environmental education is a process of acquiring knowledge and values about the environment and the role of individuals and society in promoting sustainability and conserving natural resources. It aims to develop awareness, concern, and responsible behavior toward the environment. Green infrastructure refers to the network of natural and semi-natural areas, such as parks, green roofs, wetlands, and urban forests, that provide a range of environmental, social, and economic benefits to communities. It is an approach to managing land and resources that prioritizes the conservation and restoration of natural systems and the integration of these systems into the built environment. Green infrastructure in schools refers to the integration of green spaces, such as gardens, parks, green roofs, and trees, into the design and operation of the school environment. This approach aims to provide educational, environmental, and health benefits to students, staff, and the surrounding community. The New technologies and emerging pedagogical practices that have created new requirements for educational buildings are Flexible learning spaces, Technology integration (e.g. smart boards, Wi-Fi), Makerspaces and STEAM labs, Collaborative learning environments, Active learning classrooms, Virtual and augmented reality, Personalized learning, Universal design for accessibility, Sustainable design and green technologies, Blended and online learning support spaces. Schools serve as models for decarbonization by implementing strategies to reduce their carbon footprint and promote sustainability. Retrofitting buildings with energy-efficient systems, such as lighting, reduce energy use and emissions. schools install renewable energy systems, such as solar panels or wind turbines, to generate clean energy on-site. schools adopt sustainable practices in their operations, such as composting, recycling, and reducing waste. Incorporating sustainability and environmental education into the curriculum to educate students about the importance of reducing carbon emissions and promoting behavior change.

The educational environment includes physical factors, such as the design of the classroom and school building, as well as social and psychological factors, such as the relationships between teachers, students, and staff. It also includes factors related to the culture and climate of the school, such as the values and expectations that are emphasized (Rahmatulloh, 2022). Creating a positive educational environment involves considering the needs of all students and providing the necessary resources and support to help them succeed. This may include providing access to technology, creating a safe and inclusive space, and promoting positive relationships between students and teachers (Yusuf, Yunus, Maimun, & Fajri, 2022). A student's ability to learn and their general growth and development can be significantly influenced by the atmosphere of the educational setting. Students should feel protected, supported, and motivated to learn in a good educational environment, which creates an atmosphere that is conducive to learning and creates an atmosphere that is conducive to learning. On the other side, an unfavorable educational atmosphere can make it difficult for students to study and lead to a number of other unfavorable results such as distracting noise levels, poor lighting, inadequate ventilation, overcrowded classrooms,lack of resources, uncomfortable furniture and poor classroom management (Umar, & Ko, 2022).

The physical facilities, materials, and equipment that are available to assist the teaching and learning process are collectively referred to as the "school infrastructure." Students, staff, and even members of the larger community can all reap the benefits of a well-maintained school's physical

facilities (Sánchez & Govindarajulu, 2023). A good school infrastructure also engages and motivates students to learn. A school with modern classrooms and well-maintained facilities creates a more appealing and inspiring learning environment, which encourages students to participate in class and be more actively involved in their learning. The green infrastructure allows students to participate in outdoor activities and gain knowledge about the natural world, both of which contribute to an overall improvement in the quality of their educational experience as well as their mental and physical well-being (Woodruff et al., 2022).

The term "student learning" refers to the process by which pupils acquire new information and capabilities as a result of participating in a variety of educational activities. It is the most important objective of education and can take place in a range of different locations, including classrooms, institutions, and other types of learning spaces. Student learning is assisted by a variety of factors, including excellent instruction, adequate tools and materials, and a happy learning environment (Drljević, Botički, & Wong, 2022). This is because the presence of student learning activities has the potential to subsequently improve academic involvement. The goal of active learning is to encourage students to be active participants in their education rather than only receiving information passively (Wong & Hughes, 2022).

Students attending colleges and universities are one of the most ecologically conscious groups of people in the world. They are enthusiastic about the natural world, they give sustainability a lot of thought, and they want to make a difference (Kumar, 2021). As a result, the purpose of this research is to evaluate the influence that environmental education has on green infrastructure among college students. This research contributed to the existing body of knowledge by investigating the moderating role of student learning and satisfaction. This study will be beneficial to educational institutes in the implementation of environmentally friendly infrastructure by including environmental education in their respective curricula.

H1: College students Environmental Education has a significant and positive impact on green infrastructure

H2: Student Learning has a significant and positive impact on green infrastructure

H3: Student Satisfaction has a significant and positive impact on green infrastructure

H4: Student learning moderated the relationship between college student environmental education and green infrastructure

H5: Student Satisfaction moderated the relationship between college student environmental education and green infrastructure

The research paper is broken up into several different phases; the first phase is all about the introduction, and after the introduction, the second phase of the study will provide fragments of evidence regarding college student environmental education, student satisfaction, student learning, and green infrastructure in the light of previous studies. In the third phase of the research, both the methodology that was used to gather the data and an analysis of the validity of the data will be presented. In the fourth phase, the results of the investigation will be presented. In the fifth and last phase of the study, the consequences, conclusion, and recommendations for the future will be presented.

Literature Review

Green Infrastructure

Green infrastructure refers to a network of natural and semi-natural areas within and around cities and towns, such as parks, green roofs, street trees, and wetlands, that provide environmental and social benefits. Improved air quality and reduced heat island effects. School infrastructure refers to the physical facilities, materials, and equipment that are available to support the teaching and learning process in a school. This includes things like classrooms, laboratories, libraries, sports facilities, and equipment such as computers, desks, chairs, and other supplies (Staccione, Candiago, & Mysiak, 2022). Good school infrastructure is essential for creating a conducive learning environment and providing students with the resources they need to learn effectively. It also impacts the safety and well-being of students and the wider school community (Hamel & Tan,

2022). A good school infrastructure help to create a positive and engaging learning environment for students, which in turn makes teaching more rewarding and fulfilling for teachers. It also contributes to the safety and well-being of teachers by providing safe and well-maintained facilities and equipment (Evans et al, 2022). Well-maintained and well-equipped schools can provide students with the resources they need to learn effectively. For example, a school with modern classrooms, sufficient lighting and ventilation, and access to technology can create a more conducive learning environment and improve students' academic performance (Woodruff et al., 2022).

