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RESEARCH ARTICLE

ENVIRONMENTAL EDUCATION FOR SUSTAINABLE DEVELOPMENT: EMPOWERING FUTURE GENERATIONS

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Abstract

The study looks at ESDE as one of the key levers against modern environmental problems with serious implications for climate and biodiversity. ESDE policies which come from a foundation of the green revolution and principles like ecocentrism and critical pedagogy help people and specific youth to actively participate in eco-tourism and environmental transformation. Thus, there are problems related also with disinformation. The report covers the actual state of the issue of environmental education globally, explores the performances of educational strategies in specific cases, demonstrates the youth campaign for eco-friendly actions and provides recommendations for the future. Studies showed that an imbalance and some age segregation was present in respondents' replies, and that the tailored delivery of environmental education was critical. The development of activity-based solutions might encourage environmentally conscious and proactive behavior.

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Introduction:-

Background of the study

Sustainable Development through Environmental Education (ESDE) is of central importance in educating individuals, mostly youth, with relevant theories, practices and attitudes concerning current environmental issues. These initiatives were, at the beginning part, constructed on a historical basis and nowadays, they have grown to have theoretical backgrounds like ecocentrism and critical pedagogy and they mainly focus on the active participation of learners and encourage them to be part of green transformation. Despite battling with such challenges as misinformation, EESD can be termed one of those code wars that have fought for years, especially in promoting green ways of life characterized by interdisciplinary interactions. Through the improvement of educational strategies and, by way of youth-led environmental action, the EESD actively works towards building a culture of nature conservation and securing future generations to be responsible guardians of their planet.

Problem Statement

The problem statement addresses the underutilization of non-formal environmental education practices and limited long-term outcome studies, hindering the efficacy of educational programs in promoting sustainable behaviors and societal change.

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Research aim and objectives

Aim:-

The aim of the study is to explore various aspects of environmental education that are aimed for sustainable development. This study also aims to explore its roles in empowering youth for sustainable action and accordingly provide recommendations.

Objectives:-

RO1: To investigate the current status of environmental education initiatives worldwide.

RO2: To assess the effectiveness of existing educational strategies in fostering sustainable development.

RO3: To explore the role of environmental education in empowering youth for sustainable action.

RO4: To propose recommendations for enhancing environmental education practices to empower future generations.

Research Question

RQ1: What is the current status of environmental education initiatives worldwide?

RQ2: What is the effectiveness of existing educational strategies in fostering sustainable development?

RQ3: What is the role of environmental education in empowering youth for sustainable action?

RQ4: What are the recommendations for enhancing environmental education practices to empower future generations?

Significance of the study

The research is of importance due to the fact that it serves as the predominant literature on environmental education which emerges from the requirement of long-term outcome needs examining in formal and non-formal educational settings. The paper would also show the above-mentioned weaknesses, and by taking some measures could be of assistance in improving the effectiveness of environmental education projects all over the world. In addition to that, it represents ideas of empowerment of the youth for the green shift and suggests teaching children the basics of ecology and sustainability at school. The results shall be useful in the decision-making process, for educators, and environmental campaigners; this could trigger the development of better materials used in education so as to attain sustainable development and environmental responsibilities.

Literature Review:-

Introduction to Environmental Education

Environmental education, an element in environmental studies, happens to be very important for the purpose of the resolution of modern environmental issues. It consists of the acquisition of knowledge, as well as the formation of certain attitudes and the development of required skills that are necessary for sustainable interaction with the environment. This means informing people about environmental stewardship, so they can make knowledgeable choices, and finally, let them understand the reciprocity between humanity and nature (UNESCO, 2022). Drawn from the deep past of environmental education, historical origins emerge from the life experiences of Rousseau and Agassiz who laid the foundations for nature study movements. In the course of time, the discipline has changed, and through the integration of numerous approaches and viewpoints environmental problems are to be met and challenged.

