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Influence of Classroom Interaction Patterns on Student Achievement in Basic Electricity at Technical Colleges in Federal Capital Territory, Abuja

Owodunni A. Samuel
Federal University of Technology Minna
Department of Industrial and Technology Education
Niger state, Nigeria

Abstract

The purpose of this study was to investigate the influence of classroom interaction patterns on achievements of Basic Electricity students in Technical Colleges in Federal Capital Territory, Abuja. A research question and one null hypothesis tested at 0.05 level of significance guided the study. The design of the study was a causal comparative or (expost-facto). The population of the study was 123 Basic Electricity students in Government Technical Colleges in Federal Capital Territory. The students were categorized into two groups based on previous Basic Electricity classroom interaction Categorization test (PCICT)). They were required to make responses based on their personal experience during Pervious Basic Electricity classroom Activities (PCICT). The instrument used for data collection was Basic Electricity Achievement test (BEAT). The instrument was face and content validated by three Basic Electricity Educators and two experts in Measurement and Evaluation. The reliability coefficient of BEAT was established using Kuder- Richardson formula 20 (K-R20) and this yielded an internal consistency of 0.76. Mean and standard deviation were used to answer the research question while one- way Analysis of Variance (ANOVA) was used to test the null hypothesis. Results of the study revealed that classroom interaction patterns significantly influenced students' achievements in Basic Electricity. Recommendations made among others were that classroom interaction patterns be adopted for effective teaching of Basic Electricity in Technical Colleges.

Keywords: Classroom interaction patterns, Achievement, Teaching methods and basic electricity

Introduction

Basic Electricity is one of the science and technology subjects offered in Technical Colleges in Nigeria. Studies have shown that under achievement in science and technology subjects such as Basic Electricity is linked to inappropriate methods of teaching in Technical Colleges (Aina 2000, Oranu, 2003, Federal Ministry of Education, 2000 and Nwagbo & Ohielcwe, 2009). For instance, classroom observations in many Nigerian schools and colleges during teachers' supervision showed that majority of the teachers' do not apply appropriate strategies as identified and recommended to be effective for science and technology instruction (Norom, 2009). Basic Electricity classroom activities are still dominated by teacher-centred instruction, which have been found to be ineffective in promoting Basic Electricity learning at technical college (Uzoechi, 2008). These observations are true, irrespective of the subject concerned or the experience of the teacher involved or the nature of the topic being handled (Busari, 2007). Teacher-dominated discourse is not an effective way to promote high-order thinking skills among students. This is because students are inhibited from sharing ideas with the teacher instead they are expected to comply with commands or orders without questioning. The method is related to the lecture method of teaching which affords little or no interaction between the teacher and the students during classroom activities (Viiri and Saari, 2006)

The ineffective teaching methods used in Basic Electricity delivery have been the most important factor in underachievement (Federal ministry of education, 2000). Some of these factors include incompetent mode of lesson delivery by teachers, inadequate use of instructional materials, students' attitude, and ill-equipped laboratories (Umeh, 2008). All these lead to weak classroom discourse based on rote memorization and no provision for adequate development of intellectual and thinking skills among students. Basic Electricity lessons are therefore characterized by a rigid teacher-centred pattern where students' active participation is not allowed, with the absence of opportunity for students to participate in class activities and classroom interaction quickly deteriorated into meaningless waste of time. The Basic Electricity practical and project work which were supposed to equip the students with the necessary practical skills and competencies for functional living in the society are relegated to the background (Ereh, 2005). The learning of Basic Electricity now involves listening, copying and cramming of notes, transfer of learning is at low "ebb leading to low achievement in Basic Electricity". There is a need therefore, to investigate the problem of poor classroom interaction patterns, since achievement in Basic Electricity is still not impressive.

In teaching-learning process, classroom interaction pattern is the way a teacher discusses, converses, talks and expresses verbally and non-verbally to students during learning activities. It is the verbal communication pattern or style of the teacher and the students in a classroom activity. Krat and Kratcoski (2004) opined that classroom interaction is a two-way action between the teacher and the students which may affect learning depending on the clarity of the message. An interaction that occurs in a classroom forms a communication context for learning. These assertions indicate that classroom interaction patterns are essential in teaching and learning situation and would be classified to identify the various types.

