

Effect of Kolawole Problem Solving Method On Students' Attitude Towards Biology in Secondary Schools in Ondo State, Nigeria

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ABSTRACTS: *This study investigates the impact of the Kolawole Problem Solving (KPS) method on students' attitudes towards Biology in secondary schools in Ondo State, Nigeria. The study addresses three specific objectives: (i) examining the difference in attitudinal mean scores between students exposed to KPS and those using conventional methods in Biology, (ii) analyzing gender-based variations among students using the KPS method, and (iii) evaluating differences in attitudinal mean scores between students in rural and urban schools using the KPS strategy. A quasi-experimental design with a pre-test, post-test, control group structure was employed, involving an experimental group using the KPS technique and a control group using traditional methods. The study's population comprised Senior Secondary School Two (SSS II) students enrolled in Biology courses at public secondary schools in Ondo State. The sample included 139 SSS II students from six public schools, selected through a multistage sampling procedure. Data were collected using the Students' Attitude Towards Biology Scale (SATBS). The results revealed a significant difference in attitudinal mean scores between students exposed to KPS and those using conventional methods, with the KPS group exhibiting a more positive attitude toward Biology. However, no significant gender-based differences were observed among students using the KPS method, and there were no significant variations in attitudinal mean scores based on geographical location. In conclusion, the implementation of the Kolawole Problem Solving approach positively influenced students' attitudes toward Biology, without gender bias and regardless of location. This suggests the potential benefits of incorporating the KPS method into Biology curricula and providing comprehensive teacher training to effectively utilize this approach.*

KEYWORDS: Kolawole problem solving, attitude, biology

INTRODUCTION

Biology holds significant importance within the domains of biochemistry, medicine, physiology, ecology, genetics, and molecular biology. Consequently, it has assumed a central position in various human endeavours, addressing challenges such as food scarcity, healthcare, hygiene, family dynamics, poverty alleviation, natural resource management and conservation, biotechnology, ethical considerations, societal issues, and the absence of suitable infrastructure materials.

Biology is a scientific topic commonly chosen by senior secondary students for inclusion in their senior secondary certificate examinations in Nigeria (FRN, 2013). The subject in question has garnered significant popularity among students, and its prominence relative to other scientific disciplines has rendered it a unique and favoured option for all students (Lawal, 2011). Biology has significant importance as an academic discipline, serving as a prerequisite for pursuing advanced studies in several science-related professional fields, including but not limited to medicine, agriculture, pharmacy, biotechnology, and genetic engineering. Biology has a crucial role in the advancement of economic, intellectual, social, human resource development, and overall well-being within a community. The significance of biotechnology and genetic engineering is evident in several aspects, including both individual and social progress (Lawal, 2011). Based on the aforementioned arguments on the significance of biology, it is imperative to ensure its effective instruction within secondary schools in order to enhance students' academic performance in the discipline.

Aladejana (2010) posits that attitudes encompass the assessments, corresponding beliefs, and behaviour directed towards certain things. Individuals are inherently prone to instability due to the impact of interpersonal communication and the behaviour of others. This susceptibility to change is influenced by social factors, as well as an individual's need to preserve cognitive consistency when faced with cognitive dissonance. The formation of attitude is contingent upon the interplay between emotive and cognitive components. The disposition of students towards an academic discipline plays a pivotal role in their acquisition of knowledge and attainment of success in that discipline. The perception of one's own abilities in a particular topic can significantly influence a student's academic performance.

There has been a suggestion that the inter-structural composition of an associative network can be modified by the activation of a solitary node. Therefore, by the activation of an affective or emotional mode, it is plausible that attitude change might occur, despite the inherent interconnection between affective and cognitive components. The perspective towards the field of Biology significantly influences the instructional and educational aspects of Biology. A favourable outlook on Biology indicates a good emotional inclination towards the topic, whereas conversely, an unfavourable attitude towards learning is associated with a negative emotional disposition. The

influence of emotional dispositions on an individual's conduct is evident, as individuals tend to perform more well in subjects they find enjoyable, have confidence in, or perceive as beneficial. The impact of attitude on students' academic performance in the field of Biology is significant. The attitudes towards Biology are influenced by several factors, including the teaching methodology employed, the support provided by the school's infrastructure, and the attitudes of both the students and their families towards the educational institution.