Environmental Education

The learning and general growth of kids are both significantly influenced by the atmosphere of the schools in which they are educated. A good school environment creates an atmosphere that is conducive to learning, one in which kids feel comfortable, encouraged, and driven to learn. This type of setting is important for academic success. On the other side, an unfavorable atmosphere at school can be detrimental to students' academic performance and contribute to several unfavorable results (Wong et al., 2018). Students' motivation to learn is increased and their passion for learning is fostered when the school atmosphere is supportive. In contrast, pupils' lack of motivation and disinterest in participating in learning activities are both increased when the school climate is unpleasant (Rusaina, 2019). Students are more likely to participate in class discussions and activities when the school climate fosters engagement and positive feelings (Liao & Li, 2019). According to Rahmayanti et al. (2020), students' interactions with both their fellow students and their professors are also influenced by the atmosphere of the school. A supportive atmosphere in the school helps to cultivate a feeling of community and encourages pupils to engage in beneficial social interactions (Boca & Saraçli, 2019).

The atmosphere of the school might also affect the mental health of the kids. A supportive school environment is beneficial to student's mental health, whereas one that is not supportive can contribute to students' feelings of stress, anxiety, and other mental health problems (Jorgenson, Stephens, & White, 2019). Instead, (Merritt et al., 2022) propose that environmental education that is based on a sustainable environment should concentrate on students' environmental knowledge, students' environmental attitudes, and students' environmental skills. Krasny (2020) investigates the purpose of environmental education for contemporary students in terms of their knowledge and awareness of the environment.

Environmental education emphasizes the information, attitudes, and abilities that are relevant to the environment. The foundations of a sustainable environment are built via the development of environmental education. According to Rahmatulloh (2022), environmental education is based on students' sustainable environment and focuses on students' environmental knowledge, students' environmental attitudes, and students' environmental skills. Students' environmental knowledge refers to students' knowledge and awareness about environmental issues and solutions. Students' environmental attitudes refer to the attitudes that students have toward the environment. Students' Environmental skills refer to the behaviors that students have toward the environment. Students will develop attitudes and behaviors that will make them more sensitive and concerned about the world around them if they participate in environmental education (Yusuf, Yunus, Maimun, & Fajri, 2022). This is one of the primary reasons why environmental education is so essential. Students ' environmental education has a ripple effect that can be seen in the level of environmental literacy skills possessed by their families (Ramadhan, Sukma, & Indriyani, 2019). Similarly, students transition from the character of the student. If the student viewpoint is a part of the environment, then students will carry out the process of adapting new habits in campus life and their application in the community. This will occur whether or not the student's perspective is a part of the environment (Wong, & Afandi, 2018).

Green education is an approach to education that emphasizes the importance of environmental sustainability and the protection of the planet's natural resources. It is designed to help individuals understand the impact of human activities on the environment and to provide them with the knowledge and skills needed to make informed decisions that support a sustainable future. It is important because it helps to raise environmental awareness and promote sustainable practices. It equips individuals with the skills and knowledge needed to tackle environmental challenges. It supports the development of a sustainable future by promoting environmentally

responsible behavior. It contributes to the preservation of natural resources and biodiversity for future generations. It helps to address global environmental issues such as climate change.

College students who take part in environmental education programs may have a better understanding of the significance of green infrastructure and may be more likely to advocate for its implementation in the communities in which they live (Rusaina, 2019). This is one of the potential benefits of these programs for students. Students in higher education also have the opportunity to learn about green infrastructure through the completion of coursework as well as hands-on projects, both of which can contribute to the expansion of the student's knowledge and capabilities in this area (Liao & Li, 2019). In addition, college students have a greater propensity to become involved in environmental activism and to advocate for policies and initiatives that encourage the development of green infrastructure (Stern, Powell, & Hill, 2014). They are also more likely to volunteer or intern with organizations that are involved in green infrastructure projects, which provides them with valuable experience and helps them build their understanding of this field. In addition, they are more likely to be involved in green infrastructure projects themselves (Boca & Saraçli, 2019).

H1: College student's Environmental Education has a significant and positive impact on green infrastructure

Student Learning

The importance of student learning experiences as a key measure of the quality of undergraduate education has been acknowledged on a global scale. When compared to the value-added metrics, students' judgments of their own learning experiences represent their evaluation of the learning experiences that they have undergone while attending higher education institutions (HEIs) (Li & Wang, 2022). The quality of undergraduate education can be evaluated, compared to the quality of education provided by various institutions, weaknesses in practices can be diagnosed, and suggestions for improvement can be provided through the analysis of students' perceptions of their own learning experiences. This is all possible through the process of learning experience analysis (Lam, Ho, & Chiu, 2022). Researching the educational experiences of international students is another method that can be used to test and assess the quality of education provided to international students for the same reasons. This type of research is important for promoting the positive learning experiences of foreign students studying at Chinese higher education institutions (HEIs) and improving the quality of education provided to Chinese international students (Wong & Hughes, 2022).