Theoretical Frameworks in Environmental Education

Ecocentrism and anthropocentrism represent contrasting philosophical perspectives within environmental education. Ecocentrism emphasizes the intrinsic value of nature, advocating for the protection and preservation of ecosystems for their own sake. Ecocentrism highlights the internal value of ecology which means that the world has some kind of balance per se. Preserving and protecting ecosystems for the sake of ecosystems is the main aim. On the other hand, anthropocentrism prioritizes man as the *raison d'être*, seeing nature to be for the human benefit in particular terms of human well-being (Md. Kamal Uddin, 2023). Critical pedagogy, a theoretical approach that comes from a social justice position, proposes that environmental education deals with all kinds of power, inequalities and systemic injustices in circumstances of the environment. It stresses the creation of the ability to critically think, self-realization and the aspiration to achieve both the preservation of the environment and social equality. Critical pedagogy gives the teacher a new frame to work with, thus it is possible to manage environmental education and focus on power relations, inequality, and systemic injustices in environmental contexts (Kioupi and Voulvoulis, 2019). Through the development of critical thinking, feeling of empowerment and action, it is aimed to encourage positive and sustainable impact on the ecosystem and social justice. Teachers adopting this model facilitate the

learners' critical thinking while enabling them to re-examine the mainstream stories, look from other angles, and work for transformative measures in responding to environmental crises and achieving social equality.

Current Status of Environmental Education Initiatives

The environmental education programs are required to be orientated on rapid solutions to ecological problems. As a result of implementation, society is becoming more aware and sustainable in its lifestyle, but the drawback is that it is still a complicated and confusing exercise for people to understand each step. Furthermore, fighting against fake news and contents against environmental education are still popular obstacles present in relevant settings. Although these constraints are present, efforts by promoters of environmental education as an instrument for sustainability are gaining global recognition (Fletcher, 2023). The trend towards uniting interdisciplinary studies and engaging the public in educational projects is a mark of progressive international citizenship with an environmental responsibility.

Effectiveness of Educational Strategies

Education in environmental studies will not be effective without efficient teaching methods. Strategies like student-centered learning, collaborative work, debates, and problem-solving situations foster active participation of students towards creation and adhering to environmentally friendly behaviors. These methodologies nurture skills in cognitive analysis, innovation and self-evaluation, which serve to develop independence with the learning process and environmental duties (Pauw et al., 2015). Besides, classroom-based practical projects and experiential learning will also support environmental issues in real life, thus ultimately affecting behavior lifelong. An advanced and alternative educational platform can provide learners with a deeper knowledge and skills to face environmental concerns and achieve sustainability goals.

Empowering Youth for Sustainable Action

Providing youths the opportunities to spur environmental actions involves embracing their true position in environmental movements' processes. Cases in point like that of Greta Thunberg and Xiuhtezcatl Martinez with Youth for the Future and Earth Guardians, respectively, show that it is indeed the youth leading the onus to sustainability. These movements boost the long-term future of the youth, which can fast-track policy decision-making and voluntary citizen activities. Students from all schools would be involved in tree planting projects, and waste reduction initiatives and by advocating for renewable energy they would be able to show that they know how to solve the local problems and that they have the capacity for bigger things (Nevin, 2014). They show such power in overcoming the obvious doubt and breaking the glass ceiling that this proves to be a good indicator of the role of catalysis. Supporting youth in green measures is a paramount to improve the environmental conditions.

Enhancing Environmental Education Practices

Enhancing environmental education practices involves both embracing existing best practices and say, creative lesson planning. This entails job responsibilities of directly engaging with the students, integrating the environmental issues into the curriculum by actualizing them and encouraging students to actively participate in the conservation of the environment. Policy recommendations could include both allocating resources for teacher training and curriculum development, but also considering community involvement as well. Advice can be offered, which includes the creation of cooperation between educational institutions, non-governmental organizations, and governmental agencies, interdisciplinarity of approaches, and utilization of technology for innovative learning experiences (McPhee, 2023). Achieving this will begin by putting in place environmental literacy and developing a sustainable culture, which will allow individuals and society to be the main guardians of the environment and it will always be a society of high environmental consciousness.

