EFFECTS OF KINESTHETIC-LEARNING STRATEGY ON ATTITUDE IN ECOLOGY AMONG IMPULSIVE AND REFLECTIVE SECONDARY SCHOOL STUDENTS, GIWA ZONE, KADUNA STATE: IMPLICATIONS FOR OUT-OF-SCHOOL CHILDREN

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Abstract

This paper examines the effects of the Kinesthetic-learning strategy on attitude among impulsive and reflective students and its implications for out-of-school children in Giwa education zone, Kaduna State. The study investigated how the use of kinesthetic-learning strategies influences students' attitudes across different cognitive styles, specifically impulsive and reflective learners, and explores the implications of these effects for improving learning engagement and reintegration of out-of-school children. The study adopted a quasi-experimental control group design, involving pretest and posttest. The population comprised 6,346 SSII students offering biology from 15 public co-education senior secondary schools. 120 students from two schools participated in the study. Impulsive and Reflective Student Scale (IRSS), with a reliability coefficient of 0.82, was used to establish the cognitive style of the student. The Students Attitude Questionnaire (SAQ), with a reliability coefficient of 0.79, was used to measure the attitude of students. The experimental group was taught using the Kinesthetic-learning strategy, while the control group was taught using the lecture method. Two research questions were answered using nonparametric mean rank statistics, and two null hypotheses were tested at $p \leq 0.05$. Data collected were analysed using Kruskal-Wallis H-test, Mann-Whitney test and Scheffé's test. Result revealed that: a significant difference exists between the mean rank response attitude of the experimental and control group ($P = 0.001 < 0.05$), also the calculated value ($P = 0.000 < 0.05$) revealed a significant difference between the mean rank attitude of impulsive and reflective students in the experimental and control group in favour of the experimental group. Based on these findings, it was concluded that the Kinesthetic-learning strategy enhanced students' attitude, which was attributed largely to the positive learning environment offered by the strategy. Based on the findings of the study, it was recommended that the kinesthetic-learning strategy should be integrated into everyday activities to make learning more accessible, engaging and effective for out-of-school children, helping them develop essential skills practically and enjoyably. Workshops and seminars should be organised to train teachers on how to teach using the Kinesthetic-learning strategy.

Keywords: Kinesthetic-learning strategy, Impulsive, Reflective, Attitude, out-of-school children

Introduction

Science and technology are the prime movers or pilots of the economic growth of many nations. For a nation to experience economic growth, there must be a strong stimulation of science. Science, the originator of technology, is described as a body of empirical, theoretical, and practical knowledge about the natural world that is produced by scientists who emphasise the observations, explanations and predictions of real-world phenomena. The role of science and technology in Education for the development of a nation is unanimously agreed by researchers, among whom are Shaibu (2017), Hassan (2020), to be indispensable. Science education has therefore been introduced at different levels of education, with the fundamentals of science learning studied at pre-basic and basic educational levels, like basic science and technology. At the secondary level of education, students study core science subjects such as Biology, Chemistry, Physics, and Mathematics. The National Policy on Education (2013) states that the government, to achieve development through science, must ensure that the objectives of science education match the intellectual capacity of the students who are the citizens of the nation. However Science education is not clearly defined at the primary school level in Nigeria, except for the study of basic science and technology. In secondary schools, there is basic science and technology at the Basic Education level, while biology, chemistry and physics are taught separately at the senior secondary School (SSS) level. Science is taught at the tertiary level as biology, chemistry, and physics, together with the principles and methods of education.

Mardonov (2019) posited thatBiology like every school subject, with its goals, objectives and content, is meant to contribute to the formation of a functionally competent person. Biology is the science of life that studies living matter, structure, function and behaviours of organisms. Biology is the cornerstone that cannot be overemphasised in terms of a nation's technology and industrial development. The biology curriculum is planned such that teachers are guided to use an activity-oriented, learner-centred approach to meet the needs of the learners. Effective teaching and learning of biology cannot be achieved without a positive attitude and meaningful interaction between the teacher, students, and the learning materials. The biology curriculum at the senior secondary level is made up of several units, among which is ecology.