In a study conducted by Popoola (2014), the relationship between teacher attitudes towards their job and students' academic success was examined. The findings revealed a significant disparity between instructors who possessed a more positive attitude towards the subject matter and those who did not. It has been shown that the primary factor contributing to the effectiveness of schools is the quality of instruction. When examining the elements influencing students' attitudes towards Biology, it was found that the primary determinants were the instructor and the students' academic ability. Conversely, age, gender, and language had a less correlation with attitudes. In their study, Nasr and Asghar (2011) aimed to investigate the correlation between attitude towards learning and achievement. The findings of their research indicated that achievement exhibited a causal predominance over attitude. The perception of Biology has been recognised as a significant determinant in shaping individuals' engagement and achievement in the field of Biology.

The problem-solving teaching technique developed by Kolawole is a unique pedagogical approach that may be used to several academic disciplines. Kolawole (2013) proposed a comprehensive and user-friendly problem-solving approach known as the Kolawole's Problem-Solving (KPS) method. This method is specifically designed to address two key aspects: teaching, which involves the comparison between content and behavioural objectives for the instructor. (ii) The topic of discussion pertains to the distinction between content objectives and behavioural objectives for students in the context of learning. (iii) Additionally, the evaluation process or blueprint, namely the Taxonomy of Educational Objectives, is being considered. This taxonomy encompasses the differentiation between content objectives and illustrative verbs. Kolawole and Olofin (2017a) assert that the KPS technique possesses a distinctive characteristic, as it enables teachers to employ it both for instructional purposes and for assessing pupils. The KPS method encompasses a comprehensive approach that integrates several components, including content, teacher activities, student activities, and assessment, which may be implemented in parallel.

The Kolawole Problem-Solving (KPS) technique addresses potential challenges in teaching and learning due to its unique design. One notable characteristic of the KPS method is its dual functionality, as it can be employed by teachers for instructional purposes and student assessment (Kolawole, Oladosu, & Ajetunmobi, 2013). Additionally, learners themselves can simultaneously utilise this method for self-directed learning and self-evaluation (Olofin & Kolawole, 2020; Kolawole & Olofin, 2017).

The KPS technique is a five-step approach that utilises the PASSWORDS framework, behavioural targets, and action verbs to facilitate successful teaching, learning, problem-solving, and evaluation. In order to effectively teach a subject, it is essential for the teacher to possess a strong command of the content or subject matter. Kolawole (2020) suggests that one way to approach the topic or subject matter is by breaking it down into keywords, terms, and terminologies, or by focusing on the sub-topics within the subject matter.

Understanding the notion of Biology holds significance for both educators and learners due to the inherent qualities associated with this discipline. The significance of language in comprehending Biology is of utmost relevance, as with any other academic area, due to the presence of specialised terminology unique to the field. The field of biology utilises scientific terminology to delineate and characterise the many components of organisms. In certain instances, a term commonly employed in everyday language have distinct and precise connotations within the realm of Biology. Many students encounter difficulties while attempting to understand complex biological and scientific terminology. According to Adeleye (2021), a significant obstacle to students' achievement in Biology is their limited capacity to recollect fundamental concepts and information. The capacity to retrieve biological data is a crucial skill for students, as it enables them to effectively address and respond to inquiries within the field of Biology. Numerous educators hold the belief that a child who engages in the study of Biology under the guidance of a skilled instructor employing an appropriate pedagogical approach would not only possess the ability to respond to biological inquiries on par with a child instructed through conventional means, but would also exhibit a considerable advantage in terms of comprehension and readiness for advanced Biology.

According to Olofin (2020), language has a significant role in influencing students' academic achievement. Olofin further emphasises that the specialised language used in various subjects can only be comprehended by individuals who have engaged in the study of those subjects. The significance of language proficiency in the instruction and acquisition of Biology is a compelling factor. The evaluation level refers to the point at which the instructor connects the material being taught to real-life situations and difficulties. According to Adeleye (2021), one possible reason for students' failure in Biology is their limited capacity to effectively apply the acquired knowledge to both familiar and unfamiliar scenarios. Additionally, they struggle to establish connections between given concepts and other related ideas, as well as to engage in critical thinking processes such as analysis, induction (or deduction), synthesis, and evaluation of the underlying concepts within the subject matter, which are essential for problem-solving.