Copper and Robinson (2000) pointed out that classroom interaction are in four-dimensional pattern involving interaction between teacher- student, student-student, teacher-material and student-material. The following are the characteristics of each of the patterns as revealed by literature. Teacher- student interaction pattern consist of where the teacher initiates, guides and directs classroom talk with students (Viiri and Saari, 2006).

The uniqueness of teacher-student interaction pattern is not the same as that of the student-student interaction pattern. Student-student interaction pattern enables students talk with their peers (Classmate) in a group to solve a common problem (Viiri and Saari, 2006). This discourse pattern involves the participation of every member of the group. The teacher, after teaching, divides the students into 6 students per group, each group with a peer leader, who is trained by the teacher to lead the group. The students discuss assignments given to them by their teacher in groups, while the teacher coordinates them. Low level ability students are helped by their colleagues who know better and can cope with the discussion as they learn cooperatively. The student-student interaction pattern is used to implement the co-operative/collaborative learning strategy because they are similar characteristics (Muodomugo, 2005). Student-material interaction pattern enables an individual or a class to work with instructional materials. Other examples of student-material interaction pattern include: reviewing and expanding lecture notes, reporting practical work, carrying out experiments, searching the internet and reading materials on a website (Smith, 2000). It involves students' active participation and acquisition of manipulative skills (Okoli, 2006). In the teacher-material interaction pattern the teacher illustrates teaching with instructional materials in the classroom (Jaja, 2002). Obodo (2004) found out that instructional resources are potent tools, which can be used to effectively communicate, while enriching the learning experiences of the learners. Also, Obioha (2005), found out that classroom interaction patterns can rotate from teacher to learner, learner to teacher, learner to learner, individually or in groups, verbal expression to chalkboard demonstration, sensory to tactical, visual to audio-visual and listening to performance.

In context of this study, classroom interaction patterns in teaching and learning process is a communication style used to pass information to the learner or simply teacher-student talk pattern in the classroom. The aim is to ensure that learning takes place through the pattern that prevails (Okafor, 2000). The extent of learning taking place in a classroom depends to a great extent, on the magnitude and mode of the teacher's interaction with the learner, the learning materials and the environment. This implies that teachers should provide an interactive teacher-student setting to increases students' cognitive development.

Innovations teaching methods and techniques that have been used in teaching Basic Electricity seem not to have positively influenced the achievement of students in Basic Electricity, since achievement still remains poor (Saka-Alikinla, 2015). The situation raises some doubts as to whether there are other variables such as classroom interaction patterns that can inhibit achievement in Basic Electricity. Therefore, this study is aimed at investigating the influence of classroom interaction patterns on students' achievement in Basic Electricity in technical Colleges in Federal Capital Territory, Abuja.

Statement of the Problem

Basic Electricity is a popular science and technology subject offered by both science and technology students in technical college. Literature has however revealed that students' underachievement in science and technology subjects such as Basic Electricity is linked to inappropriate methods of teaching in technical college. The persistent poor performance coupled with poor classroom practices has resulted in few students choosing Basic Electricity related courses as career. This has therefore created an educational gap of students not continuing their studies in Basic Electricity related courses at tertiary institutions. This gap can be filled by devising a more effective strategy for improving the situation in order to meet the needs of the students and the society at large. It is therefore certain that without using an effective remedial strategy, Basic Electricity teaching and learning may continue to be poor in our schools.

In view of this situation, effective classroom interaction patterns may be useful in teaching Basic Electricity in order to improve the persistent poor performance in Basic Electricity. The problem of this study posed as a question therefore is: What influence do classroom interaction patterns have on achievement in Basic Electricity in technical Colleges?

Purpose of the Study

The purpose of the study was to investigate the influence of classroom interaction patterns on students' achievement in Basic Electricity

Research Question

What is the influence of classroom interaction patterns on the mean achievement scores of students in Basic Electricity?

Hypothesis

HO: Classroom interaction patterns have no significant influence on the mean achievement scores of students in Basic Electricity.