Ecology is a unit in Biology that focuses on studying the relationship between biological organisms and their physical and chemical environment. Environmental education is thus part of the basic education, greatly encouraged in the 21st century. Umar (2015) noted that ecological education is a holistic human nature of worldview in a quest for knowledge for a better environment and has the power to develop a person in how to organise his/her environment for his/her benefit. Umar further explained that, to expose learners to the aspects of environmental education, stakeholders in science education made ecology an aspect of the Biology curriculum. The performance of students in ecology, as reported by Dashe and Nor (2020), among others not encouraging. This can be seen from reports of biology performance from the WAEC Report 2016-2022. Students' poor performance in ecology and Biology at large has been attributed to students' attitude towards the concept/ subject (Oyinloye & Ige, 2018).

Attitudes toward biology and learning in general are areas of interest to educators, past and present. The term attitude (toward science) opined by Oyinloye and Ige (2018), refers to a general and enduring positive or negative feeling about science. Extensive research has shown that a person's attitudes are learned, as opposed to being inherited. There are different factors which can influence student attitude, these include the type of science concepts taken, previous science experience, science teachers, as well as methodology. Attitude toward science can be defined as "favourable or unfavourable feelings about science subjects". A student's attitude toward a particular discipline may affect his or her motivation to excel (Okanlawon, 2023). To facilitate learning. It is therefore important that educators familiarise themselves with student attitudes and associated behaviour (that is, effort, reasoning and problem-solving skills) as well as factors that may influence student attitudes. Student attitudes toward science have been investigated by a number of researchers (Huang et al., 2021; Kljajić &Mijatović, 2022; Demirel & Dağyar, 2022; Okanlawon, 2023). Of all the variables that may influence attitude towards science, teaching method has generally been shown to have a consistent influence (Sugano & Mamolo, 2024).

The primary teaching methods in the classroom usually consist of some form of memorisation technique by either verbal or written repetition. Students are not usually actively involved in the classroom. This can be a barrier to students' positive attitude and may hinder them from fully understanding most of the concepts taught in class. If teachers can discover ways to implement more active learning in the classroom, students may develop a positive attitude and acquire a deeper understanding of the ideas/knowledge learned in class. Kotob and Arnous (2019) noted that one of the ways to encourage learners' active involvement in their education is to give them hands-on instructions to help them become better learners, regardless of the setting in which they are learning. One of such teaching strategies is the Kinesthetic-learning strategy.

Umar (2015) believes that the Kinesthetic-learning strategy involves finding multiple ways to structure a lesson so that each student has an opportunity to work at a moderately challenging level. Kinesthetic-learning strategy involves incorporating bodily movement and physical sensation, such as touching, moving, and manipulating objects and materials in the external world, among others, during the learning process. Gilakjani (2012) noted that the Kinesthetic learning strategy favours interaction with the physical world, as most of the time, learners have a difficult time staying on target and can become unfocused effortlessly. Griss (2013) sees the kinesthetic learning strategy as "the use of creative movement in the classroom to teach across the curriculum. Students activate and integrate physical, emotional, and cognitive responses to what they are learning, making learning more meaningful.

Kinesthetic-learning strategies can offer alternative learning opportunities such as community-based projects, hands-on vocational training, and environmental clubs. This can provide out-of-school children with practical education. Interactive, real-world learning may inspire re-entry of out-of-school children into formal education or participation in non-traditional learning environments. Kinesthetic-learning strategy can enhance skill development, such as problem-solving, teamwork, and environmental stewardship, offering income-generating skills, for instance, sustainable agriculture, waste recycling, among others (Amn et al., 2024). Engaging out-of-school children through the Kinesthetic-learning strategy in ecology-related projects can promote environmental conservation and sustainable practices within communities.

Metzler (2016) noted that the use of the Kinesthetic-learning strategy requires significant planning and intentionality, and hence, when teaching students with the Kinesthetic-learning strategy, certain factors need to be considered, among which are lesson duration, gender and varying cognitive abilities/styles. Cognitive styles or thinking styles are terms used in cognitive psychology to describe the way individuals think, perceive, and remember information. Cognitive styles, according to Douglas (2003), include impulsive and reflective, convergent, and divergent, among others. Kagan (1965) defines impulsive and reflective cognitive style as a conceptual tempo, or decision time variable. Kegan proposed two criteria to classify the subjects: response time and errors. Impulsive learners reach decisions and report them very quickly with little concern for accuracy. On the other hand, the reflective ones are more concerned with accuracy and take more time to reach a decision and consequently make fewer errors. This cognitive style was considered in this study.

