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EDITORIAL

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter.** STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Ebele C. Okigbo

Editor-in-Chief

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EFFECT OF GUIDED INQUIRY METHOD ON SECONDARY SCHOOL STUDENTS' INTEREST IN ECOLOGY IN AGBANI EDUCATION ZONE OF ENUGU STATE, NIGERIA

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Abstract

The study investigated the effectiveness of guided-inquiry method (GIM) on secondary school one (SS1) students' interest in ecology in Agbani Education Zone, Enugu state. Two research questions and three hypotheses guided the study. The study adopted quasi-experimental design specifically, non-randomized pretest and post-test control group design. Multi-stage sampling was adopted to draw a sample size of 129 (62 males and 67 females) SS 1 students from the co-educational schools in Agbani Education Zone from a population of 5,418 SS 1 students. The Ecological Concept Interest Inventory (ECII), adapted from Zumyil (2019), was the instrument used to collect data. Experts from Faculty of Education in Nnamdi Azikiwe University, Awka validated the instrument. The internal consistency of ECII was ascertained using Cronbach's alpha technique, a coefficient of 0.89 was obtained. The control group received instruction using traditional lecture-based teaching method. The experimental group was taught ecological concepts using GIM. While Analysis of covariance was used to test the null hypotheses at the 0.05 level of significance, mean and standard deviation were utilized to answer the research questions. Among other things, the findings revealed that GIM enhanced students' interest in ecological topics more than the traditional lecture-based teaching method. Also, when taught using GIM, gender had no discernible impact on the students' mean interest scores in ecological concepts. The study concludes that GIM had constant effect on students' interest in ecology irrespective of gender. Based on the findings, it was recommended, among others, that Biology teachers should be trained by the Ministry of Education and other relevant professional bodies through regular workshops, seminars, and in-service training programs on how to use GIM to improve students' interest in Ecological Concepts.

Keywords: Guided Inquiry Method, Interest, Ecology.

Introduction

Biology is the science that studies life and living things, including their structure, function, growth, evolution, distribution, and taxonomy. As the science of life, it focuses on the nature of organisms and their interactions with each other and their surroundings. Environmentalists and conservationists are concerned with how humans interact with their environment and sustainability (Oruonye, 2011). Ecosystem degradation has been attributed to factors such as citizen illiteracy, poor policy, improper ecosystem management, and weak institutional responses (Femi-Adeoye, 2021). To mitigate these effects, it has been recommended that school curricula incorporate environmental education. In the biology curriculum, this is addressed through the topic of ecology.

Ecology is the study of the interactions between organisms and their environments. It provides students with the knowledge and skills necessary for effective environmental management. Studying ecology helps students understand ecosystem dynamics, natural systems, and environmental issues (Zumyil, 2019). It addresses topics such as feeding relationships, erosion, sewage disposal, and conservation. Understanding ecological principles enables students to utilize resources rationally, thus promoting a high standard of living while minimizing environmental degradation (Eziyi, Mumunt, and Nwanekezi, 2016). Ecology is a vital aspect of biology education and connects to other fields like agriculture and environmental science. This explains why curriculum developers have integrated it prominently into secondary school biology programs.

Despite ecology's importance, many students struggle to understand its concepts. The WAEC Chief Examiner's report, cited in Egwu and Okigbo (2021), identifies poor comprehension of ecology as a major reason for low performance in national exams. Reports indicate that biology results in the SSCE have been inconsistent, with a fluctuating pass rate below expectations (WAEC, 2017-2021). Studies by Uzoma and Okoli (2019) and Oyovwi (2019) also confirm the low academic performance of biology students. Researchers like Enebechi (2023), Oyovwi (2019), and Onyegegbu (2018) attribute this to poor use of instructional materials and inappropriate teaching strategies.

The traditional lecture-based teaching method has been found to hinder students' ability to understand abstract ecological concepts (Zumyil, 2019). Teachers often resort to this method due to the pressure of covering extensive syllabi. In regions like the Agbani Education Zone, maintaining student interest in science subjects is challenging. Therefore, adopting more engaging and student-centered teaching approaches is essential. Active learning, which requires students to participate in discussions and activities, has been shown to enhance interest and understanding. One such method is guided inquiry.

Guided inquiry is a student-centered approach where the teacher facilitates rather than directs learning. It involves students in tasks such as drawing, data analysis, and the use of charts and specimens. According to Eziyi, Mumunt, and Nwanekezi (2016), guided inquiry is particularly effective for novices like SS1 students. This method encourages questioning, evidence analysis, and problem-solving, allowing students to construct their knowledge. The teacher introduces a problem or question and guides students toward discovering solutions (Ekomaye, 2019). This approach promotes scientific thinking and engagement.