The influence of gender and geography on students' attitudes towards Biology education has been recognised as a significant factor. The issue might perhaps be associated with the specific teaching strategies that learners are exposed to throughout their Biology sessions. As previously said, Biology is often regarded as the fundamental basis of scientific knowledge. Hence, the pedagogical approach employed by educators in instructing a particular topic has the potential to influence

students' perceptions and attitudes towards the subject, as evidenced by their performance in both internal and external assessments. Instructional strategies have an impact on the approach employed to attain the learning objectives, encompassing pre-instructional activities, information presentation, learner activities, assessment, and follow-through. The relationship between instructional tactics and student attitudes is often explored in order to optimise learning outcomes, taking into account various learning styles (Ekweni, Moranski, & Townsend-Sweet, 2016). The Problem Solving approach introduced by Kolawole seems to have a significant impact on students' disposition towards the subject of Biology. Therefore, the present study investigates the effect of Kolawole Problem Solving (KPS) method on students' attitude towards Biology in secondary schools in Ondo State, Nigeria.

The study specifically examined:

- i. the difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology;
- ii. the difference in the attitudinal mean scores of male and female students exposed to Kolawole's Problem Solving (KPS); and
- iii. the difference in the attitudinal mean scores of students exposed to KPS strategy in rural and urban schools in Biology

Research Hypotheses

The following null hypotheses were generated for this study.

1. There is no significant difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology
2. There is no significant difference in the attitudinal mean scores of male and female students exposed to Kolawole's Problem Solving (KPS).
3. There is no significant difference in the attitudinal mean scores of students exposed to KPS strategy in rural and urban schools in Biology

METHODOLOGY

The present study employed a quasi-experimental design with a pre-test, post-test, control group structure, including two groups: an experimental group and a control group. The independent variables for this study were the Kolawole Problem Solving technique and the traditional approach, whereas the dependent variable was the attitude of students. The study's population consisted of Senior Secondary School Two (SSS II) students who were enrolled in Biology courses at all public secondary schools in Ondo State, Nigeria. The study's sample comprised 139 students in their second year of Senior Secondary School (SSS II), who were enrolled in Biology courses. These students were selected from a total of six public secondary schools located in Ondo State. The sample was chosen through a multistage sampling methodology.

The data for the study was collected using the Students' Attitude Towards Biology Scale (SATBS). The instrument is comprised of two sections, namely Section A and Section B. Section A of the survey requested the participants' personal information, including details about their school location. On the other hand, Section B had a total of 30 items that assessed the students' attitudes and inclinations towards the subject of Biology. The questions are assessed using a 4-point Likert rating scale, consisting of the response options: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The scoring key utilised for the SATBS is structured as follows: a score of 4 is assigned to replies categorised as strongly agree (SA), a score of 3 is assigned to responses categorised as agree (A), a score of 2 is assigned to responses categorised as disagree (D), and a score of 1 is assigned to responses categorised as strongly disagree (SD) for positive questions. Conversely, for negative items, the scoring key is reversed. The validity of the SATBS was established by seeking guidance from knowledgeable and seasoned Biology instructors. Their expertise was sought to assess the adequacy of the test in terms of language usage, clarity of concepts, and its relevance and applicability to the field of study.

The assessment of internal consistency of the instrument was conducted by means of a pilot study. The survey was conducted on a sample of 30 students in the second year of secondary school (SSS 2) at a school located outside the designated sample region. The acquired data were subjected to analysis using the Kuder-Richardson (Kr-20) method, resulting in a reliability coefficient value of 0.88. The obtained reliability coefficient demonstrated sufficient levels of dependability, hence confirming the instrument's suitability for use in this particular investigation.

In order to conduct the research within the educational institutions, the researcher sought and gained official authorization from the governing bodies of the six schools. The research was conducted in three distinct phases, specifically the pre-treatment, treatment, and post-treatment stages. The data obtained from the instruments was subjected to analysis using both descriptive and inferential statistical methods. The hypotheses were evaluated by the application of a t-test at a significance level of 0.05.

RESULTS

Hypothesis 1: There is no significant difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology

Table 1: t-test analysis difference in the attitudinal mean scores of students exposed to KPS and conventional method

Variations	N	Mean	SD	Df	t _{cal}	P
KPS	62	87.42	4.17	137	16.433*	0.000
Conventional	77	77.22	3.14			

*p<0.05

Table 1 shows that the t-cal value of 16.433 is significant because the P value (0.000) < 0.05. This implies that null hypothesis is rejected. Hence, there is significant difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology. Students exposed to KPS strategy exhibited positive attitude to Biology than those exposed to conventional method.

Hypothesis 2: There is no significant difference in the attitudinal mean scores of male and female students exposed to Kolawole’s Problem Solving (KPS).