The quality of education provided at the tertiary level is increasingly being evaluated with the help of student learning experiences, both in countries and in universities (Sternad Zabukovsek et al., 2022). For instance, academics in Australia have considered the learning experiences of undergraduate students to be a crucial indication when monitoring and assessing the efficiency of undergraduate teaching as well as the standard of undergraduate education. If students can learn and understand the information being presented, they are more likely to retain it and take action based on what they have learned. This could lead to more effective implementation of en

\vironmental education and green infrastructure initiatives (Rahmatulloh, 2022). On the other hand, if students are not able to learn and understand the information, they may not be able to apply it in a meaningful way, which could reduce the effectiveness of these initiatives. In this way, student learning could moderate the relationship between environmental education and green infrastructure, either strengthening or weakening the effectiveness of these initiatives (Wagner, 2022).

H2: Student Learning has a significant and positive impact on green infrastructure

H4: Student learning moderated the relationship between college student environmental education and green infrastructure

Student satisfaction

It has been determined that one of the most important factors in the educational experience of online students in higher education is student satisfaction. This is because student satisfaction can have an effect on students' engagement, motivation, learning, performance, success, and ultimately, retention and graduation rates (Kirmizi, 2015). In point of fact, the Sloan-Consortium

includes a measure of student satisfaction as one of the five pillars in its quality framework since it was thought to be of such critical importance to the quality of online courses (Kumar, 2021). In a broad sense, satisfaction can be understood to refer to the gratification of a desire, contentment, or delight (Wang, Shannon, & Ross, 2013). Student satisfaction was described (Kumar, 2021) as the students' impression of value relative to their educational experience. Since student satisfaction can contain a wide variety of components, it is generally acknowledged to be a multi-faceted notion.

Between the years 2010 and 2019, a growing number of scholars focused their attention on the topic of student happiness. (Kirmizi, 2015) explored the characteristics that are most important to students when it comes to assessing their level of satisfaction with online courses. If students are engaged and motivated, they are more likely to be receptive to the information being presented and to take action based on what they have learned (Aldhahi, Alqahtani, Baattaiah, & Al-Mohammed, 2022). On the other hand, if students are not satisfied with their educational experience, they may be less likely to pay attention or retain the information being presented. In this way, student satisfaction could moderate the relationship between environmental education and green infrastructure, either strengthening or weakening the effectiveness of these initiatives (Kumar, 2021).

H3: Student Satisfaction has a significant and positive impact on green infrastructure

H5: Student Satisfaction moderated the relationship between college student environmental education and green infrastructure

Thus, on the basis of above discussion the author proposed the following framework which is shown in Figure 1.

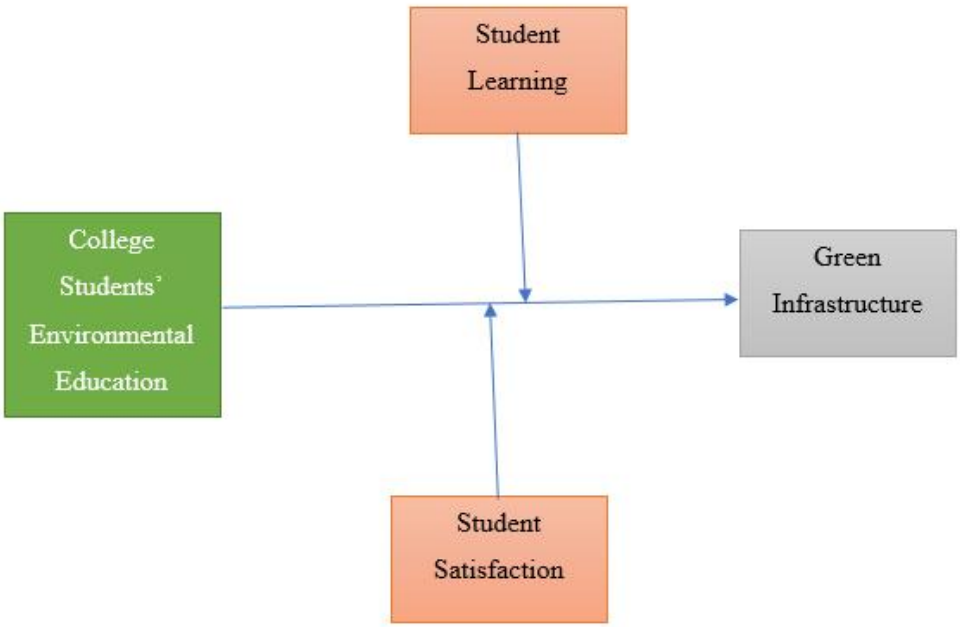

Figure 1. Conceptual framework

Methodology

Data was obtained from students who were currently enrolled in higher education institutions in the nation of China. This was done so that the objectives of the study could be fulfilled. Because of this, we decided to employ a self-administrative questionnaire. In order to accomplish the goal of acquiring information from 450 students, a method of sampling that put an emphasis on

comfort was adopted. Only 370 of the entire 450 surveys were used for the statistical analysis. The remaining 150 surveys were discarded. The responders who filled out the remaining questionnaires did not finish filling them out in their entirety. For the purpose of conducting an analysis of the demographic data, SPSS was utilized; however, Smart-PLS was utilized in order to evaluate the reliability, validity, and association between the variables.

Measures

A questionnaire that the participants would self-administer to themselves was adjusted so that data could be collected for the current study. The nature of the questionnaire was that it was open-ended. Participants are obligated to choose the answer choice that, in their judgment, best correctly depicts their response. The data collecting tool consisted of two sections; the first component was designed to collect demographic information about individuals, while the second part was aimed to collect other types of information (e.g., gender, age, year of education, and environmental knowledge). In the second portion, the primary focus was on completing an analysis of the constructs that were used during the research. This was the section where the majority of the research was conducted. The questionnaire contained a total of 38 questions. Every respondent to the survey was given a Likert scale that had a total of five points and was subdivided into the following answer categories: 1 represents complete disagreement, and 5 expresses entire agreement. The respondents were instructed to identify, using the scale, the degree to which they agreed or disagreed with each of the issues presented to them.