Several studies support the effectiveness of guided inquiry. Ibeh (2013) found it improved both performance and interest in biology. Berhanu and Sheferaw (2022) observed increased motivation

among students using guided inquiry in learning physical and chemical changes. Similarly, Igboanugo (2023) concluded that teacher experience enhances the use of guided inquiry to stimulate interest. However, there is limited research on its specific impact on ecology interest among students in the Agbani Education Zone.

Interest is a psychological state that drives learning and is linked to better academic outcomes (Nwanze and Okoli, 2021). According to Beyoh and Akudolu (2016), students who are interested in a subject tend to perform better. Efforts to increase science interest have included various innovative teaching approaches. Guided inquiry has shown promise in fostering curiosity and engagement among students.

Gender has also been explored as a factor in academic interest. Some studies find no significant gender differences in science achievement when guided inquiry is used (Odukwe and Nwafor, 2021), while others suggest gender may influence interest levels. Uzoma and Okoli (2019) reported no gender-based performance differences in biology. Nonetheless, conflicting results call for further investigation.

In conclusion, while guided inquiry has proven effective in enhancing student interest and comprehension in science, its specific influence on ecology interest in the Agbani Education Zone remains under-researched. This study aims to fill that gap by exploring how guided inquiry and gender factors interact to affect students' interest in ecology.

Statement of problem

Concern over secondary school students' waning interest in ecology and environmental science has increased recently. This pattern is especially noticeable in the Agbani Education Zone, where students frequently show a lack of interest in and drive for such topics. This disinterest could be linked to conventional teaching strategies that prioritize rote memorization and passive learning and do not promote critical thinking or practical application. A good teaching strategy produces a good learning outcome. In many academic subjects, the guided inquiry approach which promotes investigation, problem-solving, and active engagement has demonstrated potential for raising student understanding and engagement. Its precise effect on Agbani Education Zone students' interest in ecology, however, is still not fully understood.

This study aims to investigate the ways in which guided inquiry affects students' interest in ecology in secondary school. The research aims to provide insights into effective pedagogical strategies that can revitalize ecology education in this region by evaluating changes in student engagement, motivation, and understanding. In the end, the results might help educators and decision-makers develop more captivating teaching strategies to raise a generation of students who are more knowledgeable and enthusiastic about environmental issues.

Purpose of the study

The main purpose of this study was to find out effect of guided Inquiry method on senior secondary school students interest in Ecology in Agbani education Zone of Enugu state. Specifically, the study aimed at determining:

1. Disparities in the mean interest scores of students taught ecological concepts using guided-inquiry-method (GIM) and traditional lecture-based teaching method.

2. Disparities between male and female students' mean interest scores when teaching ecological concepts with GIM and traditional lecture-based teaching method
3. The interaction effect of gender and methods (GIM and traditional lecture-based teaching method) on students' interest in ecological concepts.

Research Questions

The following research questions guided the study:

1) What are the disparities in the mean interest scores of students taught ecological concepts using GIM and traditional lecture-based teaching method?
2) What are the disparities in the mean interest scores of male and female students taught ecological concepts using GIM and traditional lecture-based teaching method?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 levels of significance.

1. There is no significant disparity in the mean interest scores of students taught ecological concepts using GIM and traditional lecture-based teaching method.
2. There is no significant disparity in the mean interest scores of students taught ecological concepts using GIM and traditional lecture-based teaching method?
3. There is no interaction effect of gender and methods (GIM and traditional lecture-based teaching method on students' interest in ecological concept

Method

The study adopted a non-randomized pretest-posttest control group design due to the use of intact classes, which prevented the randomization of individual students to avoid disrupting regular lessons. The research was conducted in public secondary schools within the Agbani Education Zone of Enugu State, comprising three local government areas: Nkanu-East, Nkanu-West, and Enugu-South. The zone has 44 public secondary schools, with 34 coeducational ones. The zone was chosen due to its rich ecological environment, relevance for linking classroom learning to real-life ecological issues, and the absence of prior research on the guided inquiry method (GIM) in this context.

The population included 5,418 SS I students (2,179 males and 3,239 females) in coeducational schools. SS I students were selected because they are newly introduced to biology and are less exposed to prior instructional treatments. A sample of 129 SS I students (62 males and 67 females) was selected from two coeducational schools using a multi-stage sampling technique. First, purposive sampling was used to select coeducational schools. Next, one coeducational school was purposively selected from each LGA based on teacher qualification and experience. Then, two schools were randomly chosen using a coin toss and assigned to the experimental (GIM) and control (traditional lecture-based teaching method) groups. Finally, one intact SS I arm from each selected school was chosen via simple random sampling.

