# EFFECTS OF SHIFTING INTERACTION QUESTIONING TECHNIQUE ON STUDENTS' ACHIEVEMENT IN BASIC ELECTRICITY IN TECHNICAL COLLEGES

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**Abstract**
*This study was to investigate effects of shifting interaction questioning technique on students' achievement in basic electricity in all the technical colleges in Federal Capital Territory and Niger State using quasi experimental Pretest posttest non-equivalent research design. The population for the study consisted of 165 year I basic electricity students. The entire population was used for the study. Two research questions were developed and answered while 3 null hypotheses were formulated and tested at 0.05 level of signifcance. The instrument used for data collection was Basic Electricity Achievement Test (BEEAT). The instrument was developed by the researcher, and validated by three experts in electrical/electronic technology education and measurement and evaluation. The reliability coefficient of BEAT was found to be 0.83 using Pearson Product Moment Correlation coefficient. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. The results of the data analysis showed among other things that shifting interaction Questioning Technique was more effective in enhancing female students' achievement in Basic electricity than the conventional questioning technique. The study found out that there was no interaction effect of treatment and gender on achievement in basic electricity. Based on the findings of the study, it is recommended among others that Basic electricity teachers should practice the use of shifting interaction questioning technique as part of their teaching techniques to encourage female participation in science and technology education.*

**Keywords:** Shifting Interaction, Questioning technique, Achievement Basic Electricity and Gender

## Introduction

Most technology educators are disenchanted with the conventional pedagogy of transmission of knowledge without inculcating in the students the ability to think for themselves and use problem-solving skills to handle novel situations. According to Oranu (2001), most vocational and technical teachers still adhere to the traditional lecture method in the classroom. This adherence to lecture method led to the evolution of what looks like "Critical thinking movement" in America (Schrag, 1992). Sequel to this also, the widely spreading programme, "Questioning and Understanding for Improving Learning and Thinking" (QUILT) sprang up in the United States of America (Orletsky, 1997).

Nigeria was not left out of the development, in technical colleges, the use of constructivist method of teaching is emphasized in order to inculcate in students the ability to think for themselve and move away from the highly criticized lecture method (Owoso, 2009). Owoso (2009) further asserted that the constructivist approach has recorded many successes in many vocational and technical education domains and many vocational and technical educators now advocate for its use in the vocational and technical classroom. Any behaviour, practice or technique that will enable students develop thinking skills is likely to help them to acquire technology concepts, which will lead to better achievement. The vocational and technical teacher is therefore expected not only to know what to teach but also how to teach it.

Basic Electricity is one of the courses offered in technical colleges. It involves the basic rudiment of electricity. It provides students with basic conceptual understanding of basic electrical concepts including basic electrical measurements, basic electrical theory and understanding of how common electrical components work. UNESCO and ILO (2002) pointed out that the methodology for teaching vocational and technical subjects must enable students to think and ask questions during classroom lesson. One way of developing students' thinking skill is to ask questions in the classroom to facilitate discussion and to get the students to think. There is therefore a good link between teaching methods and questioning. Questioning therefore fits closely into the matrix of the pedagogy of science and technology subjects of which basic electricity is one.

A question is a statement that seeks to provoke thinking so as to elicit an answer. Classroom questioning has been the focus of many education researchers for over a century. Research has shown that verbal questions used in the classrooms are more effective in fostering learning than written questions (Cotton, 2001). Though, it is popularly believed that oral questioning which is the conventional ways of asking students questions in the classroom enhances students' thinking and learning, research shows that the current classroom practice falls far short of this notion (Orletsky, 1997). In other words, the type of questioning in the classrooms today does not really enhance students' thinking and learning.

There are many techniques of questioning, but how effectively they are applied to achieve the desired goal is not clear. Common questioning techniques include; wait-time in questioning, cognitive level of teacher's questions, frequency of questioning and shifting interaction. Shifting Interaction is the redirection of classroom questions from one student to another and probing each student's answer, rather than the teacher answering any question he/she asked immediately one student or two fail to provide the right answer. In shifting interaction, the teacher is very reluctant in providing the answer to his question until all available opportunities of eliciting the right answer from students have been utilized and they failed to get it. Redirection and probing are positively related to achievement (Cotton, 2001) In shifting interaction the teacher does not give long period of uninterrupted silence rather he/she uses the time to redirect a question from one student to the other ensuring adequate participation of the students in arriving at the right answer. From the foregoing analysis it was therefore, necessary to investigate the effect of this questioning technique on students' achievement in basic electricity.