Literature Gap

Environmental education is facing a gap in the literature in terms of the underutilization of non-formal education practices in the form of ecological development camps and community campaigns that aim at producing successful environmental awareness and change of behaviour. Formal education is of course the focus of a lot of attention but there must be more study into how the informal and non-traditional styles of education act to increase our environmental knowledge and influence sustainable, socially responsible behaviour. In addition to this, there is also a limited number of educational programs whose outcomes are studied for longer periods to find out the efficacy across generations and societies. The ring in these shortcomings can give bright perspectives to develop detailed and implemental environmental education programs.

Methodology:-

In order to conduct the study, a survey has been conducted involving 75 participants from the relevant fields such as educators and students of environmental studies. Young activists are also considered as the survey participants. In order to analyse the key findings, the SPSS software has been used.

Hypothesis Development

H1. Environmental education initiatives with a stronger emphasis on critical pedagogy will demonstrate higher effectiveness in fostering sustainable behaviors.

H2. Younger age groups will exhibit a stronger correlation between environmental education initiatives and empowerment for sustainable action compared to older age groups.

H3. Environmental education programs integrating interdisciplinary approaches will show a positive association with enhanced environmental literacy and sustainable behavior outcomes.

Findings

Demographic Analysis

Gender

What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	54	83.1	83.1	83.1
	Male	11	16.9	16.9	100.0
	Total	65	100.0	100.0	

Table 1:-Gender.

(Source: Quantitative Analysis)

Based on the demographic analysis results, there is a clearly significant difference among respondents about them being male or female. Males form the minority in the research (males being only 16.9% of the sample), whereas females put the most weight in the sample (which is 83.1%). The notable difference shows the bias towards the people surveyed along their gender.

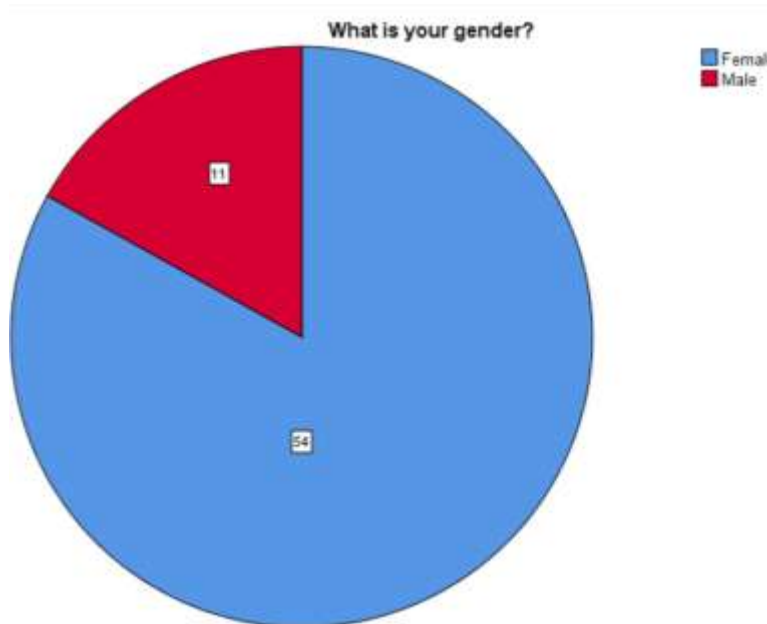


Figure 1:-Gender.

