Effect of Instructional Designs on Learners' Interest in Environmental Education Content of Junior Secondary School Basic Science and Technology

Doris Elemi Addo[1], David Francis Ekpoto[2], John Eteng Imoke[3], Amina Peter Adams[4], Celestine Unoh Nkanu[3,*], Abigail Aniefiok Effiong[3], Stephanie Sedoo Bishie-Unung[5], Emmanuel Bessong Bessong[6], Suleiman Gbenga Lawal[7], Enya Gabriel Emori[7], Samuel Orim Orim[8], Akaninyene Billy Orok[7], Innocent Obeten Okoi[7], Hycenth Okang Owui[7], Augustine Okpaje Eba[7], James Eburikure Olayi[8], Joseph Ita Asukwo[7] & Joseph Bekeh Undie[4]

[1]Department of Environmental Education, University of Calabar, Nigeria

[2]Department of Education Geography & Sustainable Development Studies, University of Calabar, Nigeria

[3]Department of Educational Technology, University of Calabar, Nigeria

[4]Department of Social Studies and Civic Education, University of Calabar, Nigeria

[5]Department of Agricultural Education, University of Calabar, Nigeria

[6]Department of Business Education, University of Calabar, Nigeria

[7]Department of Banking and Finance, University of Calabar, Nigeria

[8]Department of Special Education, University of Calabar, Nigeria

*Correspondence: Department of Educational Technology, University of Calabar, Calabar, Cross River State, Nigeria. E-mail: unoh@unical.edu.ng. ORCID: https://orcid.org/0000-0002-7987-8427

Received: August 5, 2025 Accepted: October 2, 2025 Online Published: November 17, 2025

doi:10.5430/jct.v14n4p343 URL: https://doi.org/10.5430/jct.v14n4p343

Abstracts

The research investigates the impact of instructional designs on learners' interest in environmental education content of junior secondary school (JSS) basic science and technology in Calabar Education zone of Cross River State. The research adopted a quasi-experimental approach. Specifically, the 2 x 2 factorial design was utilized. The sample included 143 respondents chosen from 5,971 students. The study utilizes a multi-stage sampling techniques involving simple random and purposive sampling approaches. Data collection tool was the "Environmental Education Contents Interest Inventory (EECII)." The instrument's internal consistency was determined using Cronbach's Coefficient Alpha, which produced a reliability coefficient of 0.84. Analysis of Covariance (ANCOVA) was utilized to test the null hypotheses at the 0.05 level of significance, while mean and standard deviation were employed to evaluate the data in order to answer the research objectives. The findings revealed that instructional designs, effectively enhanced learners' interest in environmental education (EE) contents the subject area. Also, learners' interest in EE contents was significantly influenced by their gender. Among other things, it was suggested that in order to increase learners' interest in EE contents, basic science and technology teachers be urged to use the ADDIE and Isman instructional designs.

Keywords: instructional designs, interest, environmental education, basic science and technology

1. Introduction

Education is a priceless national building block in Nigeria and in any other country in the world. It pushes the economic, social, and technological development of Nigerians and the rest of the world. It is in recognition of this essential role that the National Policy on Education of Nigeria emphasizes the importance of a robust educational system that can lead to self-sufficiency and societal development (Federal Republic of Nigeria [FRN], 2014). In this respect, an interdisciplinary part of the Basic Science and Technology (BST) curriculum, Environmental Education (EE), is central to building the awareness, knowledge, skills, attitudes, and active involvement in solving environmental issues (Dare, 2013; Badamasi, 2015). UNESCO-UNEP (Gbendu, 2019) mentions that EE is supposed

to develop: (i) environmental awareness and sensitivity, (ii) environmental knowledge obtained in various experiences, (iii) environmental values and concern, (iv) skills of solving environmental problems, and (v) possibilities of active participation in conservation work (Mondal, 2010). EE meets the urgent demands of people and society in the ever-evolving world by providing students with all the necessary equipment to manage natural resources sustainably without compromising those of future generations.

Nevertheless, the impact of EE-related BST coursework on the performance of learners in junior secondary schools (JSS) in Nigeria remains low. Studies show persistent challenges in students' engagement and achievement (Samuel, 2017; Kabutu et al., 2015). This underperformance is attributed to inefficient teaching practices, including the insufficient use of instructional media, the inability to use relatable examples, and a lack of focus on students' prior knowledge, motivation, and cognitive abilities (Gbenga & Effiong, 2015). These deficiencies create obstacles to the formation of interest and competency in EE, as well as the need for new teaching methods to improve learning rates and environmental stewardship.