Academic achievement connotes performance in school subject as symbolized by a score in an achievement test. Epunnah (1999) defined performance as the learning outcome of students which include the knowledge, skills and ideas acquired and retained through course of studies within and outside the classroom situation. Academic achievement in basic electricity is the quality and level of skills acquired and retained by students. Mbah (2002) remarked that achievement is dependent upon several factors among which are instructional techniques, the learning environment, motivation for stimulating students' interest in learning and the learners.

Besides, gender has been identified as one of the factors influencing student's achievement in vocational and technical education (Howden, 1998). The issue of gender has assumed prominence in technical and vocational education discourse. Gender is a sense of awareness of being male or female. It is a behavioural pattern and attitude perceived as masculine or femine within a culture (Coleman, 2000). There is also the long held view that gender differences in achievement in vocational and technical education in favour of the males is caused primarily by biological inheritance (Howden 1998), but Okeke (1999) asserted that so far there is no .biological evidence that boys have innate superior intellectual abilities over girls. Therefore, if differences in achievement exist, they must be caused by other factors. Recent studies show that women and men respond differently to specific teaching methods, questions and to discussion (West Virginia University for Women Studies (W V U), 1997). This is in line with Okeke's (2001)

assertion that instructional strategies are known to produce different effects on learners. Schwartz and Hanson (1992) expressed that boys volunteer more than girls in response to teacher's questions. This is supported by Okeke (2001), who stated that women are unlikely to volunteer to answer questions. Therefore, any instructional strategy that employs the voluntary answer to questions would put women learners at a disadvantage. Men tend to answer questions more confidently and quickly regardless of the quality of their responses, formulating their answer as they speak. On the contrary women choose their words carefully, wait longer to respond to a question in class (Women Science Students (WSS), 1996). This may be why it is alleged that in coeducational schools, boys dominate class discussions. Learners are likely to learn better if the teacher-student questioning interaction patterns are suitable to them. It appears from the discourse on gender that different questioning techniques may affect boys and girls differently. There was therefore, the need to investigate gender interaction, with shifting interaction techniques in classroom questioning.

**Statement of the Problem**

Many vocational and technical educators have over the years been concerned about the problem of students' low achievement in technology subjects. One of such factors that affect student's achievement in technology subjects is the non-stimulating ways of teaching the subject in technical colleges due to lack of relevant teaching skills by the teachers. If instruction is not presented in a stimulating way to students, the degree of learning may not be high. The criticism of our conventional pedagogy that emphasizes mere transmission of knowledge places the onus on teachers to find better ways of teaching that would de-emphasize mere transmission of knowledge. It is widely believed that in order to teach well, one should be able to question well. Questioning has been reported to have greater potential than any other teaching skills for stimulating thinking in students. For over one century, classroom questioning has been the focus of many education researches. But consistently researches find a large gap between typical questioning which is normally obtained in our classrooms and effective questioning, which is stimulating. Questioning is made effective by employing the right kind of questioning techniques. Effective questioning is an instrument of motivation to raise the interest of students in what is being learnt. Raising students' interest helps them to learn better and most likely retain what is learnt for a longer period and subsequently, achievement would be enhanced. The relative effectiveness of some of these questioning techniques in enhancing achievement in basic electricity was not clear, it has also been shown that boys and girls respond differently to different questioning techniques (WVU, 1997). The effect of gender on questioning techniques in enhancing achievement in basic electricity was also not conclusive. The main concern of this study was to investigate effects of shifting interaction questioning technique on students' achievement in basic electricity.

**Purpose of the Study**

The study sought to determine:

(i) The effect of shifting interaction technique in classroom questioning on students' achievement in basic electricity.

(ii) The effect of gender on students' achievement in basic electricity using shifting interaction classroom questioning.

**Research Questions**

The following research questions were answered:

(i) What is the effect of shifting interaction in classroom questioning on students' achievement in basic electricity concepts?

(ii) What is the effect of gender on students' achievement mean scores using basic electricity in shifting interaction classroom questioning?

**Hypotheses**

The following null hypotheses were tested at the 0.05 level of significance.

$Ho_1$: There is no significant difference in the achievement of basic electricity students exposed to shifting interaction and conventional Questioning Techniques

$Ho_2$: There is no significant difference between the effects of gender on students' achievement in basic electricity when exposed to shifting interaction questioning technique.

