Effect of Scaffolding Instructional Strategies on Pupils' Attitude to Basic Science and Technology in Rivers State, Nigeria

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Abstract

This study examined the effect of scaffolding instructional strategies on pupils' attitude to Basic Science and Technology in public primary schools in Rivers State. Four purpose and four null hypotheses guided the study. Non-randomized pretest, posttest control group experimental design was adopted for the study. The population consisted of 42,409basic four pupils; 147pupils in the intact classes of the sampled schools using simple random sampling technique served as sample. The modified Fennema-Sherman Attitude Scale was used for data collection. The data was analyzed using Analysis of Covariance (ANCOVA). The findings of the study revealed that there is a significant difference in the Basic Science attitude mean score of pupils taught with modeling and cueing questions and those taught with conventional method; the Basic Science attitude mean scores of boys and girls, high achievers and low achievers taught with modeling and cueing questions do not differ significantly with those taught with conventional method; there is no significant interaction effect of treatment, gender and achievement levels on the attitude of pupils towards Basic Science and Technology. Recommendations were made which include that scaffolding instructional strategy should be used in classroom teaching/learning interaction to enhance the teaching and learning of pupils as well as improve their attitude towards Basic Science and Technology.

Keywords: Scaffolding, modeling, cueing questions, attitude, gender

Introduction

Science and Technology have become the mediating culture in the global community affecting all facets of life socially, economically, morally and politically. Effective science and Technology Education (STE) has become an instrument par excellence for the development of citizens to their full potentials in keeping up with global economic challenges and demands.

Mbajiorgu (2003) noticed that children like science, and that it is at the elementary school level that meandering and request psyches are supported. It is along these lines the obligation of the BST educators to start the enthusiasm of the students at this establishment level to make them like science to such an extent that they can in the long run pick science related callings when they develop old. As expressed by Ivowu (2001), student focused methodology is exceptionally suggested for the schooling and learning of science and innovation since the visualized substance authority and attitudinal changes are outfitted towards the student. Scaffolding instructional procedure, which is a student focused methodology, could be promptly utilized by the educator in the teaching of Basic Science and Technology. Instructively scaffolding, has been seen by Dorn and Stoffos (2001) as help given by a specialist who always alters and obliges the student's obtained abilities.

Correspondingly, Reiser (2004) alludes to scaffolding as the procedure by which an educator, a teacher or a progressively proficient companion helps a student, adjusting the learning task so the student can take care of issues or achieve assignments that would customarily be unthinkable for him and to gain from the experience.

Instructional scaffolding as a schooling system be contingent intensely on the probability that offspring go to any scholastic scenery with a lot of past learning. It is the way toward structure on what an understudy positively comprehends that makes scaffolding a persuading instructional philosophy. Olson and Prath (2000) saw that in instructional scaffolding, an inflexibly encouraged different offers frameworks to stimulate the understudy's movement. The frameworks ask an understudy's capacity to create earlier learning and veil new data. The exercises provided in scaffolding guidance are simply past the degree of what the understudy can do alone. An imperative bit of scaffolding is that the stages are short lived. As the understudy's capacities increment the scaffolding given by the more learned individual is reasonably pulled back. At long last, the understudy can finish the assignments or master the considerations autonomously (Chang, Sung, and Uhem, 2002).

Instructional scaffolding expands on the understanding that students learn from various perspectives, fabricate new information dependent on related knowledge and learning, a should be bolstered in realizing when they can't accomplish without anyone else. Powerful scaffolding guidance gives customized help that is balanced on as required premise, controls for disappointment and fabricate student's certainty, utilizes illustrative input with the goal that students comprehend what they are doing well and how they can improve.

Students' mentality towards a specific school subject influences their learning regarding that matter. Little miracle that Adodo and Gbore (2012) asserted that frame of mind is the aggregate of an individual's tendency toward a particular kind of thing, foundation or thought; while Gronlunds (1976) in Adodo and Gbore (2012) suggested the broadest significance of attitude as that which handles all pieces of character improvement, for instance, solitary interest, goals, values, proficient change got from expert interests and various times of one's step by step lives. Hence, Ifayefunmi (1984) has concentrated on that firm stereotyped outlooks can impact execution in a subject where flexibility of viewpoint is important. As expressed by Ifayefunmi, poor frames of mind were significant variables prompting disappointment in science subjects henceforth, students in outrageous cases create dread and contempt for these subjects.