Research has established that students typically perform poorly and show little interest in more complex material when proper teaching approaches are not used during the teaching and learning process (Adams et al., 2025; Ameyaw & Okyer, 2018; Nkanu et al., 2025; Nkanu et al., 2024; Nwafor et al., 2024a; Nwafor et al., 2024b; Johnson et al., 2024; Ekpoto et al., 2022). Scholars, parents, the government, and other stakeholders in education are becoming concerned about pupils' poor academic achievement (Adams et al., 2024; Ulonnam et al., 2024). This requirement is also supported by the continuous decline in student performance in Environmental Education (EE) within the African curriculum of Basic Science and Technology (BST) in Nigeria. According to the results of the Calabar Education Zone Basic Education Certificate Examination (BECE) carried out annually by the National Examination Council, there has been a gradual decline in the pass rate in BST, with the results standing at 60.30% in 2018 and 40.88% in 2022 at the credit level. This trend highlights the limitations of the traditional teaching philosophy, which is not always effective in fostering student interest and background knowledge in EE, thereby impeding the achievement of the Nigerian Educational Research and Development Council (NERDC) curriculum objectives (Edinyang & Ubi, 2013; Asogwa et al., 2022). The objectives emphasize the application of instructional design in a way that allows learners to plan, analyze, synthesize, and evaluate environmental concepts. Instructional design provides a rational framework for enhancing learning environments to address these challenges. Instructional design in this work is operationally defined as a structured process of planning, developing, implementing, and evaluating learning activities to encourage student participation and proficiency in EE content (Halawa, 2024). Instructional design also provides unique, interactive learning opportunities that cater to the individual needs of students, unlike traditional tools such as lecture notes (Addo et al., 2023). It includes needs assessment, outcome planning, media selection, and performance evaluation, which engage motivating and productive learning (Defelice, 2021; Branch & Kopcha, 2014; Sandel, 2018; Bilankulu, & Ntuli, 2025). The instructional design enhances the learning process by fostering the development of knowledge, skills, and attitudes essential to environmental stewardship through a focus on student-centered strategies. In 1975, the Center for Educational Technology at Florida State University developed the ADDIE Model (Analysis, Design, Development, Implementation, Evaluation), a systematic instructional design model (Morrison, 2010; Clark, 2015). ADDIE has been used in this work to design the interactive EE lesson, incorporating needs analysis, objectives, material development (e.g., workbooks), teacher training, and outcome assessment. Its flexibility allows for its application in education, given that it can adapt resources to specific learning goals (Davis, 2013; Hsu-Hsieh et al., 2014; Allen, 2017; Branch, 2018; Bugis, 2018). Likewise, the Isman model, which places a strong emphasis on holistic planning and reinforcement, incorporates concepts from constructivism, behaviorism, and cognitivism to promote competency-based learning in EE (Isman et al., 2012; Alias et al., 2013a, 2013b). To provide EE content, including sustainable resource use, both models are employed to encourage active student participation. At the heart of this research is interest, which is an operationalized definition that motivates students to be active participants in EE topics and can be described as more attentive, putting in more effort, and persisting in the learning process (Harackiewicz et al., 2016). Interest, which encompasses cognitive, emotional, and psychological aspects, is a key contributor to academic success (Lilia et al., 2018; Soledad, 2019). It has been proposed that an interest deficit contributes to poor EE performance because students struggle to stay focused in a conventional classroom (Tarmunosa, 2019; Laine et al., 2019; Fan et al., 2016). Nonetheless, student-centered teaching frameworks, such as ADDIE and Isman, have been demonstrated to be more effective in promoting interest compared to traditional teaching approaches and provide viable solutions to EE learning (Davis, 2013; Hsu-Hsieh et al., 2014; Alias et al., 2013a, 2013b). Thus, this work aimed to explore the effect of ADDIE and Isman instructional designs on learners' interest in the EE elements of BST syllabus in Calabar Education Zone, to address the issue of declining engagement and performance by developing innovative,

theory-based interventions.

The constructivist theory of learning (Bruner, 1960), Ausubel's theory of meaningful learning (1960), and social cognitive theory (Bandura, 1983) are the theoretical bases that are specifically pertinent to this investigation. As independent factors and the dependent variable (interest), their link to this study only highlights the potential implications of the theories for instructional designs (ADDIE and Isman). Students' interest in a theory-based classroom that utilizes instructional designs (ADDIE and Isman) to teach EE subjects in basic science and technology may be influenced by this significant variable. Theory-based classroom training can consistently lead to better performance and improve students' readiness for problem-solving abilities by encouraging them to observe environmental issues and create a positive interest in finding solutions.

2. Purpose of the Study

The aim of the research is to examine the effect of ADDIE and Isman instructional designs on learners' interest in EE content of Junior Secondary School BST. Specifically, the work investigates the:

1. effects of ADDIE and Isman instructional designs on learners' interest ratings in EE contents of JSS.
2. influence of gender on students' interest in EE contents of JSS.
3. interaction effect of instructional designs and gender on learners' interest in EE contents of JSS.

3. Research Questions

Three research questions were formulated for the research.

1. What are the effects of ADDIE and Isman instructional designs on the mean interest rating of learners in EE contents of JSS?
2. What is the influence of gender on the mean interest rating of learners in EE contents of JSS?
3. What is the interaction effect of instructional design and gender on the mean interest scores of learners in EE contents of JSS?

4. Research Hypotheses

Three corresponding hypotheses were tested at .05 level of significance.

1. There is no significant difference ($p < .05$) in the mean interest of learners taught EE contents of JSS Basic Science and Technology using ADDIE and Isman instructional design
2. There is no significant difference ($p < .05$) in the mean interest scores of male and female learners in EE content of JSS Basic Science and Technology
3. There is no significant interaction effect of instructional designs and gender on the mean interest scores of learners taught EE contents of JSS Basic Science and Technology.