• College Students' Environmental Education

The construct of college students' environmental education is measured through a 11-item scale adapted from Rahmatulloh, (2022). The value of alpha is 0.917.

• Green Infrastructure

A scale consisting of 7 questions, which was adapted from Boudreau et al. (2022) was used to evaluate the green infrastructure. The value of the alpha coefficient is 0.885.

• Student Satisfaction

A scale consisting of 3 questions, which was adapted from Kumar (2021) used to evaluate student satisfaction. The value of the alpha coefficient is 0772.

• Student Learning

A scale consisting of 7 questions, which was adapted from Goss (2022) was used to evaluate student learning. The value of the alpha coefficient is 0.811.

Demographics Information

Table 1 displays the demographic information that pertains to those who participated in the survey. The survey received responses from a total of 370 people, 230 of whom were female and 140 of whom were male. Among the respondents, 104 were in the age bracket of 19 to 21 years old, 115 were in the age bracket of 22 to 25 years old, and 151 were in the age bracket of more than25 years. There were 82 students who were starting their education for the first time. There were 69 students enrolled in the second year of education, 116 students enrolled in the third year of education, and 103 students enrolled in the fourth year of education. 195 of the respondents have participated in any green activity, while the remaining 175 respondents do not participate in any green activity. The results of the inquiry into the demographic characteristics are detailed in Table 1.

Table 1. Demographic profile of the respondents

Demographic item		**Frequency**
Gender	Male	140
	Female	230
Age	19-21 years	104
	22-25 years	115
	More than 25 years	151

Demographic item		Frequency
Year of Education	1st	82
	2nd	69
	3rd	116
	4th	103
Participate in Green Activity	Yes	195
	No	175

Results

In this investigation, the data were examined utilizing Structural Equation Modeling (SEM), and Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized rather than covariance-based techniques such as AMOS (Hair, Hult, Ringle, & Sarstedt, 2021). The PLS-SEM was chosen as the research method because, depending on the goals of the inquiry, it may either be used for confirmatory or exploratory research. Because of this, the PLS-SEM was picked as the research method (Hair et al., 2021). Structural equation modeling is comprised of various methods, including Covariance-Based Structural Equation Modeling (also known as CB-SEM) and Partial Least Squares Structural Equation Modeling (also known as PLS-SEM) (Hair et al., 2021). The covariance-based method, for example, can verify or invalidate concepts, while the other way can do either. Both methods offer considerable benefits. On the other hand, PLS-SEM provides both expansions and improvements to the theoretical framework (Hair et al., 2021). In order to carry out the measurements on the data, the piece of software known as Smart PLS 3.3 was utilized. Both the measurement and the structural path were utilized in the process of measuring the data. Both were utilized in the measuring procedure. Utilizing the Smart PLS technique is beneficial when conducting studies on data that is either exceedingly challenging to work with or extremely limited in the scope of its use.

The dependability of the model, as well as its validity, are both essential components of measurement models. In this specific inquiry, convergent and discriminant forms of validity were applied in order to investigate the reliability of the model. In addition, the Cronbach alpha, composite reliability, and average variance extract were utilized in order to investigate the degree to which the model could be relied upon (Hair et al., 2021). The reliabilities of all of the variables that are modeled in this study are presented in Figure 2 and Table 2, respectively. To begin, the value needs to be higher than 0.70 so that it can be considered compliant with the conditions of the Cronbach alpha (Hair et al., 2021). In general, the values of Cronbach's alpha for the model variables in this research project are higher than 0.70. Examining the Composite Reliability (CR) and Average Variance Extract (AVE) of the model variables is the focus of the second step of the investigation. The acceptable values for the variables are greater than 0.7, and both the average variance extract and the acceptable values for the variables are bigger than 0.5. The acceptable values for the variables must be greater than 0.7. Additionally, values for the composite reliability that are greater than 0.5 are considered to be acceptable.

In addition to this, the outer loadings of each variable were analyzed, and the results of this analysis can be found in Table 2 below. A value that is more than 0.6 is regarded as appropriate for determining the allowable outside loadings for the various types of items (Figure 2). The variable contains a total of components, and each and every one of those components has a value that is greater than 0.6.