In perspective on the frame of mind of Nigerian students towards BST,it could be seen that not a lot of understudies have love for the topic and the people who study it are commonly the people who need to use it as an occupation ticket. Many research studies have established that understudies make negative air to science knowledge. This could after all be a result of the educators' inability to satisfy the understudies' wants or destinations. From time to time, a segment of the things the teachers train in science have little effect to the understudies' sensible life or their goal and now and again don't give the calling rousing powers and open entryways for them to esteem the activity of the analyst in the overall population. This has consistently provoked various destinations for understudies, instructors, guardians and ventures (Adodo and Gbore, 2012)

As per Goodlad (1984), the most well-known strategy for guidance is from a reading material. This implies the answer for disposition change depends on the tutors. They acknowledged that instructors ought start presenting other training procedures, as these movements won't simply understand a continuously rousing air toward science for their understudies; yet will give their understudies the legitimate capacities mandatory to accomplish assessments and use reason to handle issues.

As indicated by Alsop and Watts (2003), taking in includes moving from the commonplace to the new, crossing the passionate entanglement of accomplishment, self-uncertainty and test just as study hall personality. In various cases, attitudinal examinations in science instruction research have regularly been driven by the irritating pattern in the decrease in students seeking after post obligatory science training (Jenkins,1994; Lepkowska, 1996). Be that as it may, as of late there has been expansion of concentrates on students' dispositions towards science, just as surveys on such investigations (Mathews, 2004; Osborne et al., 2003; Jones, Howe and Rua, 2000; Simons, 2000; Ramsden, 1998). These offer help to the significance of attitudinal examinations in science training research. Whatever the clarifications might be, students leaving with demeanors of any sort are probably going to impact the utilization of learning, abilities or aptitudes obtained from science class for motivations behind vocation decision, vote based investment and cooperation in discussion on logical issues.
Olotu (1992) in his work on students' frame of mind to Agricultural Science said that negative mentalities are significant reasons for students' under exhibition or terrible showing and that a similar impact exists in every single other subject, including Basic Science and Technology.

Students typically find science to be boring and repetitious. That is because they are not given the opportunity to use their imaginations and develop their own understanding (NRC, 2005). If students are encouraged to develop

their own understanding, they may be able to determine that science is not about memorization of terms and formulas, but that science is about collaborating with others and working through situations to find the best answer. However, one research study concluded that although students may have been instructed using a non-traditional approach focused on more inquiry-based learning, the students' attitudes towards science did not change from that classroom experience (Wee, Fast, Shepardson, Harbor, and Boone, 2004). In the light of the foregoing, this study examined the effect of scaffolding instructional strategies on pupils' attitude to Basic Science and Technology in primary schools in Rivers State.

Statement of the Problem

Advancements in technology, information and communication (powered through the computer and internet) has ushered in knowledge-based economies all over the globe. This technological advancement is what Nigeria craves for as stated in the National Policy on Education, that one of the specific goals of education in Nigeria is to 'promote information and communication technology at all levels.' Basic science and technology at the basic education level of education is the foundation subject for promoting this technology at all other levels.

The attitude of pupils to Basic Science and Technology in public primary schools in Rivers State has been on the decline over the years despite the obvious importance of this subject. This poor attitude could be attributed to the teaching method employed in the classroom. The traditional teaching method employed by the classroom teachers in the teaching of Basic Science and Technology may not have promoted effective learning of the subject. This may have also affected the attitude of pupils to the subject. It could be imputed that the nature of instruction could lead to variations in pupils' attitude. However, for learners to improve and develop the right attitude to Basic Science and Technology, teachers must embrace and employ new methods which will make learning active, interesting and participatory. One of such methods that can be utilized by teachers during instruction is scaffolding instructional strategy. It is against this backdrop that the researcher seeks to examine whether scaffolding instructional strategies could be used to improve the attitude of pupils to Basic Science and Technology in public primary schools in Rivers State.

Purpose of the Study

The purpose of the study was to determine the effect of scaffolding instructional strategies (modeling and cueing questions) on pupils' attitude to Basic Science and Technology in primary schools. Specifically, the study sought to:

1. Determine the mean difference in the Basic Science attitude scores of pupils taught with modeling and cueing questions and those taught with conventional method in primary schools.
2. Determine the mean difference in the Basic Science attitude scores of males and females taught with modeling and cueing questions and those taught with conventional method in primary schools.
3. Determine the mean difference in the attitude scores of high achievers and low achievers taught with modeling and cueing questions and those taught with conventional method in primary schools.
4. Determine the interaction effect of treatment, gender and achievement levels on the attitude of pupils towards Basic Science and Technology.