5. Methods

This work employed a quasi-experimental design. In particular, the work employed a 2 x 2 factorial design. Because it enables the researcher to ascertain the impacts of two primary independent variables, such as ADDIE's instructional design and Isman's instructional design. The design was deemed suitable for the research since it is a 2 × 2 pretest-posttest. The factor scales measured interest in environmental education materials among JSS II students, and the moderating variable is gender, categorized into two levels: male and female. In particular, experimental group 1 was taught with the Addie instructional design, whereas experimental group 2 was taught with the Isman instructional design. Because it is impossible to randomly select the study participants without interfering with the regular schedule, classroom setup, and other school activities, intact classes were utilized to prevent disruptions from regular class lectures.

5.1 Population and Sample

A total of 5,971 JSSII students from the 88 government-owned schools in the Calabar Education Zone formed the research population. There are 3,191 female pupils and 2,780 male students in JSSII. One hundred forty-three JSSII students from four intact classrooms (77 females & 66 males) were sampled for the research. The study utilizes a multi-sampling approach. To guarantee that each LGA had an equivalent chance of being represented, a simple

random sampling approach was adopted to picked two LGAs among the seven Zone. Secondly, of the 88 schools in the Zone, four coeducational were chosen for the experiment through purposive sampling approach. The Environmental Education Content Interest Inventory (ECII) was utilized to obtain data on the degree of interest students had in studying environmental education topics in BST. The thirty items inventory were weighted on a four-point scale as: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Positively phrased items had numerical values of 4, 3, 2, and 1. For items with negative wording, the scoring was done in reverse order. For validation, they were presented to three experts for face validity. The questionnaire's internal consistency was analyzed through Cronbach's Alpha, which produced a reliability Coefficient of 0.84.

5.2 Experimental Procedure

The ECII was administered as pretest before the commencement of the treatment and as post-test, with the questions reshuffled, after the treatment. The teaching was carried out by the BST instructors in the sampled schools, that were trained as facilitators while the researchers supervised the process.

5.3 Data Analysis

Research questions were handled using the mean and standard deviation. Whereas null hypotheses were tested at the 0.05 alpha level using Analysis of Covariance (ANCOVA). The use of ANCOVA statistics was suitable (for testing the hypotheses) since it allowed the researcher to statistically regulate the initial group differences, the use of mean and standard deviation allows the researcher to ascertain the degree of dispersion of one group's mean from the other.

6. Results

RQ One: What are the effects of ADDIE and Isman instructional designs on the mean interest rating of learners in EE contents of JSS Basic Science and Technology?

Table 1. Pretest and Post-test of the Effects of ADDIE and Isman Instructional Designs on the Mean Interest Rating of Learners in EE Contents of JSS Basic Science and Technology

Experimental Groups	Pretest			Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
ADDIE Instructional Design	73	69.18	6.35	97.05	4.02	27.87
Isman Instructional Design	70	60.79	9.42	96.47	10.99	35.68

Note: N = Number of Respondents, $\bar{\mathbf{X}}$= Mean, **SD** = Standard deviation

The outcome in Table 1 revealed that learners taught using the ADDIE Instructional Design had a mean interest of ($\bar{\boldsymbol{X}}$= 69.18, SD = 6.35) at pretest and a mean interest of ($\bar{\boldsymbol{X}}$= 97.05, SD = 4.02) at posttest. Whereas, students taught with the Isman Instructional Design had a mean interest of ($\bar{\boldsymbol{X}}$ = 60.79, SD = 9.42) at pretest and a mean interest of ($\bar{\boldsymbol{X}}$= 96.47, SD = 10.99) at posttest. Then, standard deviations of 4.02 and 10.99 for the ADDIE and Isman instructional designs at posttest indicated that the interest ratings of learners in the Isman instructional design group were widely spread than the ratings of learners in the ADDIE instructional design group. Further analysis revealed that the variance among the pretest and posttest means was 27.87 and 35.68 for learners taught with ADDIE design and those taught with Isman design respectively. This variation in mean suggested that although both designs are potent in improving students' interest in environmental education (EE) contents of JSS Basic Science and Technology, the Isman Instructional Design shown to be more effective in mean interest rating than the ADDIE instructional design.

HO1: There is no significant difference ($p < .05$) in the mean interest rating of learners taught EE contents of JSS Basic Science and Technology using ADDIE and Isman instructional design.

The outcome in Table 2 revealed that while utilizing ADDIE Instructional Design and Isman Instructional Design to teach environmental education (EE) subject in JSS basic science and technology, learners' mean interest ratings did not differ significantly, $F(1, 138) = .197$, $p = .658$, $\eta^2_p = .001$). This is because, at the 0.05 alpha level where the outcome was being tried, the corresponding probability (Sig.) value of.658 is higher. Additionally, the effect size variation ($\eta^2_p = .001$), indicated that 0.1% variance exists between the mean ratings of learners taught with the two strategies, which is very small. Thus, the HO_1 which stated thus: there is no significant variance in the mean interest ratings of learners taught EE contents of JSS Basic Science and Technology using ADDIE and Isman instructional design was not rejected. The inference drawn therefore was that the mean interest ratings of learner taught EE

contents of JSS Basic Science and Technology using ADDIE and Isman instructional design does not differ significantly (p >.05).