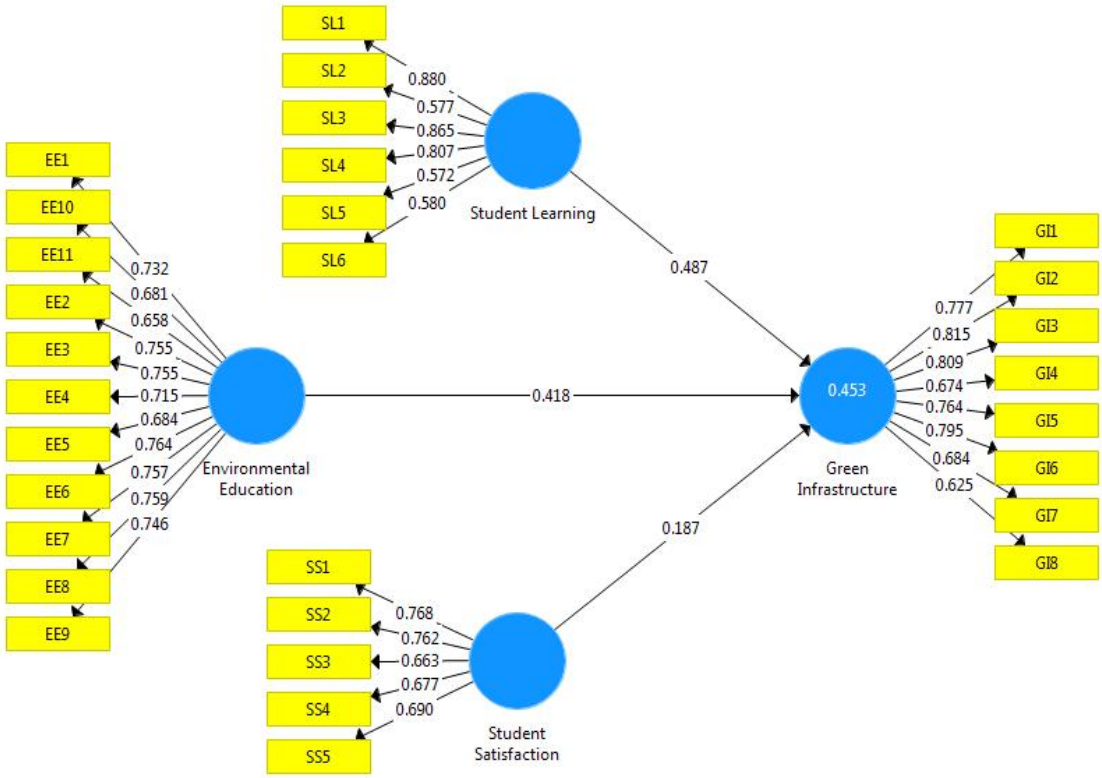

Figure 2. Measurement Model

During the course of this work, the collinearity problem was examined by employing the variance inflation factor as a research tool. According to the recommendations that were provided by the researchers, VIF scores that are lower than 5 are thought of as being acceptable (Hair et al., 2021). According to Table 2, the VIF values of the primary components of the research model range anywhere from 1.297 to 4.080. It demonstrates that the VIF values of all of the items are within the threshold's acceptable range. As a consequence of this, there was no evidence that the research model that was utilized for this investigation had a problem with collinearity.

Table 2. Construct Reliability and Validity

	Items	Outer Loading	VIF	Cronbach's Alpha	CR	AVE
College Students' Environmental Education	EE1	0.732	3.111	0.917	0.926	0.531
	EE2	0.755	3.356			
	EE3	0.755	4.080			
	EE4	0.715	3.436			
	EE5	0.684	3.271			
	EE6	0.764	2.129			
	EE7	0.757	3.486			
	EE8	0.759	3.607			
	EE9	0.746	3.266			
	EE10	0.681	2.211			
	EE11	0.658	1.971			
Green Infrastructure	GI1	0.777	2.083	0.885	0.909	0.556
	GI2	0.815	2.765			
	GI3	0.809	2.789			
	GI4	0.674	1.875			

	Items	Outer Loading	VIF	Cronbach's Alpha	CR	AVE
	GI5	0.764	2.384			
	GI6	0.795	3.005			
	GI7	0.684	2.109			
	GI8	0.625	1.617			
Student Learning	SL1	0.880	3.261	0.811	0.866	0.528
	SL2	0.577	1.297			
	SL3	0.865	3.085			
	SL4	0.807	2.228			
	SL5	0.572	1.352			
	SL6	0.580	1.348			
Student Satisfaction	SS1	0.768	2.223	0.772	0.838	0.509
	SS2	0.762	2.223			
	SS3	0.663	1.901			
	SS4	0.677	2.385			
	SS5	0.690	2.353			

In addition, when discussing the discriminant validity of the instruments, it is important to note that discriminant validity refers to the uniqueness of the instrument when it is used for measurement. This is something that must be taken into consideration when having a conversation about the discriminant validity of the instruments. The idea that there is no relationship between two different ideas that do not need to be linked together in any manner underpins the concept of discriminant validity, which can be summarized as "there is no connection between two different ideas." It suggests that if there are two instruments that measure two different concepts and are theoretically distinct from one another, then those instruments should not be connected to one another. This is because it would be inaccurate. In addition to this, it implies that every one of the devices should be measuring a different concept (Hair et al., 2021). As a means of ensuring that discriminant validity is maintained, the heterotrait-monotrait ratio (HTMT) has been applied. According to (Hair et al., 2021), in order to determine whether or not there is discriminant validity, the HTMT ratio must be lower than 0.9. In the meantime, the HTMT ratio of all constructs is lower than 0.9, and as a consequence, discriminant validity can be demonstrated, as shown in Table 3.

Table 3. Discriminant Validity (HTMT)

	EE	GI	SL	SS
College Students' Environmental Education				
Green Infrastructure	0.500			
Student Learning	0.476	0.655		
Student Satisfaction	0.695	0.317	0.591	

When the R2 score is greater than 0.3, it is determined that the strength of the model in the initial data is to be considered moderate. The findings of this study indicate that the value of R2 for the outcomes of green infrastructure is 0.453. The R2 value suggested that the degree of model robustness was about average (Hair et al., 2021). The significance of R2 was illustrated in Table 4.

Table 4. R-Square values for the variable

	R Square	R Square Adjusted
Green infrastructure	0.453	0.448

Direct Relationship

The structural model route coefficients that reflect the hypothesized correlations were shown to be statistically significant when the PLS-SEM bootstrapping approach was utilized. This confirmed the existence of the relationships. The PLS-SEM assessment for college students' environmental education, which empirically proved that it is a significant predictor of green infrastructure, is illustrated in Table 5, which illustrates the path relationships and testing decision for hypotheses. Table 5 depicts the path relationships and testing decisions for hypotheses. In addition, the path linkages and testing decisions for hypotheses are depicted in table 5. The data indicate that there is a correlation between college students' environmental education and green infrastructure that is statistically significant (t = 7.998, p = 0.0001). Therefore, it is possible to accept Hypothesis 1. The results of the PLS-SEM analysis indicate that there is a substantial correlation between student learning and green infrastructure (t = 11.042, p = 0.0001; see also Student Learning and Green Infrastructure). As a consequence of this, the second hypothesis of the research was shown to be supported by statistical evidence. The results of the PLS-SEM analysis indicate that there is a substantial correlation between student contentment and green infrastructure (t = 3.693, p = 0.0001; see also Student Satisfaction and Green Infrastructure). As a direct consequence of this, the third hypothesis of the investigation was shown to be supported by statistical evidence. Table 5 contains the findings and interpretations that were arrived at by the researchers.