The theoretical framework upon which this study was based is the theory of discovery. This area of educational interest is a learning theory propounded by cognitive psychologists, Brunner (1966). This learning theory maintains that learning is best promoted when one is able to figure things out for oneself. In other words, Brunner advocates a learning situation in which learners become "detectives". The implication of Brunner's learning by discovery theory emphasises discovery activity in which the students utilise his/her own mental skills to find the answers. The focus is to develop skills that are practical in the teaching and learning of biology. This study was guided by the following research objectives;

Objective of the Study

The objectives of the study are to;

1. Examine the effect of the Kinesthetic-learning strategy on the attitude of SSII students taught ecology concepts.
2. Establish the effect of the Kinesthetic-learning strategy on the attitude of SSII impulsive and reflective SSII students taught ecology concepts.

Research Questions

1. To what extent does the attitude level between SSII students taught ecology concepts using the Kinesthetic-learning strategy differ from those taught using the lecture method?
2. To what extent does the attitude level between SSII impulsive and reflective students taught ecology concepts using the Kinesthetic-learning strategy differ from those taught using the lecture method?

Hypotheses

There is no significant difference between the attitude level of SSII students taught ecology concepts using the Kinesthetic-learning strategy and those taught using conventional methods.

There is no significant difference between the attitude level of SSII impulsive and reflective students taught ecology concepts using the Kinesthetic-learning strategy and those taught using lecture methods.

Methodology

The study adopted a quasi-experimental control group design (Akorede et al, 2019). The population of this study was made up of all 6,346 SSII biology students, 3,762 males and 2,584 females, all from Public senior secondary schools within the Giwa Education Zone of Kaduna state. Four co-education schools were selected from the 15 senior secondary schools in Giwa Education Zone. In each of these four schools, one intact class was selected and subjected to an equivalent test, from which two schools that were significantly equivalent in ability were finally selected and assigned to experimental and control groups. Two research instruments were used to generate data in this study: the Impulsive Reflective Student Scale (IRSS) and the Students' Attitude Questionnaire (SAQ).

Students in both experimental and control groups were subjected to IRSS to determine impulsive and reflective students in each of the groups before commencement of the treatment. Using Kegan's (1966) MFFT samples, the researcher adapted and developed 10 similar test items named IRSS to suit SSII students. The rule of the task is that students are shown a familiar image (standard) and six similar variants. Only one of the variants is identical to the standard. The students are asked to select the variant that is identical to match the standard. The score is the average of the number of errors and response time to the first selection across the total number of test items. Students with below-median errors and above-median response times were classified as reflective, while those with above-median errors and below-median response times were deemed impulsive. The experimental group was made up of 34 impulsive and 21 reflective students. The control group was made up of 44 impulsive and 21 reflective students.

The Students Attitude Questionnaire (SAQ) was adapted from previous instruments of Oyinloye and Ige (2018). SAQ was used to solicit students' responses on their attitude towards ecology, the importance of ecology, the area of difficulty in ecology, as well as their future career in ecology. SAQ was divided into two sections. Section A, which is bio data, section B items on students' attitude, which consist of 22 items to be responded to, by the students on 5 5-point Likert scale format; Strongly Agree (SA=5), Agree (A=4), Undecided (UD=3), Disagree (DA=2), Strongly Disagree (SD=1). These instruments were subjected to both face and content validity. The face validity was done by senior lecturers who are experts in test/evaluation in the faculty of Education, they reviewed items for clarity, suitability of language to the target respondents. The reliability of the instrument yielded a PPMCC of 0.82 and a Cronbach alpha of 0.79 for IRSS and SAQ, respectively. Descriptive statistics were employed in the analysis of the data collected. All research questions earlier stated were answered using mean rank and sum of mean rank, while the hypotheses were tested using the Mann-Whitney test, Kruskal-Wallis (H test), as well as post hoc Scheffes' test at a $P \leq 0.05$ level of significance.