Table 2. ANCOVA of the Difference in the Mean Interest Rating of Learners Taught EE Contents of JSS Basic Science and Technology Using ADDIE and Isman Instructional Design

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared (η^2_p)	Decision
Corrected Model	626.680[a]	4	156.670	2.434	.050	.066	
Intercept	20699.187	1	20699.187	321.579	.000	.700	
PreEE interest	12.119	1	12.119	.188	.665	.001	
Group	12.702	1	12.702	.197	.658	.001	NS
Gender	399.203	1	399.203	6.202	.014	.043	S
Group * Gender	204.641	1	204.641	3.179	.077	.023	NS
Error	8882.705	138	64.367				
Total	1348602.000	143					
Corrected Total	9509.385	142					

Note: df = Degree of Freedom, **F** = F-ratio, **Sig**.= Significant/Exact probability value, **S** = Significant, **NS** = Not Significant

RQ two: What is the influence of gender on the mean interest rating of learners in EE contents of JSS Basic Science and Technology?

Table 3. Pretest and Posttest of the Influence of Gender on the Mean Interest Rating of Learners in EE Contents of JSS Basic Science and Technology

Gender		Pretest		Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
Male	66	64.80	8.04	98.56	8.03	33.76
Female	77	65.30	9.83	95.23	8.05	29.93

***Note: N** = Number of Respondents, $\bar{X}$= Mean, **SD** = Standard deviation*

The outcome in Table 3 showed the mean interest ratings of male and female learners in EE contents of JSS Basic Science and Technology. The outcome showed that male learners had a mean interest of ($\bar{X}$= 64.80, SD = 8.04) at pretest and a mean interest of ($\bar{X}$= 98.56, SD = 8.03) at posttest. The pretest and posttest mean variance gotten for the male learners' interest ratings was 33.76. Whereas, the female learners had a mean interest of ($\bar{X}$ = 39.92, SD = 6.56) at pretest and a mean interest of ($\bar{X}$ = 56.47, SD = 5.31) at posttest. The pretest and posttest mean variance gotten for the female students' interest was 29.93. The standard deviation of 8.03 and 8.05 for the male and female students at posttest correspondingly, can be interpreted that the interest ratings of male and female learners were similarly spread across the groups. Based on the pretest and posttest mean difference obtained, it could be deduced that male demonstrated somewhat higher interest in environmental education (EE) contents of JSS basic science and technology than their female contenders.

HO2: There is no significant difference (p < .05) in the mean interest ratings of male and female learners in EE content of JSS.

The outcome in Table 2 also presented that there was a significant variation in the mean interest ratings of male and female learners in EE content of JSS basic science and technology, $F(1, 138) = 6.202$, $p = .014$, $\eta^2_p = .043$). This is because the associated probability (Sig.) value of .014 is less than 0.05 level of significance at which the result was being tested. Furthermore, the effect size difference ($\eta^2_p = .043$), indicated that4.3% variance exists among the mean interest of the male and female learners, which is considerable. Therefore, the null HO_2 which holds that there is no significant difference in the mean interest of male and female learners in EE content of JSS basic science and technology was rejected. Inference drawn was that the mean interest of male and female learners in EE content of JSS

basic science and technology differ significantly ($p < .05$). This showed that gender is a factor of learners' interest in environmental education (EE) contents of JSS basic science and technology.

RQ three: What is the interaction effect of ADDIE and Isman instructional design and gender on the mean interest scores of learners in EE contents of JSS Basic Science and Technology?

Table 4. Pretest and Post-test Mean Interaction Effect of Instructional Design and Gender on the Interest Scores of Students in EE Contents of JSS Basic Science and Technology

Experimental Groups			Pretest		Posttest		
	Gender	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
ADDIE Instructional Design	Male	34	69.29	6.35	97.56	4.41	28.27
	Female	39	69.08	6.44	96.62	3.65	27.54
Isman Instructional Design	Male	32	60.03	6.85	99.63	10.59	39.60
	Female	38	61.42	11.19	93.82	10.74	32.40

Note: N = Number of Respondents, $\bar{X}$= Mean, SD = Standard deviation

Table 4 revealed the interaction effect of ADDIE and Isman instructional design and gender on the mean interest of learners in EE contents. The findings revealed that male learners taught with ADDIE Instructional Design had a mean interest of ($\bar{X}$ = 69.29, SD = 6.35) at pretest and a mean of ($\bar{X}$ = 97.56, SD = 4.41) at posttest. The variations in mean among pretest and posttest was 28.27. Whereas, female learners taught using ADDIE Instructional Design had a mean interest of ($\bar{X}$ = 69.08, SD = 6.44) at pretest and a mean of ($\bar{X}$ = 96.62, SD = 3.65) at posttest. The variation in mean amid the pretest and posttest was 27.54. Also, the outcome revealed that males taught using Isman Instructional Design had a mean interest of ($\bar{X}$= 60.03, SD = 6.85) at pretest and a mean ($\bar{X}$ = 99.63, SD = 10.59) at posttest. The variation in mean amid the pretest and posttest was 39.60. Although, the females taught using the same Isman Instructional Design had a mean interest of ($\bar{X}$ = 61.42, SD = 11.19) at pretest and a mean of ($\bar{X}$ = 93.82, SD = 10.74) at posttest. Variation in mean amid the pretest and posttest was 32.40. In summary, the findings revealed that the male had a slightly better interest rating than their female counterparts in EE contents of JSS basic science and technology when taught with both ADDIE and Isman instructional designs.