Table 5. Direct effects

Hypotheses	Relationship	Beta	T value	P Values	Decision
H1	EE -> GI	0.418	7.988	0.0001	Supported
H2	SL -> GI	0.487	11.042	0.0001	Supported
H3	SS -> GI	0.187	3.693	0.0001	Supported

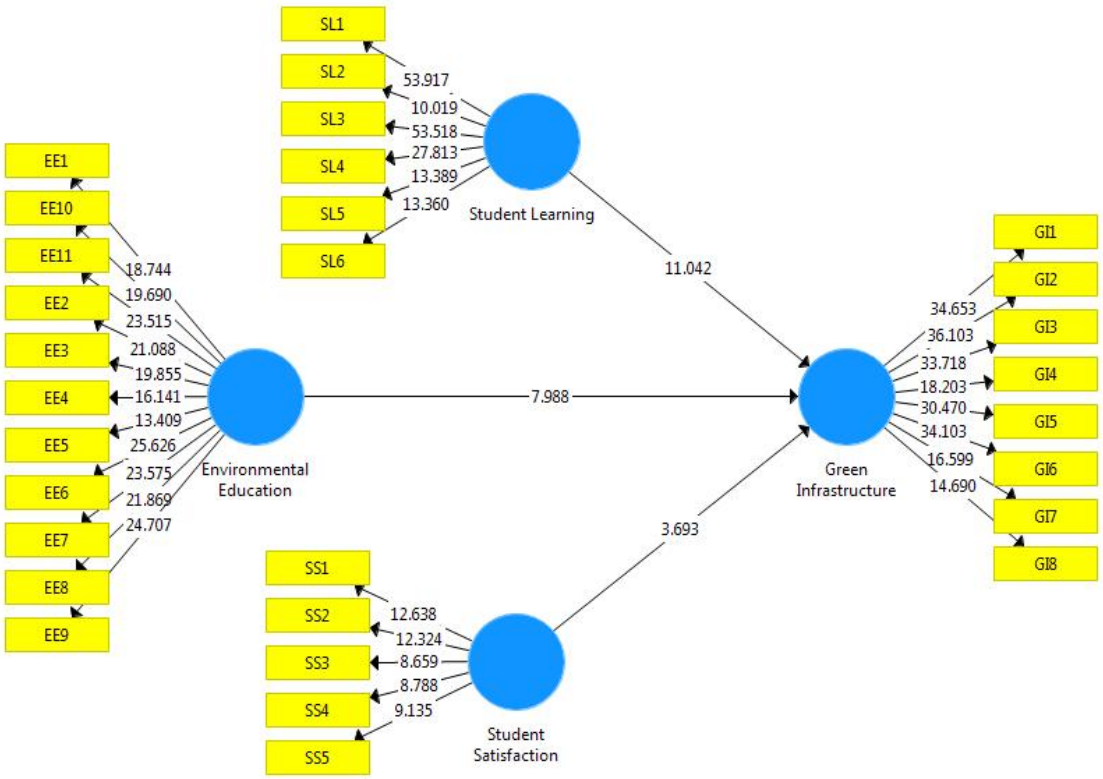

Figure 3. Structural Model

Moderation Effect

Additionally, Hypothesis 4 predicted that there would be a moderating influence of student satisfaction between green infrastructure and college students' environmental education. According to the t and p values of Hypothesis 4, the association between college students' environmental education and green infrastructure has been positively modulated by the learning that students have gained. As a result, H4 is permitted. Similarly, Hypothesis 5 (H5) hypothesized that there would be a moderating influence of student learning on the relationship between college students' environmental education and green infrastructure. The t and p values of Hypothesis 5 suggest that the relationship between college students' environmental education and green infrastructure has been positively regulated by the student learning that has taken place. Therefore, option H5 is acceptable. The findings of the moderation analysis were shown in Figures 4, 5, and Table 6.

Table 6. Moderation Effect

	Original Sample	**T values**	**P Values**
SL x EE -> Green Infrastructure	0.128	2.108	0.0001
SS x EE -> Green Infrastructure	0.264	2.933	0.0001