Table 2: t-test analysis for gender difference in attitudinal mean scores of students exposed to Kolawole’s Problem Solving (KPS)

Variations	N	Mean	SD	Df	t _{cal}	P
Male	35	87.49	4.29	60	1.378	0.321
Female	27	86.04	3.63			

P>0.05

Table 2 shows that the t-cal value of 1.378 is not significant because the P value (0.321) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant difference in the attitudinal mean scores of male and female students exposed to Kolawole’s Problem Solving (KPS).

Hypothesis 3: There is no significant difference in the attitudinal mean scores of students exposed to KPS strategy in rural and urban schools in Biology.

Table 3: t-test analysis for difference in academic attitudinal mean scores of students exposed to Kolawole's Problem Solving (KPS) based on location

Variations	N	Mean	SD	Df	t _{cal}	P
Urban	33	88.21	4.24	60	1.618	0.111
Rural	29	86.52	3.97			

P>0.05

Table 3 shows that the t-cal value of 1.618 is not significant because the P value (0.111) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant difference in the attitudinal mean scores of students exposed to KPS strategy in rural and urban schools in Biology.

DISCUSSION

The results indicated a statistically significant disparity in the average attitudinal scores between students who were exposed to Kolawole's Problem Solving (KPS) and those in the Control Group (COG) following the intervention. The studies conducted by Olofin and Falebita (2020), and Olofin and Kolawole (2020) all demonstrate that the implementation of the KPS technique resulted in superior outcomes compared to the conventional approach. According to the findings of Olofin (2020), the use of effective teaching practises has the potential to enhance the attitudinal disposition of pupils.

The findings indicated that there was not a statistically significant disparity in the mean attitudinal ratings between male and female students who were exposed to Kolawole's Problem Solving (KPS). The KPS technique may be inferred to be free from gender bias, as the gender of the students does not appear to have any impact on the attitudes of those who were exposed to Biology using this strategy. The present study aligns with the research conducted by Olofin (2020) which examined the demographic characteristics of KPS and its impact on the gender distribution of students who were instructed using the KPS technique.

The findings of the study indicated that there was no statistically significant variation in the average attitudinal scores of students who were exposed to Kolawole's Problem Solving (KPS) method, based on their geographical location. The KPS technique may be seen as not exhibiting location bias, as the geographical location of students does not appear to have any discernible impact on the attitudes of students who were instructed in Biology using the KPS strategy. The present outcome corroborates the conclusions established by Awodun (2017), which suggest that the geographical location of schools does not have a substantial impact on students' academic achievement and attitudes towards the subject of Biology.

CONCLUSION

Based on the results obtained from this study, it can be inferred that the implementation of Kolawole's Problem Solving approach yielded a more positive attitude towards Biology among students compared to the usual strategy. Furthermore, it was seen that Kolawole's Problem Solving method did not exhibit any gender bias and shown effectiveness across all locations.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. It is recommended that educational institutions and instructors contemplate the incorporation of Kolawole's Problem Solving technique within the Biology curriculum. The findings of the study indicate that the implementation of this instructional approach has promise in enhancing students' dispositions towards the discipline of Biology.
2. It is imperative that educators and instructors undergo comprehensive training and engage in ongoing professional development initiatives to proficiently use Kolawole's Problem Solving technique within the educational setting. This will guarantee that educators have the necessary skills and resources to effectively employ this method to its maximum capacity.
3. The research conducted revealed that Kolawole's Problem Solving methodology had no discernible gender bias, therefore rendering it an inclusive pedagogical strategy suited for students of both genders. It is imperative for educational institutions and instructors to actively advocate for and foster the utilisation of this methodology in order to establish a learning environment that is characterised by fairness and equal opportunities.
4. The research findings indicate that Kolawole's Problem Solving technique shown effectiveness across all examined areas. Educational institutions situated in diverse geographical contexts can readily use this technique without apprehensions over its effectiveness across disparate locations.
5. It is important to regularly review and evaluate the execution of Kolawole's Problem Solving technique in order to ascertain its ongoing efficacy. In order to provide required enhancements and adjustments to the pedagogical approach, it is imperative to take into account the input provided by both students and instructors.
6. Additional investigation and cooperation among educational establishments, scholars, and curriculum designers can contribute to the enhancement and broadening of the implementation of Kolawole's Problem Solving approach in the field of Biology education.

The dissemination of exemplary practises and novel methodologies can foster ongoing enhancements in pedagogical techniques.

7. It is recommended that schools and educational organisations invest resources towards the development and implementation of Kolawole's Problem Solving technique. The effective integration of this teaching technique is contingent upon investing in the requisite resources and support.

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