HO3: There is no significant interaction effect of instructional designs and gender on the mean interest scores of learners taught EE contents of JSS.

Results in Table 2 also showed that there is no significant interaction effect of instructional designs and gender on the mean interest of learners taught EE contents of JSS basic science and technology, $F(1, 138) = 3.179$, $p = .077$, $\eta^2_p = .023$). This was as a result of the related probability (Sig.) of .077 is higher than 0.05 level of significance at which the outcome was being tested. Additionally, the effect size difference ($\eta^2_p = .023$), showed that 2.3% variance exists amid the mean interest of the male and female learners, which was small. Consequently, the null HO_3 which specified that there is no significant interaction effect of instructional designs and gender on the mean interest of learners taught EE contents of JSS basic science and technology was not rejected. The inference drawn was that the interaction effect of instructional designs and gender on the mean interest ratings of learners in EE contents of JSS basic science and technology was not statistically significant ($p > .05$).

7. Discussion

According to the study's findings, the Isman instructional design outperformed the Addie instructional design, despite both designs being effective in raising students' interest in environmental education (EE) materials in JSS basic science and technology. Because Addie and Isman both use student-centred teaching approaches, this conclusion is accurate. Fundamentally, active involvement in all learning events is a requirement for students to be engaged in the instructional process. In contrast, the teacher provides more than just supervision, responding to questions and taking notes as the session advances. Students' interest in the environmental education curriculum of JSS basic science and technology could be effectively increased by implementing Addie and Isman instructional designs. This finding supports the results of some earlier investigations. For example, the results corroborate those of Kassem (2019), who discovered that student-centred instructional designs significantly outperformed the traditional teaching approach in raising students' mean interest scores. Similarly, this supports the findings of Danjuma's (2015) study, which demonstrated that collaborative learning techniques improved students' interest in and performance in basic science. Additionally, the results are consistent with those of Usman and Okeke (2017), who found that the

jigsaw learning approach favoured learners' interest in quadratic equations over the lecture method, and Ugboduma (2017), who found that learners taught geometry with ADDIE had a better mean interest score than those taught geometry with the expository method. The results of the aforementioned studies suggest that using Addie and Isman instructional designs in the classroom can meaningfully increase students' interest in the environmental education (EE) curriculum of JSS.

The research also found that the mean interest of male and female learners in the EE material varied significantly. This finding suggests that pupils' interest in the environmental education (EE) components of JSS basic science and technology is significantly impacted by their gender. This finding aligns with previous research by Kurumeh et al. (2012), which revealed that male learners were statistically significantly more interested in their studies than female students. Similarly, Nawi et al. (2015) found that the flipped classroom approach to teaching stimulated students' interest and curiosity in geography. Similarly, Obiekwe (2018) found that male students performed better academically than their female counterparts. Nonetheless, the result supports a previous conclusion from Mercy et al.'s (2021) research, which demonstrated that learners' interest in the subject was not significantly influenced by their gender. Students of both sexes showed comparable degrees of interest in the subject. On the other hand, this study discovered that male students' interests in the EE content differ considerably from those of female students.

Additionally, this research discovered that the mean interest ratings of learners in the EE subjects did not significantly interact with gender or instructional designs. This result suggests that the environmental education (EE) components of JSS basic science and technology attracted comparable levels of attention from male and female learners taught utilizing both Addie and Isman instructional styles. The results of some earlier investigations are consistent with this one. For example, the results corroborate those of Demalata et al. (2024), who discovered that there is no significant interaction between gender and instructional styles in terms of learners' mean interest ratings. The results are also consistent with those of Kurumeh et al. (2012), who discovered no statistically significant interaction between gender and instructional styles in influencing learners' interest. This discovery suggests that the instructional strategies used increased the interest of learners regardless of their gender. Therefore, the outcome of this research displayed that there is no substantial interaction effect between gender and instructional models on students' mean interest in the EE content.

8. Conclusion

This paper highlights the potential transformational nature of the ADDIE and Isman instructional designs in rejuvenating students' interest in the Environmental Education aspects of the Basic Science and Technology framework of study in JSS in Nigeria. Both models were found to be effective in improving engagement, though Isman demonstrated a slight advantage due to its iterative and reinforcement-based approach. These results are a direct response to the continuing decline in student performance in EE, as evidenced by the BECE pass rates in the Calabar Education Zone, and support the idea that structured, student-centred designs can work in reverse to produce curious, engaged, and meaningful student learning.

Outside the classroom, the research underscores the overall importance of EE in Nigeria's pursuit of sustainable development. Although gender appeared to play a role, with male students exhibiting greater interest, the lack of an interaction effect suggests the universality of ADDIE and Isman, indicating that they apply to a wide range of learners. Such a stand is especially critical in a society where education is essential to national development, and none of the existing education systems can afford inequity.