$Ho_3$: There is no significant interaction effect of treatments on gender with respect to their mean scores in basic electricity achievement test

**Methodology**

The research design is a quasi- experimental design using intact classes. Specifically, pre-test, post-test, non-randomized comparison groups design. This design was used because the researcher wants to use intact classes. The design is symbolically represented as follows:

EG = $O_1$ × $O_2$

CG = $O_1$ – $O_2$

Where EG stands for experimental (shifting interaction) group:

$C_G$ = stands for control (conventional) group

$O_1$ = stands for pre-test observation

$O_2$ = post -test

X = shifting interaction questioning technique

\- = Conventional questioning technique

The population of this study comprises 165 (121 boys and 44 girls) year I students of basic electricity in all the technical colleges that offer basic electricity in Niger State. The entire population was used for the study.

**Instruments for Data Collection**

The instrument used was Basic Electricity Achievement Test (BEAT) developed by the researcher. The instrument was designed to measure the cognitive achievement of the students before and after treatment in Basic electricity before and after treatment. BEAT was used for pre-testing and post-testing the subjects.

The determination of the face validity of BEAT was done by a team of experts comprising two technical educators, two basic electricity teachers and one specialist in Measurement and Evaluation. The corrections they made were adequately done before the final copy of the instrument was produced. The reliability coefficient of BEAT was determined as 0.79 using split-half estimate and Spearman-Brown's correlation factor.

**Experimental Procedure**

The researcher developed four lesson notes for each of the two questioning technique. The notes have built-in mode questions that were used for classroom interactions. The lesson notes were used by the Basic electricity teachers of the sampled colleges (Sulaiman B Technical College Suleja and Government Science Technical College, Garki). Before the experiment commenced, the researcher held a pre-experimental training for the Basic electricity teachers who served as research assistants. The training centred on the focus of the study and how to use the lesson plans appropriately.

Before the experiment, both groups were pre-tested. The pre-testing involved administration of BEAT to the subjects. After pre-testing, the treatment began and it lasted for five weeks. This experiment was done during the normal 'school periods. The wait time in questioning was measured using a wristwatch with liquid crystal display (LCD), which displays time in seconds. '

The experimental group was exposed to shifting interaction in questioning by redirection of questions from one student to the other while probing each student's response. The emphasis here was on using the students to get the right answer and ensuring the participation of as many students as possible within a certain frame. Whether a student was willing to answer a

question asked or not was not important here. The teacher made sure that almost all- the students had an opportunity to answer the question in class by asking both willing and non-willing students. He did not give the students long time of silence to think but he was patient enough to probe any answer supplied by a student whether right or wrong. The teacher developed more questions from one student's answer, which he distributed to other students thereby giving almost every student a fair opportunity to attempt one question or the other in a lesson. The teacher guided the students in such a manner as to lead the students to arrive at an answer to a question by themselves without the teacher supplying the answer. The control group was exposed to conventional method of questioning which involve asking students questions in a normal way without probing.

At the end of the five weeks of experiment, the students of the two groups were post-tested which also involved administering BEAT to the students. Data collected from pre and post were used to answer the research questions and test the hypotheses. The research questions were answered using mean scores and standard deviation while the hypotheses were tested using ANCOVA.

## Results

The results of the analyzed data are presented and interpreted in line with the research questions and hypotheses.

**Research Question 1:** What is the effect of shifting interaction questioning in classroom on students achievement mean scores in basic electricity concepts?

**Table 1:** Achievement mean scores and standard deviation of scores of students exposed to shifting interaction and conventional questioning technique in basic electricity

| **Group** | **N** | **Pretest** | | **Posttest** | | **Mean Gain** |
|---|---|---|---|---|---|---|
| | | $\overline{X}$ | **SD** | $\overline{X}$ | **SD** | |
| Experimental | 84 | 4.39 | 2.18 | 25.34 | 4.32. | 20.95 |
| Control | 81 | 4.24 | 1.94 | 17.70 | 1.94 | 13.46 |

**Key:**
N = Number of subjects
$\overline{X}$ = Mean\
SD = Standard Deviation

The data presented in Table 1 show that the experimental group had a mean score of 4.39 and a standard deviation of 2.18 in the pretest and a mean score of 25.34 and a standard deviation of 4.32 in the posttest making a pretest, posttest mean gain in experimental group to be 20.95. The control group had a mean score of 4.24 and a standard deviation of 1.94 in the pretest and a posttest mean score of 17.70 and a standard deviation of 3.24 with a pretest, posttest mean gain of 13.46. With this result, the students in the experimental group performed better in the achievement test than the students in the control group. Hence, shifting interaction questioning technique is effective than the conventional questioning technique on students achievement in basic electricity.

