

Effects of Kolawole Problem Solving and Instructional Simulation Strategies On Senior Secondary School Students' Attitude Towards Biology in Ondo State, Nigeria

AUTHOR(S): AKINWUMI, Ibukun Omolara

Abstract:

The study examined the effects of Kolawole Problem Solving and Instructional Simulation strategies on senior secondary school students' attitude towards Biology in Ondo state, Nigeria. This study adopted a pre-test, post-test, control group quasi experimental design. The population of the study comprised all S.S.S. 2 students offering Biology in all the public secondary schools in Ondo State, Nigeria. The sample consisted of class intact size (students offering Biology) drawn from 6 public secondary schools in Ondo State. The sample was selected using multistage sampling procedure. Students' Attitude towards Biology Scale (SABS) was used for collecting the data for the study. The face and content validity of SABS were ensured while the internal consistency of the instrument was carried out through a pilot study to determine the reliability of the instrument. The data collected were analysed using Kuder-Richardson (Kr-20) which yielded reliability co-efficient value of 0.86. The study was carried out in three phases namely pre-treatment, treatment and post-treatment. The data collected through the instruments were analysed using descriptive and inferential statistics. The findings of the study revealed that the use of KPS and INS enhanced students' positive attitude towards the learning of Biology than the conventional strategy with INS being the most effective strategy. It was recommended among others that the use of Instructional Simulation (INS) and Kolawole's Problem-Solving (KPS) strategies should be encouraged in Biology class in secondary schools so as to positively enhance students' attitude towards the learning of Biology.

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About Author

Author(s):

AKINWUMI, Ibukun Omolara

Department of Science Education,
Bamidele Olumilua University of Education, Science and Technology,
Ikere – Ekiti, Nigeria.

akinwumi.ibukun@bouesti.edu.ng



Introduction

Attitude is one of the variables that determines what a person will do or say in a particular situation, what he will enjoy or dislike, his approach to other people and above all, his reaction to events in his own life and in the world around. Michael and Gwyneth (2015) defines attitude as the way a person behaves towards something that show how the person feel or think about something. Attitude is concerned with an individual way of thinking and behaving which has serious implications for learner, the teacher, the immediate social group with which individual learner relates and the school system as a whole.

Attitude can be formed as a result of some opinion or by following examples of someone like parents, teachers, peer group and friends. Attitude is a learned pre-disposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept or another person. Attitude can be acquired through learning and can be changed through persuasion using variety of techniques (Sarmah & Puri, 2014). Attitude to Biology plays a crucial role in the teaching and learning of Biology. Usually, the way Biology is represented in the classroom and perceived by students, even when teachers believe they are presenting it in the right way stands to alienate many students from Biology. It appears that positive attitude to Biology could lead students to success in Biology. It has been observed that among the determinant factors to enhance students' attitude to Biology are the ways or methods through which teaching is conveyed to the learners. This goes a long way to show the importance of instructional strategies in a teaching and a learning situation. One of the major contributory factors for negative attitude towards Biology examination by students is linked to the use of conventional method in the teaching of secondary school Biology.

This conventional method of teaching has been reported to dwell more on the transmission of knowledge in a manner that emphasizes memorization and has been criticized as a poor method of teaching Biology and other science subjects because it involves unidirectional flow of information/knowledge from the teacher to the students (Robert, 2011). The quest to curtail the shortcomings of the conventional method used in teaching and learning of Biology led to the adoption of other innovative teaching methods, such as, the inquiry method, instructional simulation, blended learning, concept mappings, simulations and games, spaced-learning, problem based learning among others (Opara, 2011). These innovative methods are considered as effective teaching methods that can improve students' attitude towards Biology. The two instructional strategies considered in this study were Kolawole's Problem-Solving (KPS) and instructional simulation.

KPS is a five steps teaching strategy as described below:

Step 1: In step 1, the teacher will adequately make effort to identify all relevant keywords, terms and terminologies (IKTT) associated with the problem/topic upon which questions would be formulated.

Step 2: In step 2, the teacher 'DIRECT' the Problem/Topic via D,I²,R³,E,C²,T². In teaching and evaluating students at this ability level, the verbs that can be used include: **Define, Identify, Indicate Recognise, Relate Regulate, Enumerate, Categorize, Classify and Treat** all Identified Keywords (K), Terms (T), Terminologies (T) [IKTT] of the problem/topic or equivalent verbs or synonyms of the problem/topic (Kolawole & Olofin, 2017).