Finally, the research confirms the effectiveness of instructional design not only as a pedagogical resource but also as a tactical course toward the development of eco-conscious citizens. With innovative designs applied to teaching activities, Nigeria can produce a generation more knowledgeable, participatory, and empowered to spearhead sustainability practices. It implies that a paradigm shift in EE pedagogy is required - one that is open to innovation, equity, and action-oriented learning as a way to build the nation's future.

9. Recommendations

The following suggestions were prompted by the research findings:

1. Basic science and technology teachers should be invigorated to adopt the ADDIE and Isman instructional designs when teaching environmental education content to improve students' interest in the area.
2. Curriculum designers and developers should integrate the use of Addie and Isman instructional designs as essential approaches to instruction in environmental education content.

3. Education administrators should organize seminars for basic science and technology teachers on the use of Addie and Isman instructional designs. Such action would equip teachers with the knowledge to follow the designs in teaching environmental education (EE) content, thereby promoting students' interest in this area.
4. Basic science and Technology textbook authors should endorse the ADDIE and ISMAN instructional designs as practical approaches to teaching environmental education (EE) content.

References

Adams, A. P., Ekpoto, D. F., Ejoh, A. O., Atawodi, J. U., Ekpoto, R. D., & Anim, D. A. (2025). School Learning Resources and Learning Outcome in Social Studies in Calabar Metropolis, Cross River State, Nigeria: Implications for Sustainable Development Education. *International Journal of Social Sciences and Management Research, 11*(2), 209-219. https://doi.org/10.56201/ijssmr.vol.11no2.2025.pg.209.219

Adams, A. P., Ekpoto, D. F., Uduak, P. E., & Edinyang, S. D. (2024). Income Inequality, Sustainable Development, and Students' Academic Achievements in Public Universities in Cross River State. *Prestige Journal of Education, 7*(1), 207-215.

Addo, D., Efut, E., Akpo, D., & Egor, O. (2023). Innovative Instructional Design Packages for Promoting Inclusive and Participatory Interactive Learning Experience in Nigeria. *Shodh Sari-An International Multidisciplinary Journal, International Council for Education Research and Training*, *2*(2), 70-87. https://doi.org/10.59231/SARI7575

Asogwa, U. D., Nkanu, C. U., & Sabo, A. (2022). Assessment of e-learning readiness of lecturers and students in federal colleges of education in North-East, Nigeria. *International Journal of Curriculum and Instruction, 14*(1), 455-472.

Alias, N., Siraj, S., Daud, M., & Hussin, Z. (2013a). Effectiveness of Facebook based learning to enhance creativity among Islamic studies students by employing Isman instructional design model. *Turkish Online Journal of Educational Technology-TOJET, 12*(1), 60-67.

Alias, N., Siraj, S., DeWitt, D., Attaran, M., & Nordin, A. (2013b). Evaluation on the Usability of Physics Module in a Secondary School in Malaysia: Students' Retrospective. *Malaysian Online Journal of Educational Technology, 1*(1), 44-53

Allen, M. (2017). Designing online asynchronous information literacy instruction using the ADDIE Model. In Maddison, & M. Kumaran (Eds.), *Distributed Learning* (pp. 69-91). Chandos Publishing: Elsevier. https://doi.org/10.1016/B978-0-08-100598-9.00004-0

Ameyaw, Y., & Okyer, M. (2018). The efficiency of some teaching and learning instructions that enhance students' performance in excretion. *Ann Rev Research, 1*(5), 555-571.

Ausubel, D. (1960). The use of advanced organizers in learning and retain of meaningful verbal material. *Journal of Educational Psychology, 51*, 12-25.

Badamasi, S. (2015). *Effect of two models of virtual field-trips approach on students' achievement and attitude to some environmental education concepts in basic science*. An unpublished Ph.D. Thesis, University of Nigeria, Nsukka.

Bandura, A. (1983). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bilankulu, H. J., & Ntuli, T. G. (2025). An exploration of teaching strategies used to teach natural sciences at the science centre in Pretoria, South Africa. *Journal of Curriculum and Teaching, 14*(1), 226-233. https://doi.org/10.5430/jct.v14n1p226

Branch, R. (2018). Characteristics of instructional design models. In R. A. Reiser, & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (4th ed., p. 28). Pearson Merrill Prentice Hall.

Branch, R., & Kopcha, T. (2014). *Instructional design models in handbook of research on educational communications and technology*. Springer

Bruner, J. S. (1960). *The process of education*. Harvard University Press.

Bugis, Yosra. (2018). *Creating digital stories with Saudi Arabian pre-service teachers: using the analysis, design, development, implementation, and evaluation model to promote lesson plan development*. (Doctoral

dissertation). University of Northern Colorado. ProQuest Number: 10829604

Clark, D. (2015). *Instructional design*. Retrieved from nwlink.com

Danjuma, G. (2015). *Effects of collaborative and competitive learning strategies on Upper Basic II students' interest and achievement in Basic Science in Southern Zone of Taraba State*. An unpublished Ph.D. Thesis, University of Nigeria, Nsukka.