Results

Question one: To what extent does the attitude level between SSII students taught ecology concepts using the Kinesthetic-learning strategy differ from those taught using the lecture method?

Table 1: Nonparametric statistics of SAQ in the Experimental and Control Groups

Groups	N	Mean Rank	Sum of Ranks
Experimental	55	144.50	12716.00
Control	65	50.50	5050.00
Total	120		

Results from Table 1 of the Nonparametric Mean Rank statistic revealed a difference between the attitudes' mean rank responses of SSII students in the experimental and control groups. The computed Mean Rank Attitude of students in the experimental and control groups are 144.50 and 50.50, with a mean difference of 94.00. This indicates that the computed Mean Rank Attitude of the experimental group is higher than the Mean Rank Attitude for the control group.

Question two: To what extent do the attitude levels between SSII impulsive and reflective students taught ecology concepts using the Kinesthetic-learning strategy differ from those taught using the lecture method?

Table 2. Nonparametric Test for SAQ Scores in Experimental and Control Groups

Cognitive Style	Group	N	Mean Rank	Mean Difference
Reflective	Experimental	21	92.52	46.14
	Control	20	46.38	
Impulsive	Experimental	34	91.24	64.71
	Control	44	26.53	

Results from Table 2 of the Nonparametric Mean Rank statistic revealed a difference between the attitudes' mean rank response of SSII impulsive and reflective students in experimental and control groups. The computed Mean Rank Attitude of reflective students in the experimental and control groups are 92.52 and 46.38, with a mean difference of 46.14, while the mean rank response of impulsive students in the experimental and control groups is 91.24 and 26.53, with a mean difference of 64.71. This indicates that the computed Mean Rank Attitude of the experimental reflective and impulsive students are much higher than the Mean Rank Attitude for the control reflective and impulsive students.

Ho_1: There is no significant difference between the attitude level of SSII students taught ecology concepts using the Kinesthetic-learning strategy and those taught using lecture methods.

Table 3. Mann-Whitney test of SAQ in the Experimental and Control Groups.

Groups	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	P value	Remark
Experimental	55	144.50	12716.00	0.04	11.83	0.01	Sig.
Control	65	50.50	5050.00				
Total	120						

P = 0.01< 0.05, Z = 11.83> Mann Whitney U = 0.04

Results of the Mann-Whitney non-parametric statistics revealed that a significant difference exists in the Attitude level of experimental and control groups. Reasons being that the p-value calculated 0.01 is lower than the 0.05 alpha level, and its computed Z score was 11.83, which is greater than the Mann-Whitney score of 0.400, implying a significant difference in the attitude mean rank response between experimental and control groups in favour of the experimental group. Therefore, the null hypothesis was rejected.

Ho_2: There is no significant difference between the attitude level of SSII impulsive and reflective students taught ecology concepts using the Kinesthetic-learning strategy and those taught using lecture methods.

Table 4: Kruskal-Wallis Test on SAQ Scores in Experimental and Control Groups

Groups Cognitive Styles	N	Mean Rank	KruskalWalis	df	P value
Experimental Reflective	21	92.52	91.252	3	0.000
Impulsive	34	91.24			
Control Reflective	20	46.38			
Impulsive	44	26.53			
Total	119				

P calculated = 0.000 < 0.05 alpha level of significance.

Result of Kruskal Wallis test from Table 4 indicates that the calculated P value 0.00 is less than the P 0.05 level of significance at df 3, suggesting that a significant difference exists between the attitude mean rank response of SSII impulsive and reflective students in experimental and control group in favour of the experimental group. Therefore, null hypothesis two was rejected. To reveal the groups with significant differences, data were analysed using a post hoc Scheffe’s test, and the result is presented in Table 5

Table 5: Multiple Comparison of Students' Attitude in Experimental and Control Groups