Step 3: In step 3 of KPS strategy, the teacher 'DEVECQUIT' the Problem/Topic through D,E,V,E,C³,Q²,U,I,T². The verbs to be used for teaching and evaluating students at this level include **Discuss, Explain, Verify, Expantiate, Criticize, Compose, Compare, Query, Quit, Understand, Inquire, Transform, Test** all Identified Keywords (K), Terms (T), Terminologies (T) [IKTT] of the problem/topic or equivalent verbs or synonyms of the problem/topic.



Step 4: In stage 4 of this strategy, the teacher 'SCRIPT' out the Problem/Topic via S³,C³,R,I,P, T³. The verbs for teaching and evaluating students at this level include **Solve, Simplify, Sketch, Calculate, Compute, Construct, Read, Interpret, Plot, Tabulate, Test and Transform** all Identified Keywords (K), Terms (T), Terminologies (T) [IKTT] of the problem/topic or equivalent verbs or synonyms of the problem/topic.

Step 5: In the final stage of the strategy which is step 5, the teacher 'APPRAISE' the topic via A,P,P,R,A,I,S,E². The evaluative verbs for evaluating students' ability at this level include: **Apply, Preview, Predict, Review, Assess, Induce, Summarize, Estimate and Examine** all Identified Keywords (K), Terms (T), Terminologies (T) [IKTT] of the problem/topic or equivalent verbs or synonyms of the problem/topic. In summary, the five steps of KPS are:

- i. 'IKTT' the Problem/Topic
- ii. 'DIRECT' the Problem/Topic via D,I²,R³,E,C²,T²
- iii. 'DEVEQUIT' the Problem/Topic via D,E,V,E,C³,Q²,U,I,T²
- iv. 'SCRIPT' out the Problem/Topic via S³,C³,R,I,P, T³
- v. 'APPRAISE' the topic via A,P,P,R,A,I,S,E²

It is important for teachers and students to understand the concept of Biology because of some characteristics that the subject possesses. The importance of language in understanding Biology cannot be over-emphasized because, like any other discipline, Biology also has its own technical terminologies. Biology employs scientific terms to describe various parts of living things. In some cases, a word in general usage has different and specific meanings with Biology. Most students have problems in comprehending these biological and scientific languages. Adeleye (2021) opined that one of the challenges militating against positive attitude towards Biology is their inability to recall the major facts (concept). It is important for students to have the ability to recall biological facts, as this would help the students to solve or answer questions in Biology. Many educators believe that a child who studies Biology under a competent teacher using the appropriate method, would not only be able to answer biological questions as well as a child trained in the conventional manner, but would also be far ahead in understanding and in preparation for advanced Biology.

Instructional simulation includes instructional elements that help a learner explore, navigate or obtain more information about that system or environment that cannot generally be acquired from mere experimentation. Instructional simulations combine visual and interactive learning experiences, promotes application of knowledge, and provides a simplified representation of real world systems (Eskrootchi & Oskrochi, 2010). Simulation could be in form of role plays, games, computer programmes that encourage students to become active participants in Biology classroom. Simulation can be inferior, substitute, imitating an original or a display of not real behaviours. Instructional simulation in teaching and learning of Biology helps understanding of abstract and difficult concepts by allowing the students to experiment on the variables that form the concept. Instructional simulation helps students to develop their own understanding of Biology concepts.

Computer simulations can significantly affect and improve attitude of students towards Biology and be effectively used as instructional method in Biology classroom (Nireti, Morenike & Joyce, 2014). Computer simulations brings about students' interest and involvement in the learning process, foster retention of information and offers opportunities for affective and behavioural learning (Guy & Lownes-Jackson, 2015).

Therefore, the present study investigates the effects of Kolawole Problem Solving and Instructional Simulation strategies on senior secondary school students' attitude towards Biology in Ondo state, Nigeria. The study specifically examined:

1. the attitude of the students towards Biology before treatments in the experimental and control groups;
2. the students' attitude towards the learning of biology before and after exposure to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and conventional method on students' attitude towards Biology;
3. the difference in the attitudinal mean score of students in the experimental and control groups before and after treatment in Biology; and
4. the difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology.

Research Questions

The following research questions were raised to guide the study:

1. What is the attitude of the students towards Biology before treatments in the experimental and control groups?
2. What is the students' attitude towards the learning of biology before and after exposure to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and conventional method on students' attitude towards Biology?

Research Hypotheses

The following null hypotheses were generated for this study.