(Source: Quantitative Analysis)

Age

What is your Age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-30	11	16.9	16.9	16.9
	31-50	14	21.5	21.5	38.5
	More than 50	40	61.5	61.5	100.0
	Total	65	100.0	100.0	

Table 2:-Age.
(Source: Quantitative Analysis)

The detailed analysis of age groups which sum up the surveyed population shows high diversity among participants: different enthusiasts and reluctants. A fairly large majority of the respondents constituting 61.5%, which is quite a large number in itself, fall within the more than 50 age category and hence the predominance of elderly people is quite significant. An opposite example is the "31-50" group consisting of 21.5% which is the next highest group with the youngest group, aged "19-30," among respondents representing 16.9%. Distinguished with this average age distribution it is evident that older demographics seem to approach the survey more promptly or be more attentive, thus implying that older demographics may have special preferences but also high availability.

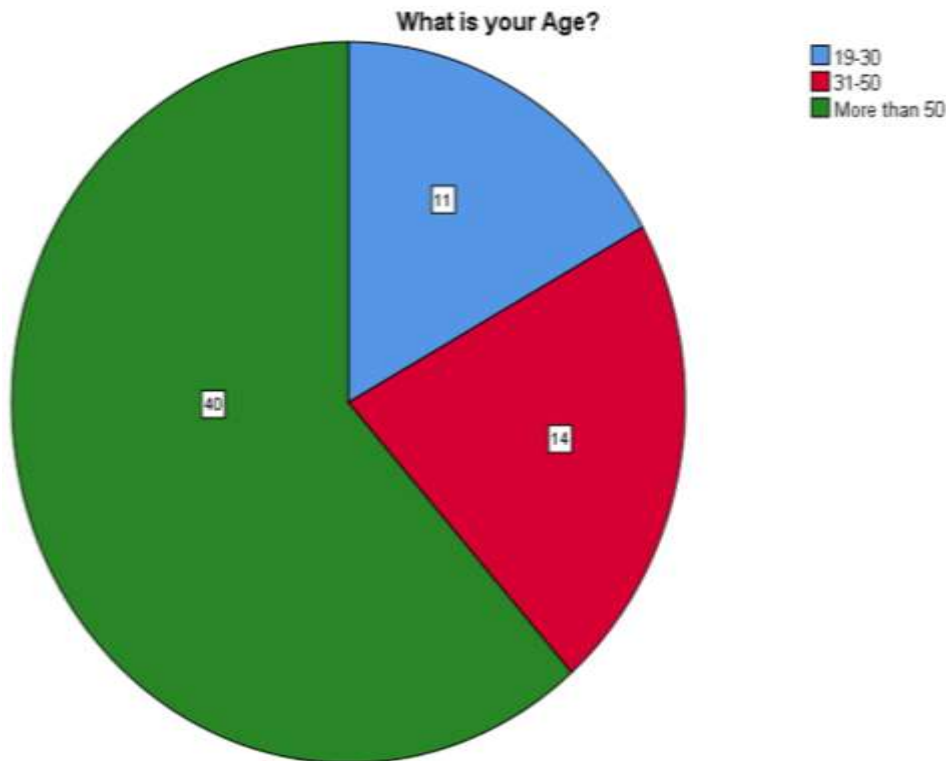


Figure 2:-Age.
(Source: Quantitative Analysis)

Variable related hypothesis
Validity Test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	2.857
	df	1
	Sig.	.091

Table 3:-Validity Test.

(Source: Quantitative Analysis)

The validity test results have presented a differentiated view. The Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy, which addresses a question about whether the data is appropriate for factor analysis, comes to 0.500, which is just below the conventional threshold value of 0.5. This indicates the data feasibility issues for using it in such research. In a contrasting manner, Bartlett's Test of Sphericity evaluating the correlation among variables provides a chi-square of 2.857 (with 1 df) and a non-significant p-value of 0.091. This statement demonstrates that variables are independent.

Descriptive Analysis

Descriptive Statistics

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
DV1.1	65	3	5	4.15	.775	-.276	.297	-1.273	.586
IV1.1	65	2	5	3.75	1.199	-.290	.297	-1.489	.586
IV2.2	65	3	5	4.26	.735	-.458	.297	-1.008	.586
IV3.1	65	3	5	3.83	.762	.298	.297	-1.204	.586
IV4.1	65	3	5	4.57	.829	-1.418	.297	.009	.586
IV4.2	65	4	5	4.62	.490	-.486	.297	-1.821	.586
Valid N (listwise)	65								

Table 4:-Descriptive Analysis.