The instrument used was the Ecological Concept Interest Inventory (ECII), adapted from Zumyil (2019) and modified to suit the study's context. It used a 4-point Likert scale: Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1), where higher scores indicate higher interest. Validation was done by experts from Nnamdi Azikiwe University. Internal consistency was confirmed using Cronbach's alpha, yielding a reliability coefficient of 0.89.

Permission was obtained from school principals. Two biology teachers (one per group) were trained on the implementation procedures. The control group teacher used scripted traditional lecture-based teaching method, while the experimental group teacher was trained in GIM delivery. A pretest was administered before the intervention, and the treatment lasted four weeks, with both groups covering ecological concepts under their respective instructional strategies.

To ensure fidelity, the researcher conducted three random observations per group and held debriefing meetings with the teachers. Both groups followed provided lesson plans. At the end of the treatment, the ECII was re-administered as a post-test. Scripts were collected and scored by the researcher.

Data analysis included mean and standard deviation to answer research questions, and ANCOVA to test hypotheses at $\alpha = 0.05$. The decision rule was: If $p \leq 0.05$, reject HO (significant difference exists). If $p > 0.05$, fail to reject HO (no significant difference)

Results

Research Question 1: What are the disparities in the mean interest scores of students taught ecological concepts using GIM and traditional lecture-based teaching method?

Table 1: Mean and standard Deviation of students' interest in ecology when taught using Guided- Inquiry method (GIM) and traditional lecture-based teaching method.

Groups	Pre-test			Posttest		Mean Gain	Mean Difference*
	N	Mean	SD	Mean	SD		
Experimental Group	69	2.84	.34	3.52	.13	.68	.43
Control group	60	2.95	.33	3.20	.46	.25	

Table 1 shows the mean interest scores of students who were exposed to the guided inquiry method compared to those who were not. The table displayed the mean interest scores at the pre-test for the guided inquiry method and traditional lecture-based teaching method. Respectively, with standard deviations of.34 and.33. At the post-test, mean interest scores of 3.52 and 3.20 with standard deviations of.13 and.46 were observed for both the guided inquiry approach and traditional lecture-based teaching method. In addition, there was a .43 mean gain score difference between the two groups. Consequently, the results imply that when it comes to piquing students' interest in ecology, the guided inquiry method approach outperforms the traditional method.

$H0_1$: There is no significant disparity in the mean interest scores of students taught ecological concepts using GIM and traditional lecture-based teaching method

Table 2: Summary of Analysis of covariance (ANCOVA) of Students' Mean Interest scores in Ecological Concepts when exposed to Guided-Inquiry Method and traditional lecture-based teaching method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3.331[a]	4	.833	9.220	.000
Intercept	17.195	1	17.195	190.370	.000
Pretest ECII	.048	1	.048	.526	.470
Method	3.110	1	3.110	34.428	.000
Gender	.168	1	.168	1.863	.175
Method *Gender	.002	1	.002	.018	.895
Error	11.200	124	.090		
Total	1507.615	129			
Corrected Total	14.532	128			

From Table 2, F (1,124) =34.428, P=.000. The researcher concludes that students exposed to the GIM approach had a significantly higher mean interest score in ecology than students who were not, with the advantage going to the students who were exposed to the GIM approach. Because the probability value (.000) is less than the significance level of .05, the null hypothesis is thus rejected. This showed even more how employing GIM to teach ecology significantly increased students' interest scores when compared to traditional lecture-based teaching method**.**

Research Question 2: What are the disparities in the mean interest scores of male and female students taught ecological concepts using GIM and traditional lecture-based teaching method

Table 3: Mean and standard Deviation of students' interest in ecology when taught using Guided-Inquiry method (GIM) and traditional lecture-based teaching method.

		Pre-test		Post-test		Gain Scores	Gain Scores Differences
Gender	N	Mean	SD	Mean	SD		
Male	62	2.85	.29	3.44	.31	.59	.14
Female	67	2.91	.39	3.36	.36	.45	

From Table 3, male students had a marginally higher mean interest score than female students. This is indicated by a very tiny mean gain difference of.14. Consequently, gender had a negligible effect on students' interest in ecological concepts when teaching with a GIM approach more so for male students than for female students.