1. There is no significant difference in the attitudinal mean score of students in the experimental and control groups before treatment in Biology.
2. There is no significant difference in the attitudinal mean score of students in the experimental and control groups after treatment in Biology.
3. There is no significant difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology
4. There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology

Methodology

This study adopted a pre-test, post-test, control group quasi experimental design in which three groups (two experimental and control groups) were involved. The homogeneity of the groups were established by pre-test while post-test was used after the treatment to measure students' attitude towards learning. The population of the study comprised all S.S.S. 2 students offering Biology in all the public secondary schools in Ondo State, Nigeria. The sample consisted of class intact size (students offering Biology) drawn from 6 public secondary schools in Ondo State. The sample was selected using multistage sampling procedure.

Students' Attitude towards Biology Scale (SABS) was used for collecting the data for the study. Students' Attitude towards Biology Scale (SABS) aims at investigating the affective domain of the students in Biology. The instrument consists of Sections A and B. Section A sought for student's personal information and school location while Section B consists of 30 items covering the disposition of the students to Biology. The items are rated on a 4-point Likert rating Scale type of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The scoring key of SABS is as follows: SA = 4, A = 3, D = 2, SD = 1 for positive responses and the reverse for the negative items.

The face and content validity of SABS was done through the advice of qualified and experienced Biology educators to determine its suitability in terms of language of presentation, clarity of ideas, relevance and applicability to the study. The internal consistency of the instrument was carried out through a pilot study. The instrument was administered on 30 SSS 2 students in one of the schools outside the sample area. The data



collected were analysed using Kuder-Richardson (Kr-20) which yielded reliability co-efficient value of 0.86. The reliability coefficient was high enough to affirm the instrument reliable and hence used for this study.

To carry out the research in the schools, the researcher obtained permission from the authorities of the six schools. The study was carried out in three phases namely pre-treatment, treatment and post-treatment. The data collected through the instruments were analysed using descriptive and inferential statistics. The research questions were answered using means, standard deviation and bar chart. Hypotheses were tested using t-test and One-way Analysis of Variance at 0.05 level of significance.

Results

Research Question 1: What is the attitude of the students towards Biology before treatments in the experimental and control groups?

Table 1: Mean and standard deviation of attitude of students exposed to KPS, INS and conventional methods before treatment

Strategies	N	Mean	S.D
KPS	62	66.23	5.15
INS	74	65.99	4.11
Conventional	77	66.81	4.59
Total	213		

Table 1 showed the attitudinal mean scores and S.D. of students in Biology of KPS group as 66.23 and 5.15, INS as 65.99 and 4.11 and that of the control group as 66.81 and 4.59. The graphical representation below further shows the attitude of the students towards Biology before treatments