(Source: Quantitative Analysis)

The studied variables are found to be closely linked in this assessment. The mean values (DV1.1= 4.15; IV1.1= 3.75; IV2.2= 4.26; IV3.1=3.83; IV4.1=4.57 and IV4.2= 4.62) measured the central tendency of data. It is noticed that the downside is that the skewness values for DV1.1 and IV1.1 are minimal but skewed to the negative side, whereas the reverse is the case with IV2.2, IV3.1, IV4.1 and IV4.2 which shows a negligible skewness. Besides, the kurtosis values endeavour to prove that all variables constitute generally a platykurtic distribution for the entire data set, with DV1.1 and IV3.1 slightly deviating from this norm. The results therefore suggest that there can be mid-array scores across variables; however, this is slightly more prominent in the higher scores in the data. Besides, the negative skewness discovered in DV1.1 and IV1.1 should be investigated on the hypothesis of other impacting factors that determine these distributions, thus providing a better additional investigation of subsequent ones and decision-making processes.

Correlation Test

		Correlations				
		DV1.1	IV1.1	IV2.1	IV3.1	IV4.1
DV1.1	Pearson Correlation	1	-.261 [*]	.427 ^{**}	-.617 ^{**}	-.576 ^{**}
	Sig. (2-tailed)		.036	.000	.000	.000
	N	65	65	65	65	65
IV1.1	Pearson Correlation	-.261 [*]	1	.276 [*]	-.474 ^{**}	.332 ^{**}
	Sig. (2-tailed)	.036		.026	.000	.007
	N	65	65	65	65	65
IV2.1	Pearson Correlation	.427 ^{**}	.276 [*]	1	-.868 ^{**}	-.798 ^{**}
	Sig. (2-tailed)	.000	.026		.000	.000
	N	65	65	65	65	65
IV3.1	Pearson Correlation	-.617 ^{**}	-.474 ^{**}	-.868 ^{**}	1	.576 ^{**}
	Sig. (2-tailed)	.000	.000	.000		.000
	N	65	65	65	65	65
IV4.1	Pearson Correlation	-.576 ^{**}	.332 ^{**}	-.798 ^{**}	.576 ^{**}	1
	Sig. (2-tailed)	.000	.007	.000	.000	
	N	65	65	65	65	65

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Table 5:-Correlation Analysis.
(Source: Quantitative Analysis)

The correlation analysis reports some positive and significant relationships between independent and dependent variables. For example, DV1.1 is moderately negatively correlated with IV3.1 ($r = -0.617$, $p < 0.01$) and IV4.1 ($r = -0.576$, $p < 0.01$). Thus, higher IV3.1 and IV4.1 go along with lower values of DV1.1. While DV1.1 shows a modest degree of coherence with IV2.1 ($r = 0.427$, $p < 0.01$), indicating that a higher level of IV2.1 is associated with a greater value of DV1.1. Moreover, there is a very strong negative correlation between IV3.1 and IV4.1 ($r = -0.798$, $p < 0.01$), which means that one variable growth is associated with others' decline. Also, the correlation between IV2.1 and IV3.1 ($r = -0.868$, $p < 0.01$), likewise the one between IV2.1 and IV4.1 ($r = -0.798$, $p < 0.01$), are strong negative relationship, denoting the inverse relation between these variables.