Dara, E. (2013). Environmental education for sustainable human and resource development in Nigeria. *Mediterranean Journal of Social Sciences*, *4*(12), 97-102. Retrieved from http://www.mcser.org/journal/index.php/mjss/article/download/1786/1790.

Davis, A. L. (2013). Using instructional design principles to develop effective information literacy instruction: The ADDIE model. *College & Research Libraries News, 74*(4), 205-207. https://doi.org/10.5860/crln.74.4.8934

Defelice, R. (2021). What is instructional design? Retrieved from http://www.td.org.talent-development-glossary

Demalata, J. G., Teves, R. M. C., Oreiro, L. A. A., Mariano, G. F. A., Estrellan, J. C., Valdez, A. G., & Valdez, D. M. (2024). Gender influence on students' interest, classroom participation, academic achievement and academic performance in science. *ASEAN Journal of Community Service and Education, 3*(2), 119-134.

Edinyang, S., & Ubi, I. (2013). Gender, socio-economic status, teacher qualification and their interaction on student's retention in social studies in Akwa Ibom State Nigeria. *International Knowledge Sharing Platform, 2*(3), 35-40.

Ekpoto, D. F., Nkanu, C. U., Offiong, A. E. O., Ugah, J. C., & Egbulefu, L. C. (2022). Effective Integration of Flipped Classroom Strategies for Instructional Delivery in Geography in Nigerian Schools. *International Journal of Innovation and Research in Educational Sciences, 9*(1), 1-10.

Fan, A, Odidi, M., & Lucia, A. (2016). Effect of casual- comparative research design to explore the relationship between peer group and students' academic achievement in social studies. *International Journal of Humanitarian and Social Science, 3*(4), 33-64.

Federal Republic of Nigeria [FRN] (2014). *National Policy on Education*. National Educational Research and Development Council.

Gbendu, G. (2019). *Effect of computer-mediated instructional strategies on students' interest and achievement in environmental education concepts in senior secondary school geography Yenagoa Education Zone Bayelsa State*. An unpublished Ph.D. Thesis, University of Nigeria, Nsukka.

Gbenga, A., & Effiong, O. (2015). Effects of Two Methods on Student's Achievement in Junior Secondary Schools in Yakurr, Cross River State. *International Letters of Social and Humanistic Sciences, 61*, 70-81. https://doi.org/10.18052/www.scipress.com/ILSHS.61.70

Halawa, S., Lin, T. C., & Hsu, Y. S. (2024). Exploring Instructional Design in K-12 STEM Education: A Systematic Literature Review. *International Journal of STEM Education*, *11*, 43. https://doi.org/10.1186/s40594-024-00503-5

Harackiewicz, J., Smith, J., & Priniski S. (2016). Interest matters: the importance of promoting interest in education. https://journal.sagepub.com/doi/10.1177/2372732216655542

Hsu, T., Lee-Hsieh, J., Turton, M., & Cheng, S. (2014). Using the ADDIE model to develop online continuing education courses on caring for nurses in Taiwan. *Journal of Continuing Education in Nursing, 45*(3), 124. https://doi.org/10.3928/00220124-20140219-04

Isman, A., Abanmy, F., Hussein, H., & Saadany, M. (2012) Effectiveness of instructional design model (Isman-2011) in developing the planning teaching skills of teachers' college students at king Saud University. *The Turkish online journal of educational technology, 11*. Retrieved from https://www.researchgate.net/publication/282288548

Johnson, I. E., Ofoegbu, T., Asogwa, U., Offiong, A. E. A., Eteng, I. J., Abanyam, V. A., Ushie, D. E., Addo, D. E., Akanimoh, M. E., Denwigwe, C. P., Ekpoto, D. F., Adams, A. P., Ngwu, M. E., & Iyam, M. A. (2024). Comparing the academic achievement of students taught Educational Technology with Doodly-designed Multimedia Instructions in Classroom and Online Learning Environments. *Ianna Journal of Interdisciplinary Studies, 6*(2), 161-177. https://doi.org/10.5281/zenodo.12189075.

Kabutu, F., Olayede, O., & Bandele, M. (2015). An investigation into the achievement of junior secondary school

students taught integrated science using the cooperative learning strategy in Nigeria. *European Journal on Physics and Chemistry*, *7I*(2), 63-73.

Kassem, H. M. (2019). The impact of student-centered instruction on EFL learners' affect and achievement. *English Language Teaching, 12*(1), 134-153. https://doi.org/10.5539/elt.v12n1p134

Kurumeh, M. S., Onah, F. O., & Mohammed, A. S. (2012). Improving students' retention in junior secondary school statistics using the ethno-mathematics teaching approach in Obi and Oju local government areas of Benue State, Nigeria. *Greener Journal of Educational Research, 2*(3), 54-62.

Laine, E., Veermans, M., Lahti, A, & Veermans, K. (2019). Generation of students' interest in an inquiry-based mobile learning environment. *Frontline Learning Research, 5*(4), 42-60. https://doi.org/10.14786?flr.v5i4.306

Lilia, H., Norshariani, A., Ria, Z., & Lilia, M. (2018). The role of parents in cultivating children's interest towards science leaning and careers. *Kasetsort Journal of Social Sciences, 39*(2), 190-196.