(I) Groups of Cognitive Styles	(J) Groups of Cognitive Styles	N	Mean	Mean Difference (I-J)	Std. Error	P value	Remark
Experimental Reflective	Experimental Impulsive	34	91.24	.99*	.22	.000	Sig
	Control Reflective	20	46.38	45.85*	.24	.000	Sig
	Control Impulsive	44	26.53	65.91*	.21	.000	Sig
Experimental Impulsive	Experimental Reflective	21	92.52	-.99*	.22	.000	Sig
	ControlReflective	20	46.38	44.86*	.22	.000	Sig
	Control Impulsive	44	26.53	64.91*	.18	.000	Sig
Control Reflective	Experimental Reflective	21	92.52	-45.85*	.24	.000	Sig
	Experimental Impulsive	34	91.24	-44.86*	.22	.000	Sig
	Control Impulsive	44	26.53	20.05*	.21	.000	Sig
Control Impulsive	Experimental Reflective	21	92.52	-65.91*	.21	.000	Sig
	Experimental Impulsive	34	91.24	-64.91*	.18	.000	Sig
	Control Reflective	20	46.38	-20.05*	.21	.000	Sig

*The mean difference is significant at the 0.05 level.

Table 5 post hoc mean comparison test indicates significant differences exist between the attitude mean rank response of SSII impulsive and reflective students in the experimental and control groups. The post hoc Scheffe's means comparison clearly indicates that the P calculated 0.00, 0.00 and 0.00 is lower than the P value 0.05, which implies that a significant difference exists between the mean rank response of experimental reflective, experimental impulsive, control reflective and control impulsive in favour of experimental reflective and impulsive students.

Discussion of Findings

Findings revealed a significant difference in the attitude of students between the experimental and control groups in favour of the experimental group. The significant difference in attitude was because of treatment, as suggested by the data. Kinesthetic-learning strategy made learning more interactive and enjoyable, reducing boredom and passive learning. Students' physical involvement in learning helped students feel more connected to the material, and their active participation fosters a sense of ownership and responsibility for learning, which reduces anxiety and improves attitude. This concurs with Solomon et al. (2023), who noted that the Kinesthetic-learning strategy increases students' motivation, which enhances a positive attitude towards learning. Umar (2015) also noted an increased positive attitude of students taught with the Kinesthetic learning strategy. Similarly, Ali (2013) argued that attitude towards science had a significant positive relationship with the achievement of science students at secondary school levels. However, Lustgarten (2017) found that student attitudes decreased through kinesthetic learning experiences.

Findings also revealed that through the kinesthetic-learning strategy, impulsive and reflective student had a better attitude towards learning than their peers in the control group. Reflective learners benefit from actively engaging with materials through physical activities, such as experiments, role-playing, and simulations, which allows them to observe and analyse before responding, aligning with their preference for thoughtful consideration. Impulsive learners, on the other hand, thrive on movement and quick decision-making; kinesthetic strategies align with their natural tendencies. Activities like interactive games and hands-on problem-solving keep them engaged and reduce distractions. This active involvement improved their confidence and motivation, which enhanced a positive attitude. This aligns with Abubakar (2016), who noted that students` cognitive styles (impulsive and reflective) were significantly correlated with their attitudes and preferences for instructional delivery modes. Similarly, Ellah (2014) stated that the relationship between measures of students' cognitive styles and attitude was not statistically significant.

Conclusion

Kinesthetic-learning strategy improved the attitude of students at the SSS II level. This shows that the positive attitude of students can be enhanced through the appropriate use of teaching and learning strategies. This study is also an indication that ineffective teaching and learning strategies may be responsible for students' (impulsive and reflective) poor and negative attitude in biology at secondary schools. Kinesthetic-learning strategy for out-of-school children serves as a bridge to meaningful education and empowerment. Integrating hands-on learning into informal education programs can foster environmental awareness and equip learners with valuable life skills.

Recommendations

The following recommendations were made from this study

1. Senior secondary school teachers could be sensitised by professional bodies like the Science Teachers Association of Nigeria (STAN) through workshops, conferences, and symposia on the use of the Kinesthetic-learning strategy in learning science (Ecology/Biology).
2. School administrators like principals and senior masters should perpetually encourage and support biology teachers in providing resources (or improvising) and using the Kinesthetic-learning strategy to facilitate classroom explorations and hands-on learning.

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