Table 3 was also used to test Hypothesis 2. The table's result shows that gender has no discernible impact on students' interest in ecology (F (1, 124) =1.863, P=.175). So, the null hypothesis which claims that there isn't any appreciable difference between male and female students' mean interest scores in ecology

is not rejected. The analysis presented in Table 3 was used to test hypothesis 3. The method and gender-related probability value of.895 is shown in the table to be greater than the 0.05 level of significance (F (1,124) =.018, p=.895). Thus, there is no discernible interaction between gender and method on students' ecological interest scores.

Discussion

The results of the study show that students who were exposed to GIM scored higher on the mean interest test than students who were exposed to the conventional method (traditional lecture-based teaching method). This suggests that compared to traditional lecture-based teaching method, GIM greatly increased students' interest in ecological concepts. The covariance analysis in Table 3 further supported the result by showing a significant influence on students' interest in ecological concepts came from the teaching methodology. This demonstrates that, in comparison to the traditional method, the use of the guided-inquiry method greatly facilitated students' interest in ecological concepts. The outcome also suggests that the guided-inquiry approach fosters students' interest in what they are learning and maintains it, leading to a deeper comprehension of biology. The student-centered, activity-based, and problem-solving-focused nature of the instruction may have contributed to the students' growing interest in the GIM. According to Dewey's theories, learning is a process, thus in order to encourage students to apply the concepts they are trying to learn, they must be involved in worthwhile and engaging activities. The results of this study are consistent with those of Okoro (2011), who found that senior secondary school students' interest in biology was greatly increased by the use of interaction patterns. The study's conclusions also matched those of Femi Adeoye (2021), whose research recommends that educators use flipped learning as a teaching method to encourage complete student participation. The results of this study, which demonstrated that students in experimental group had higher interest mean scores than students in the conventional method, corroborate the findings of Eze (2013), Babagana et al. (2018), Direito et al. (2017), Godpower and Ihenko (2017), and Igboanugo (2023). The findings also revealed that male students using GIM had a marginally higher mean interest score than their female counterparts, albeit not statistically significantly. This is indicated by a very tiny mean gain difference of.14. This might be related to the fact that both boys and girls are actively involved. It might also be a result of men's innate curiosity and enthusiasm for science.

Table 3's additional covariance analysis (ANCOVA) showed that there was no discernible difference between male and female students' mean interest scores in ecological concepts. This suggests that there was a chance component contributing to the male students' somewhat elevated interest average score. The results also showed that, when using GIM, male students' mean interest scores were marginally higher than those of their female counterparts. This suggests that the interest of both male and female students in biology was piqued by the use of GIM as an instructional strategy. GIM was utilized to establish an educational setting that was appealing to both genders. The outcome could be explained by the fact that GIM allows both male and female students to actively participate in the learning process without regard to their gender, and it gives the students direct responsibility for their education. This result is consistent with that of Kan and Cleson (2022) and Godpower and Ihenko (2017), who discovered that in the sciences, male students performed better than female students. This runs counter to studies by Ibe (2013), Beyoh, and Akudolu (2016), which found that students who were female outperformed those who were male. On the other hand, Ekomaye's (2019) findings support the idea that gender has no discernible impact on students' performance.

The results show that the curiosity of the students in ecological concepts is not significantly impacted by the interaction of gender and teaching methods. The outcome suggests that GIM had a consistent effect on students of both genders. That is, with a consistent level of interest, The GIM method benefited students, both male and female. It's possible that encouraging students to take part in active learning in the GIM without gender discrimination is what led to the lack of a significant interaction effect between method and gender. The outcome is consistent with a report by Igboanugo (2023), which found no significant interaction between gender and the reciprocal peer tutoring strategy on students' interest in reading comprehension. Male and female students benefited equally from the GIM approach in terms of increasing their interest in ecology, as evidenced by the lack of an interaction effect between method and gender on students' interest in ecological concepts.

Conclusion

The study concludes that the Guided Inquiry Method (GIM) is more effective than the Conventional Method (traditional lecture-based teaching method) in enhancing students' interest in ecological concepts, with no significant influence of gender. Despite limitations like lack of randomization and small sample size, the findings support the broader application of innovative teaching strategies to foster student engagement.

Recommendations

The study's findings and conclusion led to the following recommendations being made:

1. Biology teachers should be trained through workshops, seminars, and conferences on how to effectively implement the Guided Inquiry Method (GIM) to boost students' interest in ecological concepts.
2. Teachers should create inclusive classroom environments where all students, regardless of gender, are equally encouraged and engaged in learning ecological concepts.
3. Government agencies and professional bodies involved in curriculum development should prioritize and promote the integration of inquiry-based approaches like GIM in biology instruction at the senior secondary school level.

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