**Research Question 2:** What is the effect of gender on students' achievement mean scores in basic electricity in shifting interaction classroom questioning?

**Table 2:** Achievement mean scores and standard deviation of scores of students exposed to shifting interaction and conventional questioning techniques by gender in basic electricity

| | **Shifting Interaction questioning technique** | | | | | **Conventional questioning technique** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Gender | N | Pretest | SD | Posttest SD | *Mean Gain* $\overline{X}$ | N | Pretest SD | Posttest SD | | *Mean Gain* $\overline{X}$ |
| Male | 84 | 4.37 | 1.93 | 24.13 3.32 | 19.76 | 60 | 4.10 1.85 | 19.02 3.65 | | 14.92 |
| Female | 23 | 4.44 | 2.04 | 26.45 3.68 | 22.01 | 21 | 4.12 1.95 | 19.13 3.75 | | 15.01 |

**Key**

N = Number of subjects

$\overline{X}$ = Mean

SD = Standard Deviation

The data presented in Table 2 show that female students had a mean score of 4.44 and a standard deviation of 2.04 in the pretest and a mean score of 26.45 and a standard deviation of 3.68 in the posttest making a pretest, posttest mean gain of the female students in basic electricity during shifting interaction classroom questioning technique to be 22.01. Meanwhile, male students had a mean score of 4.37 and a standard deviation of 1.93 in the pretest and a posttest mean of 24.13 with a pretest, posttest mean gain of 19.76 in basic electricity during shifting interaction classroom questioning technique. Also, male students had a mean score of 4.10 and a standard deviation of 1.85 in the pretest and a mean score of 19.02 and a standard deviation of 3.65 in the posttest making a pretest, posttest mean gain in the male students in basic electricity using conventional questioning technique to be 14.92. Meanwhile, female students taught had a mean score of 4.12 and a standard deviation of 1.95 in the pretest and a posttest mean of 19.13 and a standard deviation of 3.75 with a pretest, posttest mean gain of 15.01. With these results female students had higher mean scores than male students in the Achievement Test. Thus, there is an effect attributable to gender on the achievement of students in basic electricity during shifting interaction classroom questioning technique.

**Hypotheses**

$Ho_1$: There is no significant difference in the achievement of basic electricity students exposed to shifting interaction and conventional Questioning Technique.

$Ho_2$: There is no significant mean difference between the effects of gender on students' achievement in basic electricity when exposed shifting interaction questioning technique.

$HO_3$: There is no significant interaction effect of treatments on gender with respect to their mean scores in basic electricity Achievement Test

Table 3, shows the Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control groups in the Achievement Test, Effects of Gender and Interaction Effect of Treatments given to Students and their gender with respect to their mean scores in the basic electricity Achievement Test.

**Table 3:** Summary of Analysis of Covariance (ANCOVA)

| Source | Sum of Squares | df | Mean Square | f | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 992.311[a] | 4 | 239.046 | 46.379 | .000 |
| Intercept | 1699.012 | 1 | 1699.012 | 331.007 | .000 |
| Pretest | 3.456 | 1 | 3.456 | .666 | .415 |
| Group | 772.970 | 1 | 772.970 | 152.128* | .000 |
| Gender | 24.990 | 1 | 24.990 | 4.794* | .029 |
| Group * Gender | 4.997 | 1 | 4.997 | 1.006 | .327 |
| Error | 502.335 | 100 | 5.008 | | |
| Total | 48878.000 | 165 | | | |
| Corrected Total | 1502.642 | 104 | | | |

*Significant F< .05

The data presented in Table 3 shows F-calculated values for mean scores of experimental and control groups in the achievement test, gender and interaction effect of treatments and gender on students' achievement in basic electricity. The F-calculated value for Group is 152.128 with a significance of F at .000 which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result, there is a significant difference between the mean achievement scores of students exposed to shifting interaction questioning technique and conventional Questioning Technique. The F-calculated value for gender is 4.794 with a significance of F at .029 which is less than .05. This means that there is significant difference between the effects of Gender on students' achievement. Therefore, the null hypothesis of no significant difference between the effect of gender (male and female) on students' achievement in basic electricity is rejected at .05 level of significance. The interaction of treatments and gender has F-calculated value of 1.006 with significance of F of .329. Since .329 is higher than .05, the null hypothesis for interaction effect of treatment and gender is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the basic electricity Achievement Test.