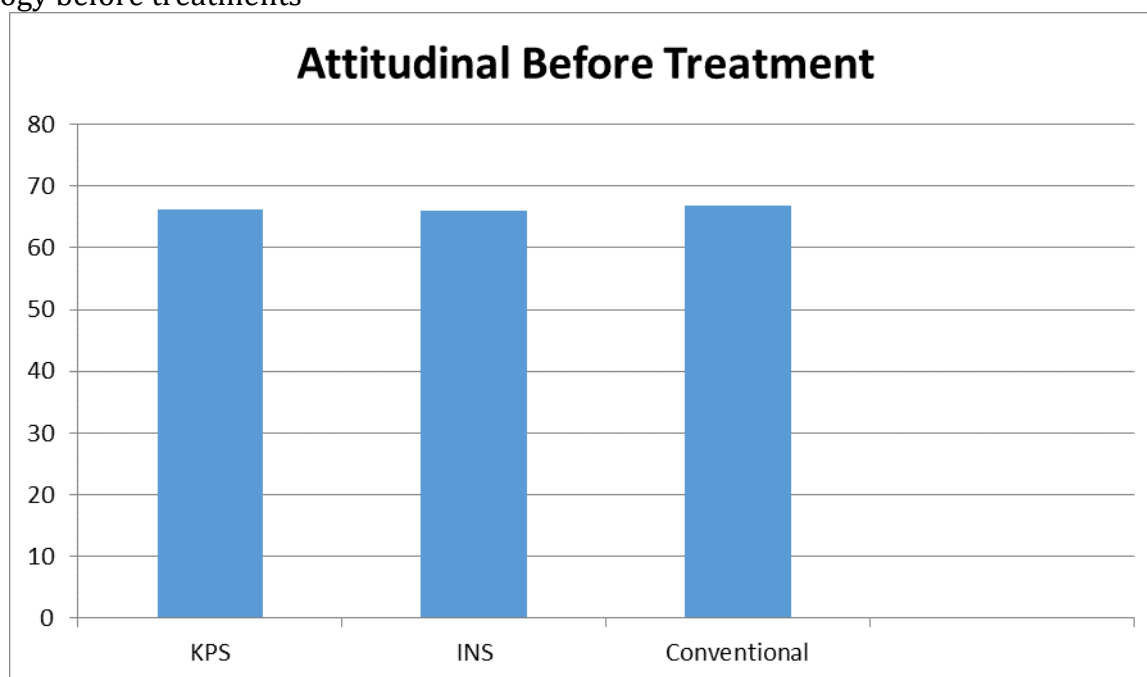


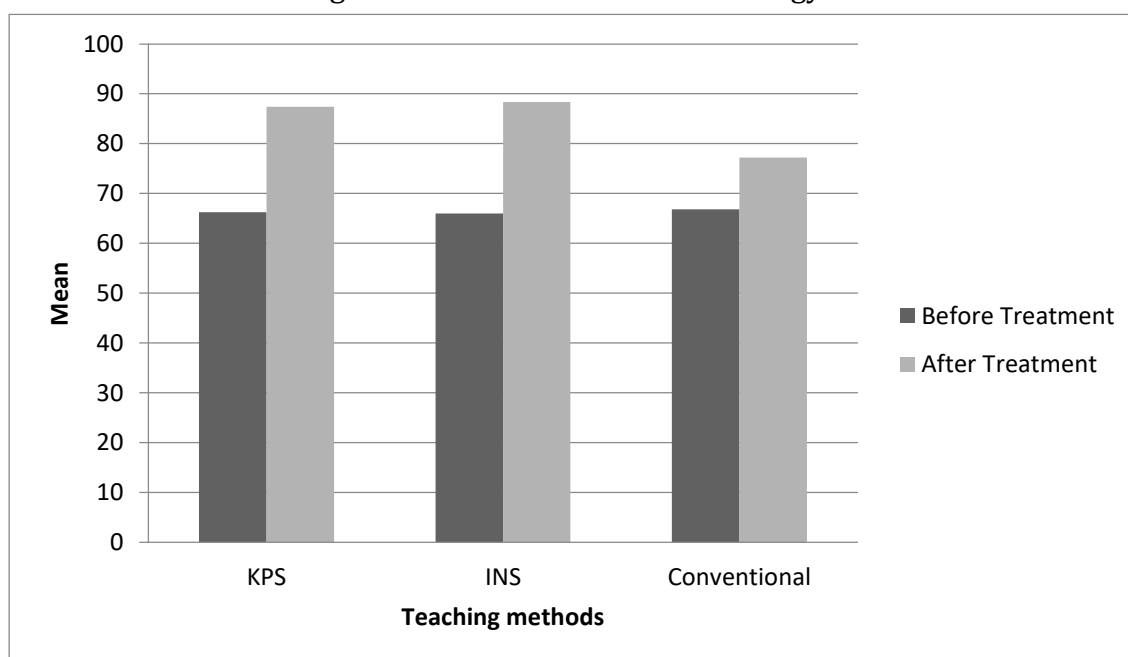
Figure i: Attitudinal mean scores of students exposed to KPS, INS and conventional methods before treatment

Research Question 2: What is the students' attitude towards the learning of biology before and after exposure to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and conventional method on students' attitude towards Biology?

Table 2: Mean and standard deviation of attitude of students exposed to KPS, INS and conventional methods before and after treatment

Strategies	Attitude	N	Mean	S.D	Mean Diff.
KPS	Before	62	66.23	5.15	21.19
	After		87.42	4.17	
INS	Before	74	65.99	4.11	22.35
	After		88.34	2.79	
Conventional	Before	77	66.81	4.59	10.41
	After		77.22	3.14	
Total		213			

From Table 2, it is shown that the mean difference in students' attitude towards Biology before and after treatment for KPS method is 21.19, INS method is 22.35 and conventional method is 10.41. It appears that the use of Kolawole's Problem Solving (KPS) and Instructional Simulation (INS) and conventional methods influences students' attitude towards Biology with INS method being the most effective method in enhancing students' attitude towards Biology. The graphical representation below further shows the most effective method in enhancing students' attitude towards Biology.

**Figure ii:** Attitude of students exposed to KPS, INS and conventional methods before and after treatment**Testing of Hypotheses**

Hypothesis 1: There is no significant difference in the attitudinal mean score of students in the experimental and control groups before treatment in Biology

Table 3: Difference in attitude of students in Biology exposed to KPS, INS and COG before treatment

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.219	2	5.110	1.398	.304
Within Groups	767.860	210	3.656		
Total	778.080	212			

P > 0.05

The result presented in table 3 showed that F-cal value of 1.398 is not significant because the P value (0.304) > 0.05 at 0.05 level of significance. This implies that students in the three groups have similar attitude to Biology before treatment.