Null Hypotheses

The following null hypotheses were formulated to further guide the study:

1. There is no significant difference in the Basic Science attitude mean score of pupils taught with modeling and cueing questions and those taught with conventional method in primary schools.
2. The Basic Science attitude mean scores of males and females taught with modeling and cueing questions do not differ significantly with those taught with conventional method in primary schools.
3. There is no significant difference in the mean attitude scores of high achievers and low achievers taught with modeling and cueing questions and those taught with conventional method in primary schools.
4. There is no significant interaction effect of treatment, gender and achievement levels on the attitude of pupils towards Basic Science and Technology.

Methodology

Research Design

The study is quasi-experimental. It adopted a non-randomized pre-test posttest control group research design; this design was deemed suitable for the study since the variables were manipulated and their effects upon other variables observed.

Population of the Study

The population of this study consisted of all the 42,409 Basic Four pupils in the 943 public primary schools in Rivers State (Rivers State Ministry of Education, 2016). Pupils in Basic Four were chosen since Basic Four is in the Middle Basic, which prepares the child for science classes in the Upper Basic (which is the first three classes in the secondary school).

Sample and Sampling Technique

The sample for the study consisted of 147 Basic Four pupils in the intact classes of three public primary schools. The three public primary schools in Obio/Akpor Local Government Area were chosen using simple random sampling technique. Out of the three schools chosen two were used for the experiment group (one of the schools was used for the modeling scaffolding instructional strategy, and the second was used for cueing questions scaffolding instructional strategy); while the third school was used as the control group.

Instrumentation

The study employed (1) the Adapted Fennema-Sherman Attitude Scale used for determining pupils' attitude towards BST. The adapted Fennema-Sherman Attitude Scale have five subscales with five items for each subscale making it a total of 25 items for the scale; and (2) instructional package (lesson notes and research assistants training guide).

Validation of the Research Instruments

The instruments: the adapted Fennema-Sherman Attitude Scale and instructional package were validated by the Basic Science and Technology classroom teacher, two experts in Early Childhood Education, and a test and measurement expert from the Faculty of Education, University of Uyo, Uyo, AkwaIbom State. These experts carefully and critically examined the instruments in terms of relevance, content clarity and difficulty level. The instrument was modified after due scrutiny from the specialists.

Reliability of the Instrument

The instruments were administered to Basic Four pupils in private primary schools in Obio/Akpor Local Government Area; who were not part of the study. The data collected was analysed to determine the reliability index. Cronbach alpha was used to determine the reliability of the modified Fennema-Sherman attitude scale. The reliability coefficient of the instrument was found to be 0.732. With this level of reliability coefficient, the instrument was considered to be highly reliable for this study.

Administration of instrument

In administering the instruments, the researcher first obtained permission from the head-teachers of the sampled schools. Thereafter the researcher guided the research assistants on scaffolding instructional strategy using the instructional package in the first one week. This was followed by the administration of the pre-test of the modified Fennema-Sherman attitude scale to the pupils in the classes in that same first week to establish their equivalence before they were exposed to the scaffolding instructional strategy and the conventional teaching methods, respectively.

The treatment (the instruction in Basic Science and Technology) followed after the pre-test and lasted for six weeks using three periods in a week. At the sixth week, a posttest of the attitude scale was administered both to the experimental group and control group. Basic four pupils in two different public primary schools were taught with scaffolding instructional strategies (modeling and cueing questions) and the third school was taught with the conventional method of chalk and talk. The school taught with the conventional method was used as the control group.

The Basic Science and Technology teachers of the selected classes were used as research assistants. To qualify, the researcher used one week to brief and guide them on how to teach their respective groups using the researcher developed lesson packages. This includes teaching using the specified instructional methods and sequence following the topics in the lesson plans. The scoring of the instruments was handled by the researcher to avoid bias and experimental contamination.

Method of data analysis

Mean and standard deviation were used in answering the research questions while analysis of covariance (ANCOVA) was used in testing the null hypotheses at .05 level of significance.

Findings and discussion

Null Hypothesis One

There is no significant difference in the Basic Science attitude mean score of pupils taught with modeling and cueing questions and those taught with conventional method in primary schools.