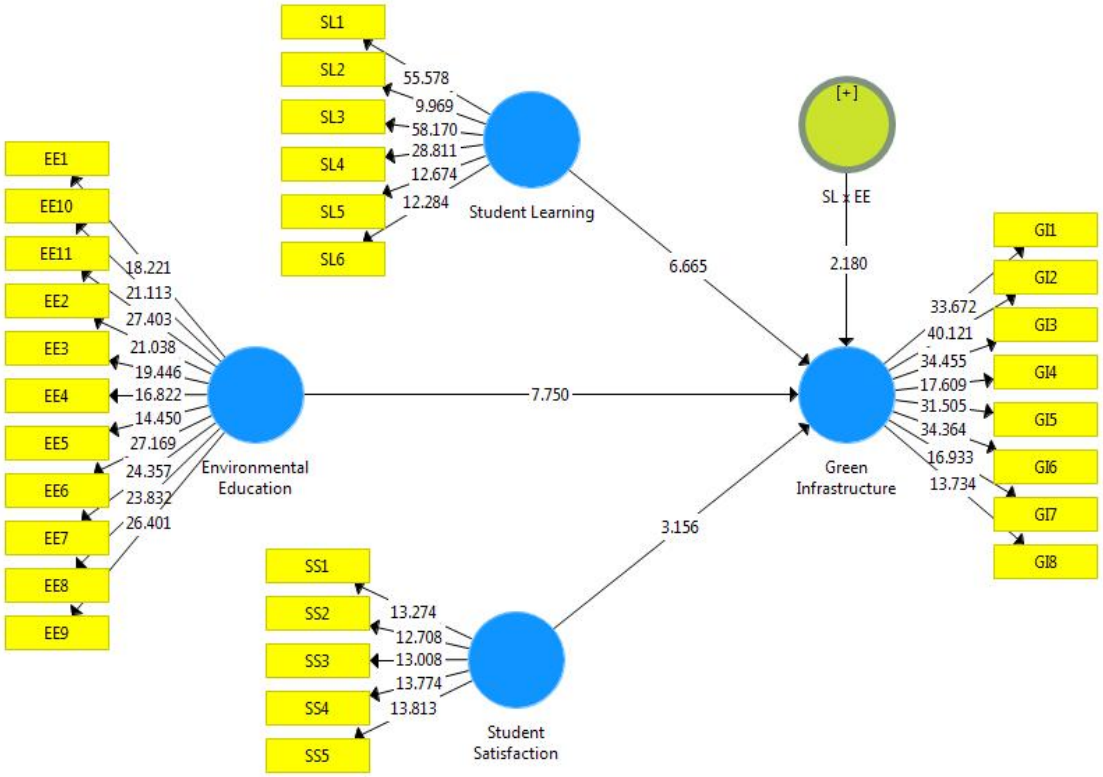

Figure 4. Student Learning as a moderator between EE and GI

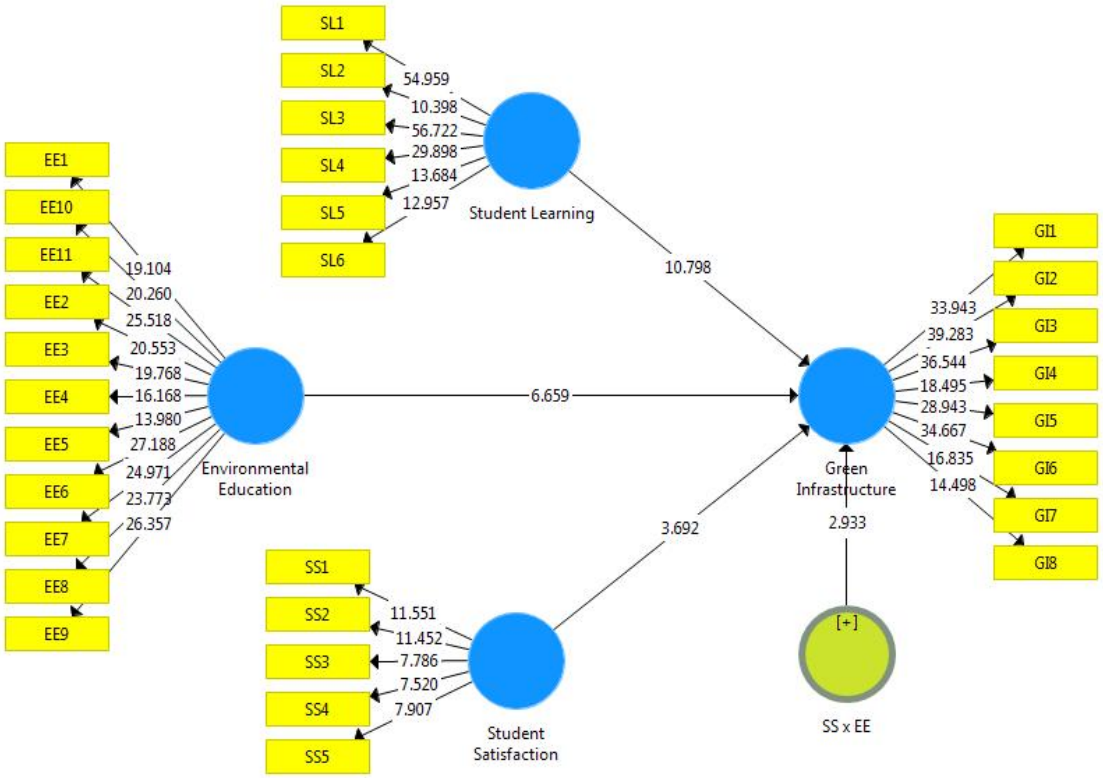

Figure 5. Student Satisfaction as a moderator between EE and GI

Discussion

School Environmental education is the process of teaching people about the school environment and the issues that affect it, with the goal of promoting environmental awareness, understanding, and action among the students. College students' environmental education can be provided through a variety of formats, including formal classroom instruction, outdoor experiential learning, community projects, and more (Rusaina, 2019). The aim of this study is to investigate the relationship between college student environmental education and green infrastructure. The findings of the study showed that Environmental education has a significant and positive impact on green infrastructure, as it helps students understand the importance of protecting the school environment and promoting sustainability. By learning about college environmental issues and solutions, students become more aware of the ways in which their actions and behaviors impact the college environment, and they make more informed decisions about how to protect natural resources and reduce their own environmental impact (Rahmatulloh, 2022). This knowledge also encourages students to advocate for policies and practices that support the green infrastructure of educational institutes, such as the development of green spaces and the use of renewable energy sources (Sörensen, 2018).

The second objective of the study was to investigate the impact of student learning on green infrastructure. The findings of the study showed that student learning has a significant and positive impact on green infrastructure. By gaining an understanding of environmental issues and solutions, students become more aware of the ways in which their actions and behaviors impact the environment, and they make more informed decisions about how to protect natural resources and reduce their own environmental impact (Boca & Saraçli, 2019). Additionally, students who are educated about the importance of green infrastructure are more likely to get involved in community efforts to improve and protect these resources, which helps to further support the development and maintenance of green infrastructure in their local areas (Rolf, 2020).