Hypothesis 2: There is no significant difference in the attitudinal mean score of students in the experimental and control groups after treatment in Biology.

Table 4: Difference in attitude of students in Biology exposed to KPS, INS and COG

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5655.534	2	2827.767	249.415*	.000
Within Groups	2380.898	210	11.338		
Total	8036.432	212			

* P < 0.05

The result presented in table 4 showed that F-cal value of 249.415 is significant because the P value (0.000) < 0.05 at 0.05 level of significance. Hence, the null hypothesis is rejected. This implies that there was significant difference in the attitudinal mean score of students exposed to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and the Control Group (COG) after treatment. In order to determine the source of the significant differences observed, Post - hoc analysis (Scheffe) with mean difference was carried out in Table 5.

Table 5: Scheffe Post - hoc Test multiple range test of the attitude of students in Biology exposed to KPS, INS and COG

Groups	N	Mean	KPS	INS	COG
			87.42	88.34	77.28
KPS	62	87.42			
INS	74	88.34			
COG	77	77.28	*	*	

* P < 0.05

In Table 5, significant difference was not found in attitude of students in Biology exposed to KPS and INS. There was significant difference in attitude of students in Biology exposed to KPS and COG in favour of students exposed to KPS. Also, there was significant difference in attitude of students in Biology exposed to INS and COG in favour of students exposed to INS.

Hypothesis 3: There is no significant difference in the attitudinal mean scores of students exposed to KPS and conventional method in Biology

Table 6: 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 6 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 4: There is no significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology

Table 7: t-test analysis difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method

Variations	N	Mean	SD	Df	t _{cal}	P
instructional simulation strategy	74	88.34	2.79	149	22.946*	0.000
Conventional	77	77.22	3.14			

*p<0.05

Table 7 shows that the t-cal value of 22.946 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 instructional simulation strategy and conventional method in Biology. Students exposed to instructional simulation strategy exhibited positive attitude to Biology than those exposed to conventional method.

Discussion

The findings of this study revealed that there was no significant difference in the attitudinal mean score of students in Biology exposed to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and the Control Group (COG) before treatment. This finding established the homogeneity of the three groups involved in the study prior to the experiment.

The findings also revealed that there was significant difference in the attitudinal mean score of students exposed to Kolawole's Problem Solving (KPS), Instructional Simulation (INS) and the Control Group (COG) after treatment. Instructional Simulation (INS) method was the most effective strategy in enhancing students' attitude towards Biology. Followed by Kolawole's Problem Solving (KPS) method and the worst was conventional strategy. The result showed that instructional simulation teaching approach is more potent in stimulating students' positive attitude towards Biology in secondary schools than the KPS and the conventional method in vogue in the nation. The implication of this result is that: conventional method of instruction is not potent enough to effect positive change in students' positive attitude towards Biology, whereas, the simulation teaching approach expedite significant change in the attitude of students towards Biology. This finding agrees with the research findings of Awodun and Oyeniyi (2018) that simulation instructional strategy is an antidote for students' negative attitude towards Biology and other science subjects. Simulation may, therefore, make learning more concrete and meaningful.

The findings also revealed that there was 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. The findings of Kolawole and Ojo (2016), Olofin and Falebita (2020) and Olofin and Kolawole (2020) show that KPS strategy application yielded better results than the conventional method. Olofin (2019) concluded that good teaching strategies have the potent to improve disposition of students.

It was also revealed that there was significant difference in the attitudinal mean scores of students exposed to instructional simulation strategy and conventional method in Biology. Students exposed to instructional simulation strategy exhibited positive attitude to Biology

than those exposed to conventional method. Dauda (2015) and Adoke (2015), on the effect of instructional simulation technique on students' attitude found that instructional simulation technique was more effective in comparison to other teaching techniques of teaching.

Conclusion

Based on the findings of this study, it could be concluded that the use of KPS and INS enhanced students' positive attitude towards the learning of Biology than the conventional strategy with INS being the most effective strategy.

Recommendations

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

1. The use of Instructional Simulation (INS) and Kolawole's Problem-Solving (KPS) strategies should be encouraged in Biology class in secondary schools so as to positively enhance students' attitude towards the learning of Biology.
2. Biology teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of Instructional Simulation (INS) and Kolawole's Problem-Solving (KPS) strategies in teaching.

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