Table 1: Summary of analysis of covariance (ANCOVA) of pupil's attitude score classified by treatment groups with pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pre-Attitude	6343.057	1	6343.057	30.238	.000
Treatment	285.282	2	142.641	.680	.508
Error	29997.700	143	209.774		
Total	1144093.000	147	-	-	-
Corrected Total	37358.136	146	-	-	-

In Table 1 the calculated F-ratio for the effect of instructional strategies on the attitude of pupils towards Basic Science Technology with df 2,143 is 30.238 while its corresponding calculated level of significance is .00 alpha level. The F-cal 30.238 is greater than the F-crit3.09 at .05 alpha, indicating that modeling and cueing scaffolding method used had statistically significant effect on attitude of pupils towards basic science technology. Hence hypothesis four which assumed a no significant difference in the BST attitude mean score of pupils taught with modeling and cueing questions scaffolding instructional strategies and those taught with conventional method in primary schools is rejected.

Null Hypothesis two

The Basic Science attitude mean score of males and females taught with modeling and cueing questions do not differ significantly with those taught with conventional method in primary schools.

Table 2: Summary of analysis of covariance (ANCOVA) of pupil's attitude score classified by treatment groups and gender with Pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pre-Attitude	6636.967	1	6636.967	32.418	.000
Treatment	117.723	2	58.861	.288	.751
Gender	1056.749	1	1056.749	5.162	.025
Treatment * Gender	294.174	2	147.087	.718	.489
Error	28662.215	140	204.730		
Total	1144093.000	147	-	-	-
Corrected Total	37358.136	146	-	-	-

In Table 2 the calculated F-ratio for the effect of instructional strategies on the attitude of male and female pupils in Basic Science Technology with df 2, 140 is .718 while its corresponding calculated level of significance is .489 alpha level. The F-cal .718 is less than the F-crit3.09 at .05 alphas, indicating that instructional strategies used had no statistically significant effect on the attitude of pupils in BST. Hence hypothesis 5 which assumed a no significant difference in the attitude score of boys and girls pupils towards BST taught with modeling and cueing scaffolding instructional strategies and those taught with conventional method in primary schools is retained.

Null Hypothesis three

There is no significant difference in the mean attitude scores of high achievers and low achievers taught with modeling and cueing questions and those taught with conventional method in primary schools.

Table 3: Summary of analysis of covariance (ANCOVA) of pupil's attitude score classified by treatment groups and achievement with Pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pre-Attitude	4764.236	1	4764.236	23.956	.000
Treatment	329.918	2	164.959	.829	.438
Achievers	1760.357	1	1760.357	8.852	.003
Treatment * Achievers	167.848	2	83.924	.422	.657
Error	27842.616	140	198.876		
Total	1144093.000	147	-	-	-
Corrected Total	37358.136	146	-	-	-

In Table 3 the calculated F-ratio for the effect of instructional strategies on the attitude of high and low achieving pupils in Basic Science Technology with df 2, 140 is .422 while its corresponding calculated level of significance is .657 alpha levels. The F-cal .422 is less than the F-crit3.09 at .05 alphas, indicating that instructional strategies used had no statistically significant effect on the attitude of high and low achieving pupils in BST. Hence hypothesis six which assumed a no significant difference in the mean attitude score of high and low achieving pupils in BST taught with modeling and cueing questions scaffolding instructional strategies and those taught with conventional method in primary schools is retained.

Hypothesis four

There is no significant interaction effect of treatment, gender and achievement levels on the attitude of pupils towards Basic Science and Technology.

Table 4: Summary of analysis of covariance (ANCOVA) of pupil's attitude scores classified by treatment groups, gender and achievement levels with pre-test as covariate with Pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Treatment	1142.485	2	571.243	2.530	.083
Gender	385.305	1	385.305	1.707	.194
Achievement Levels	1971.208	1	1971.208	8.732	.004
Treatment * Gender	408.746	2	204.373	.905	.407
Treatment *Achievement Levels	280.111	2	140.056	.620	.539
Gender* Achievement Levels	1.979	1	1.979	.009	.926
Treatment*Gender* Achievement Levels	1357.589	2	678.795	3.007	.053
Error	30477.355	135	225.758	-	-
Total	1144093.000	147	-	-	-
Corrected Total	37358.13	146	-	-	-

In Table 4 the calculated F-ratio for the interaction effect of treatment, gender and achievement levels on the attitude of pupils in Basic Science Technology with df2,35 is 3.007 while its corresponding calculated level of significance is .053 alpha levels. The F-cal3.007 is less than the F-crit3.09 at .05 alpha, indicating that the interaction effect of treatment, gender and achievement levels had no statistical significant effect on the attitude of pupils in BST. Hence hypothesis 8 which assumed a no significant effect of treatment, gender and achievement levels on the attitude of pupils in Basic Science and Technology is retained.