Multiple Regression**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000 ^a	1.000	1.000	.000

a. Predictors: (Constant), IV4.1, IV1.1, IV2.3, IV3.2

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86.215	4	21.554	.	. ^b
	Residual	.000	60	.000		
	Total	86.215	64			

a. Dependent Variable: DV1.2

b. Predictors: (Constant), IV4.1, IV1.1, IV2.3, IV3.2

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.833	.000		-72702215.5	.000
	IV1.1	-.333	.000	-.344	-237506307	.000
	IV2.3	-1.667	.000	-1.129	-410396405	.000
	IV3.2	.333	.000	.284	66256963.49	.000
	IV4.1	2.167	.000	1.547	275389304.3	.000

a. Dependent Variable: DV1.2

Table 6:-Multiple regression analyses.
(Source: Quantitative Analysis)

The results of the multiple regression show that the model is highly significant ($F(4, 60) = 86.215, p < 0.001$). Therefore, it can be concluded that the predictors are jointly a significant part of DV1's variance. The model explains for all the variability DV1.2 with $R^2 = 1.000$, which shows a perfect fit degree. Among these measures, the standardized coefficient of IV4.1 shows the strongest positive level ($\beta = 1.547, p < 0.001$), then IV2.3 demonstrates the weakest negative level ($\beta = -1.129, p < 0.001$), followed by IV1.1 ($\beta = -0.344, p < 0.001$) This means that amongst IV the IV4.1 has the greatest influence on DV1.2, being then IV2.3, IV1.1, and IV3.2 in this order. Interestingly, all factors are shown to have statistically significant coefficients ($p < 0.001$), pointing to their individuality in predicting DV1.2. The results indicate that the simultaneous application of IV4.1, IV2.3, IV1.1, and IV3.2 will effectively predict DV1.2 defining the responsibility of the identified variables in the explained variance of the dependent variable.

Discussion:-

The result shows a substantial difference between female and male respondents where female gender tension is relatively high. The balance reveals that the majority of our citizens are older. It can be observed that a validity test which underpins some data provision issues and descriptive analysis which reveals a series of skewness and kurtosis patterns over variables. Analysis of correlation shows that there are outstanding connections between the independent and dependent variables. Multiple regression also leads to the collective significance of the predictors

in seeing the variance, and IV4.1 which shows the most contribution in the outcome is DV1.2 Overall, (the) results (show that) it is imperative especially environmental education projects should consider these variations and aim for a targeted solution for specific ages and genders. Such efforts will have a larger impact on the environmentally conscious behavior of everyone.

Conclusion:-

The study emphasizes how the crucial role of environmental education could be used as a solution to modern environmental challenges. The key findings support the fact that critical pedagogy should be further promoted to improve the efficiency of education programs. create an account to decode the meaning of this sentence In addition, the subject differences in answers also reflect the need for speciality delivery systems. The finding regarding the interdisciplinary approach as a major driving force in positive behaviour outcomes could provide the background for the development of a holistic educational strategy. Due to the response gender gap, it is important that environmental education is placed with gender neutrality. Ultimately, the findings draw attention to establishing such measures as a way of educating people to be environmentally friendly. These in return equip the generations to come for much-needed sustainable action.

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Appendices

1. What is your gender?
2. What is your age?
3. Do you think that environmental education initiatives should prioritize critical pedagogy to foster sustainable behaviors?
4. Do you believe that younger age groups show a stronger correlation between environmental education initiatives and empowerment for sustainable action compared to older age groups?
5. Do you think that environmental education programs integrating interdisciplinary approaches have a positive association with enhanced environmental literacy and sustainable behavior outcomes?
6. Do you agree that formal education receives more attention compared to non-formal education in environmental education practices?
7. Should environmental education be promoted with gender neutrality?
8. Do you believe that youth-led environmental actions, like tree planting projects and waste reduction initiatives, are effective in promoting sustainable behaviors?
9. Should environmental education initiatives focus more on practical projects and experiential learning in classrooms?
10. Is there a need for longer-term outcome studies of environmental education programs to assess their efficacy across generations and societies?
11. Do you think that collaboration between educational institutions, non-governmental organizations, and governmental agencies is crucial for enhancing environmental education practices?
12. Should environmental education aim to empower individuals and society to be the main guardians of the environment?