The third objective of the study was to investigate the impact of student satisfaction on green infrastructure. The findings of the study showed that student satisfaction has a significant and positive impact on green infrastructure as students who are engaged and satisfied with their learning experiences are more likely to be motivated to learn about and support sustainability

initiatives. students who participate in hands-on learning experiences related to green infrastructure, such as designing and building green spaces or learning about renewable energy technologies, may be more likely to feel satisfied with their educational experiences and to be motivated to advocate for sustainable practices in their own lives and communities (Boudreau , Gransaull, Lister, & Pritchard, 2022). Additionally, students who feel that their educational experiences are meaningful and relevant to their interests and goals may be more likely to be engaged in their learning and to apply what they have learned in practical ways. This includes advocating for policies and practices that support green infrastructure, participating in conservation or environmental stewardship projects, or using their knowledge and skills to contribute to the development and maintenance of green infrastructure in their communities (Sörensen, 2018).

The fourth objective of the study was to investigate the moderating effect of student learning on the relationship between environmental education and green infrastructure. The findings of the study showed that student learning significantly moderated the relationship between environmental education and green infrastructure. The more students learn about environmental issues and solutions, the more likely they may be to understand the importance of protecting the environment and promoting sustainability (Merritt et al., 2022). This understanding, in turn, influence their attitudes and behaviors related to green infrastructure, such as their willingness to advocate for policies and practices that support green spaces and renewable energy sources. The relationship between environmental education and attitudes toward green infrastructure may be stronger for students who have a higher level of learning, compared to those with a lower level of learning. This is due to the fact that students who have a deeper understanding of environmental issues are more likely to appreciate the benefits of green infrastructure and be more supportive of its implementation. On the other hand, students who have a weaker understanding of these issues are less likely to see the value in green infrastructure and less supportive of its adoption (Grabowski, McPhearson, Matsler, Groffman, & Pickett, 2022).

The fifth objective of the study was to investigate the moderating effect of student satisfaction on the relationship between environmental education and green infrastructure. The findings of the study showed that student satisfaction significantly moderated the relationship between environmental education and green infrastructure. This means that the relationship between environmental education and attitudes toward green infrastructure is stronger for students who are more satisfied with their educational experience, compared to those who are less satisfied (Boca & Saraçli, 2019). This is due to the fact that students who are more satisfied with their education more engaged and motivated to learn about environmental issues and the benefits of green infrastructure, and as a result, are more likely to support its implementation. On the other hand, students who are less satisfied with their education are less engaged and motivated to learn about these issues, and as a result, less likely to support the adoption of green infrastructure (Closs, Mahat, & Imms, 2022).

Conclusion

The study concluded that the environmental education has the potential to contribute to the promotion of the adoption and implementation of initiatives relating to green infrastructure if it educates students about the benefits and significance of green infrastructure. The findings of the study indicated that there is a significant and favorable relationship between environmental education and green infrastructure and that student learning and student satisfaction moderated this relationship.

Limitation

Generalizability is a significant study limitation. Only students who participated in green education were included in this study. Other students may be considered in future research to broaden the applicability of the findings. The study's use of surveys to gauge environmental education and green infrastructure is another drawback. Future researchers may gather data using an experimental technique. Additionally, the moderator in this study was student learning and

satisfaction. Future research can take into account additional mediating and moderating factors like motivation, peer support, and teacher support.

Future direction

By examining the relationship between environmental education and green infrastructure using student satisfaction and learning as moderators, this study made a significant contribution to the literature. By providing environmental education to students, this study will assist the educational institution in determining how to improve the green infrastructure of their institutions. Additionally, this study will assist students and teachers in identifying elements that will strengthen the link between environmental education and green infrastructure.

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Appendix

Questionnaire

Demographic Information *(Please chose one option from Demographic information)*

Gender
_____ Male
_____ Female

Age
_____ 19-21 years
_____ 22- 25 years
_____ More than 25 years

Year of education
_____ 1st
_____ 2nd
_____ 3rd
_____ 4th

Participated in any green activity
_____ Yes
_____ No

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

	1	2	3	4	5
Student Learning					
I made myself ready for green infrastructure.					
I pay attention and listen during every discussion.					
I want to get good knowledge about green infrastructure					
I actively participate in every activity.					
I gain focus when I see problems.					
Solving problems is a useful hobby for me.					
Student Satisfaction					
I am generally satisfied with the education system of our university.					
I adapted to connected to the education system and of watch my lectures.					
In case I have problems, I can reach the education department manager.					
I can connect to the education system without any problems.					
I can quickly access the lecture contents.					
Environmental Education					
I bring all my lunch to school in reusable containers					
I walk or bike to places instead of asking for a ride					
I turn off the tap water while I brush my teeth					
At home, I try to recycle as much as I can					
I talk to others about helping the environment					
I pick up litter when I see it in a park or a natural area					
I am a member of an environmental club or group					

	1	2	3	4	5
I write to politicians about things that concern me					
I work on outdoor projects to improve the environment					
I have helped raise money to support an environmental cause					
I read about the environment for fun					
Green Infrastructure					
Placement of infrastructure in environmentally responsible, efficient ways, conserve land.					
Encourages the efficient utilization of materials/ resources, selection of environmentally friendly materials.					
Design features that mitigate environmental impacts of infrastructure, by reducing the effects of pollutants					
Design of infrastructure that maximizes functional efficiency of infrastructure.					
The opportunities for integrating capital and operation of infrastructure, ensuring reliability of level of service					
The opportunities for integrated cost effective adoption of green infrastructure options.					
The environmental impact of infrastructure by incorporating safety into the design.					
Social sustainability of infrastructure, promoting convenience, social resources and public participation					