Mercy, A. I., Abigail, O. C., Chikodiri, I. C., & Tafi, F. I. (2021). Effect of gender on Basic Science students' academic achievement in secondary schools in Enugu Education Zone, Enugu State, Nigeria. *Unizik Journal of Educational Research and Policy Studies, 2*(1), 9-14. https://doi.org/10.5897/UNIJERPS2021.0004

Mondal, P. (2010). Environmental education: objectives, aims and principles of environmental education. Retrieved from Https://www.yourarticleslibrary.com/environmental-education-objectives-aims-and-principles-of-environmental-education/39724

Morrison, G. R. (2010). *Designing Effective Instruction* (6th ed.). New York: John Wly & Sons.

Nawi, N., Jawawi, R., Matzin, R., Jaidin, J., Shahrill, M., & Mundia, L (2015). To flip or not flip: challenges and benefits of using flipped classroom in geography lesson in Brunei Darusalam. *Review of European Studies*, *7*(32), 133-145.

Nkanu, C. U., Asogwa, U. D., Bisong, A. E., Imoke, J. E., Effiong, A. A., Ekpo, E., Abam, O. T., Idaka, E. I., Kingsley, C. E., Monity, F. M., Akpo, F. A., Bessong, E. B., Ekpoto, D. F., & Adie, P. I. (2024). Effect of Digital Storytelling on Secondary School Students' Self-Efficacy in Civic Education. *International Journal of Information and Education Technology, 14*(6), 883-889. https://doi.org/10.18178/ijiet.2024.14.6.2114.

Nkanu, C. U., Ekpoto, D. F., Adams, A.P., Johnson, I. E., Bisong, A. E., Offem, O. O., Nkanu, E. E., Opoh, F. A., Takon, S. M., Offiong, A. E. A., Olayi, J. E., Orim, S. O., Monity, F. M., Ewa, J. A., Abam, O. T., Egbe, J. E., Orok, A. B., & Ekpang, J. E. (2025). Digital Storytelling and Students' Academic Engagement in Civic Education: Implications for Sustainable Development. *Ianna Journal of Interdisciplinary Studies, 7*(2), 748-760. https://doi.org/10.5281/zenodo.15562519

Nwafor, P. I., Ekpoto, D. F., & Okeke S. U. (2024a). School related variables and students' academic performance in Social Studies in Calabar Municipal Council Area, Cross River State, Nigeria: Implication for Geography Education. *Global Journal of Applied, Management and Social Sciences (GOJAMSS), 28*, 378-384.

Nwafor, P. I., Ekpoto, D. F., Akpama, V. S., & Ekpoto, R. D. (2024b). Learning resources availability and students' academic performance in social studies in Calabar Municipal Council, Cross River State, Nigeria: Implication for Geography Education. *International Journal of Arts, Languages and Business Studies (IJALBS), 13*, 79-85.

Obiekwe, C. F. (2018). *Effect of constructivist instructional approaches on students' achievement and interest in basic ecological concepts in biology*. An unpublished M.Ed. Thesis, University of Nigeria, Nsukka.

Samuel, I. (2017). *Assessment of Basic Science Teachers' Pedagogical practice and students' achievement in Keffi Educational Zone, Nasarawa, State, Nigeria (*Masters Dissertation.)

Sandel, J. (2018). *Instructional Design: Principles, theories, models and practice*. New York, University Press.

Soledad, G. (2019). The influence of access to informal stem learning experiences on middle school students' self-efficacy and interest in STEM. Retrieved from https://uknowledge.uky.edu/stem_etds/10

Tarmunosa, B. (2019). Influence of fieldtrip and video technology methods on students' interest in social studies. *European Journal of Training and Development Studies, 6*(3), 27-37.

Ugboduma, S. (2017). Effectiveness of ADDIE instructional model design based on interest of senior secondary school students in geometry. *The Journal of the Mathematical Association of Nigeria (ABACUS), 42*(2), 176-182.

Ulonnam, S. C., Nkanu, C. U., Imoke, J. E., & Edet, P. E. (2025). Audio Compact Disc and Audio-Visual Podcast

Instructional Resources and Students' Achievement in English Listening Comprehension. *Electronic Research Journal of Social Sciences and Humanities, 6*(IV), 46-54.

Usman, K. O., & Okeke, A. M. (2017). Effect of jigsaw instructional strategy on student's achievement and interest in quadratic equations in Nsukka Education Zone. *Journal Mathematical Association of Nigeria, 42*(2), 303-310.

Acknowledgments

Not applicable.

Authors contributions

D. E. A., D. F. E., A. P. A. and C. U. N. were responsible for study design and revising. A. E. A, S.S.B. and J. B. U. developed the instructional package. S. G. L, E. G. E., A. B. O., H. O. O and A. O. E. were responsible for data collection, analysis and discussion of result. J. I. A., E. B. B. and C. U. N. drafted the manuscript. D. E. A., J. E. O. and D. F. E. revised the manuscript and S. O. O., I. O. O., and J. E. I. proofread it. All authors read and approved the final manuscript.

Funding

This study did not receive fund from any source.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.