**Discussion of findings**

Table 1 showed that the experimental group had higher achievement mean gain score than the control group. This is further supported by the ANCOVA result in Table 3, which showed that there is significant differences in the achievement mean scores of the treatment groups at P< 0.05. Shifting interaction had a more positive effect on students' achievement in basic electricity than the conventional questioning technique.

The significant difference in achievement mean scores obtained in favour of shifting faction may be as a result of the fair distribution of questions in class. This is in agreement with the submission of Brualdi (1998), who asserted that fair distribution of questions in the classroom enhanced students' participation and stimulate student interest in the lesson. In shifting interaction both the higher achieving students and the lower achieving students had equal chances of attempting questions asked in class. The result of this study is in line with the findings of Cotton (2001), who stated that redirection of questions and probing are positively related to achievement. The fair distribution of questions keeps the students alert as the question can get to any of them anytime. Before it gets to anybody's turn, the person would have been thinking about the answer to the question and because the teacher digs deeper, the students are faced with more challenges which help to sharpen their thinking skills. However, literature did not contain information on a comparative study such as this. The result of this study suggests that students understanding and learning were enhanced more by the use of shifting interaction questioning technique in teaching than the use of conventional questioning technique.

Table 2 showed that in shifting interaction group, the female students had higher mean gain score than their male counterpart. This suggests that possibly Shifting Interaction had more positive effect on the achievement mean score of female students. This higher mean gain score recorded by female students of Shifting Interaction group seems to support the view of Okeke (2001), that any instructional strategy that sticks to calling just the volunteers to answer questions put women learners at disadvantage. The fair distribution of questions may have given the females edge over the males since females do not rush to raise their hands up and be thinking while already answering the question. While males are struggling to dominate the class discussion, they take the opportunity to think through the answer to the question. Shifting interaction frees females from male dominance in class discussion and enhances their interest in what is being studied since questions are distributed irrespective of whether one raised the hand or not. However, the ANCOVA result on Table 3 showed that the interaction effect ($P< 0.05$) between gender and the questioning techniques on students' achievement in basic electricity is not significant.

**Conclusion and Recommendations**

Basic electricity teachers have a role to play in using classroom interaction patterns that would make teaching and learning process more effective. Shifting interaction questioning technique has been shown to be one of such effective interaction means and the onus lies on the basic electricity teacher to use it in class. This is because the result of this study has shown that students exposed to shifting interaction achieved better than those exposed to conventional questioning technique. Since this study has shown that there was no interaction effect between gender and treatment on students' achievement, both male and female students should be exposed to Shifting Interaction questioning technique. On this note, the use of Shifting Interaction has been shown to enhance students' achievement in basic electricity more than conventional. This perceived strength in Shifting Interaction should be led by basic electricity teachers while teaching seemingly difficult basic electricity topics that may discourage students in learning basic electricity. Basic electricity teachers in schools should try to exclusively use shifting interaction technique because of its effect on female learners.

Based on the findings of this study, the following recommendations are made:

(i) Teachers, especially basic electricity teachers should practice the use of shifting interaction questioning technique as part of their teaching techniques since this study has shown that shifting interaction questioning technique is a better questioning technique to use than convention questioning technique for effective classroom teaching.

(ii) Basic electricity teachers in girls' schools should try to exclusively use shifting interaction questioning technique in classroom interaction since it has been shown to favour female learners.

(iii) The State and Federal Governments should from time to time organize workshops and seminars to sensitize teachers on effective teaching techniques. This would enable teachers to increase their knowledge base on such teaching techniques.

(iv) Basic electricity textbook authors and publishers while preparing teachers' guide-textbooks should emphasize the use of shifting interaction as an effective technique of conducting classroom questioning. This is to always draw the attention of teachers to the importance of such effective questioning technique.

(v) Professional associations like National Association of Teachers of Technology (NATT), Science Teachers Association of Nigeria (STAN), Association for Promoting Quality Education in Nigeria (APQEN), should also undertake to organize periodic training sessions in the form of workshops or seminars for basic electricity teachers on the use of effective questioning techniques like shifting interaction to improve classroom teaching and learning.

(vi) Faculties of Education in Universities, Colleges of Education and other teacher education institutions should emphasize the use of effective questioning techniques like shifting interaction while training the would-be classroom teachers. This would

enable the student-teachers to be armed with the necessary competencies needed to make a good teacher.

(vii) Federal and State governments should also provide other incentives that can improve the interest of female students in basic electricity.

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