Discussion of Findings

The findings from the results in hypothesis one as shown in table 1 revealed that the F-cal 30.238 is greater than the F-critical 3.09 at .05 alpha. This means that the null hypothesis is rejected. Therefore, there is a significant difference in the Basic Science attitude mean score of pupils taught with modeling and cueing questions scaffolding instructional strategies and those taught with conventional method. The finding of the study supports the findings of Guzeller and Akin (2012) who revealed in their study on the effects of scaffolding using web-based mathematics instruction on the mathematics achievement, attitudes, anxiety and self-efficacy of students that there is a statistically significant difference between the experimental group and the control group on the post-mathematics attitudes scores in favour of experimental group. On the contrary, the findings disagree with the findings of Liu (2004) who in his study submitted that there was no difference in the attitude score of students (experimental and control group) in the study.

The findings from the results in hypothesis two as shown in table 2 revealed that the F-cal .718 is less than the F-critical 3.09 at .05 alpha. This leads to the retention of the null hypothesis. Therefore, the Basic Science attitude mean score of boys and girls taught with modeling and cueing questions scaffolding instructional strategies does differ significantly with those taught with conventional method. The finding of the study is in agreement with the earlier studies of Liu (2004) who submits that no gender difference was found in the performance, nor in the attitudes among the students who were exposed to hypermedia technology as a needed scaffolding in technology enhanced PBL environment and the students that were not exposed to the hypermedia technology scaffold. The findings of the study is also at variance with the views of Casem (2013) who postulates in his study aimed at determining the level of effectiveness of the use of scaffolding and traditional strategies in the selected topics in mathematics III based on the mathematics performance and attitude of students, that gender of students positively affects their attitude towards mathematics.

The findings from the results in table 3 revealed that the F-cal 4.422 is greater than the F-critical 3.09 at .05 alpha. This implies that the null hypothesis is rejected.
Therefore, there is a significant difference in the mean attitude scores of high achievers and low achievers taught with modeling and cueing questions scaffolding instructional strategies and those taught with conventional method. This finding is at variance with the earlier findings of Oyetunda (2010) who reports in his study on the effects of models on attitude and academic achievement of auto-mechanics students in technical colleges that ability level has no effect on the academic achievement and attitude of the students in auto-mechanic work. Also, the finding disagrees with the findings of Mata, Monteiro and Peixoto (2012) who submitted in their study that the achievement levels of students had no effect on their attitude towards mathematic.

The findings from the results in table 4 revealed that the F-cal .514 is less than the F-critical 3.09 at .05 alpha. This means that the null hypothesis is retained. The finding indicates a no significant combined effect of scaffolding instructional strategies and gender on the attitude of pupils towards Basic Science and Technology. This finding is at variance with that of Casem (2013) who investigated the level of effectiveness of the use of scaffolding and traditional strategies in the selected topics in mathematics III based on the mathematics performance and attitudes of the third-year high school students and submitted that there is a significant interaction effect of scaffolding instructional strategy and gender on the attitude of students towards mathematics. On the other hand, the finding is in agreement with the findings of Mata et al. (2010) who in their study found no interaction effect of gender and achievement levels of students on their attitude towards mathematics.

Conclusion

Scaffolding instructional strategies enhance pupils' attitude to Basic Science and Technology better than the traditional method and pupils' gender is not a significant determinant of pupils' attitude when taught using scaffolding instructional strategies. The researcher is of the view that the use of scaffolding instructional strategy in Rivers State has not been encouraging, and that a good utilization of scaffolding instructional strategies in the classroom will positively change the attitude of pupils towards Basic Science and Technology.

Recommendations

Consequent on the findings of the study and the conclusion drawn there from, the researcher recommends as follows:

1. Scaffolding instructional strategy is an effective instructional tool than the traditional classroom teaching. Therefore, scaffolding instructional strategy should be used in classroom teaching/learning interaction by teachers to enhance the teaching and learning of pupils as well as improve their attitude to Basic Science and Technology.
2. More time should be allotted to the teaching periods by the school administrators since scaffolding instructional strategies especially modeling requires more time and efforts.
3. Training and retraining of Basic Science and Technology. Teachers ought to be given need by the State and Federal Governments to improve and refresh their aptitudes and learning on current patterns in their general vicinity of specialization. This will empower them grow new instructional models that could be utilized to get ready specialists for the quick changing working environments that are portrayed by basic and explanatory occupation aptitudes.

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