Methodology

The study was a causal comparative or (expost4acto) design, where the independent variables among subjects cannot be manipulated or controlled. The subjects are studied in their settings without any behaviour modifications introduced by the researcher.

The population of the study consisted of all 123 Technical Two (TC II) Basic Electricity students in Government Science and Technical College (GSTC) Garki and Federal science and Technical College (FSTC) Orozo all in FCT. The entire population was used for the study. GSTC Garki had one intact class of 48 that offered Basic Electricity and FSTC Orozo had two intact classes of 73 that offered Basic Electricity. The students were categorized with Previous Basic Electricity Classroom Interaction Categorization Test (PCICT) which also classifies learners into (a) Teacher Active, Students Mainly Receptive, (b) Teacher Active, Students Equally Active and Students Active, Teacher Partly Receptive. These two categorization tests were administered effectively with the help of the trained research assistant in each technical college.

Basic Electricity Achievement Test (BAT), constructed by the researcher was the only instrument used for data collection in this study. Developed BAT is a multiple-choice objective test. Each item has 4 options, lettered A — D. The test was based on the units of study in TC II Basic Electricity curriculum used for the study. The researcher initially constructed 100 multiple-choice items before face validation. The items measured the six objectives in the cognitive domain of Bloom's taxonomy of educational objectives. A table of specification was used in constructing the BAT objectives items. The weighting for the objective levels were based on the proportion of the low and high order performance objectives in the unit of study. The instrument was validated experts in Basic Electricity. BAT reliability coefficient was determined with Kuder-Richardson 20 (K — R20) methods and was found to be 0.76.

The researcher briefly trained three research assistants each with B.Sc. (Ed) qualifications for two hours each day for three days on the concepts of classroom interaction patterns and its relevance in teaching/learning process were explained to the participants. The researcher taught them that classroom interaction using PCTCT categorizes was designed specifically to classify learners into different categories of learning. The relevance was to assist in meeting the learners' needs during teaching/learning process. The Researcher Assistants were taught how to identify classroom interaction patterns in teaching/learning

situation and previous classroom interaction patterns in a teaching/learning situation. The participants were required to share their experiences as regards to poor results in Basic Electricity.

The categorization test used in this study was Previous Classroom Interaction Categorization Test (PCICT). The PCICT has a scale range and was designed to assess interaction processes of the learners in the previous Basic Electricity classroom activities and was also used to classify learners into three categories. The three categories are: (a) Teacher Active, Students mainly Receptive ranging from 1 to 1.49; (b)Teacher Active, Student Equally Active ranging from 1.50 to 2.49; and (c) Student Active, Teacher Partly Receptive ranging from 2.49 to 3.00. They were required to make responses based on their personal experience during previous Basic Electricity classroom activities. PCICT is preferred for use in this study because it provides a range to identify different types of interaction processes in previous Basic Electricity classroom activities. This was administered in the two technical colleges to students with the help of the trained research assistants. This provides a range to identify different types of interaction processes in previous Basic Electricity classroom activities. At the end, BAT instrument was administered on each of the students in the colleges. The scripts from students were marked and recorded using the marking guide. The scores collected were used for data analysis.

Data were analyzed using descriptive and inferential statistical methods. The research question was answered with mean and standard deviation while Analysis of Variance (ANOVA) was used to test the null hypothesis at 0.05 level of significance. To determine the direction of the difference for significant means, post-hoc multiple comparison test were conducted, using the scheffe method. This method was deemed appropriate because it is applicable to groups of unequal sizes.

Results

The result of this study is presented in accordance with the research questions and hypotheses that guided the study.

Research Question

What is the influence of classroom interaction patterns on the mean achievement scores of students in Basic Electricity?

Groups	Previous classroom interaction category	N	Mean	Standard deviation
PCIC 1	Teacher Active, Students Mainly Receptive	32	28.33	5.25
PCIC 2	Teacher Active, Students Equally Active	40	26.35	6.28
PCIC 3	Students Active, Teacher's partly Receptive	51	23.65	5.15
Average Mean and Standard Deviation			**26.11**	**5.56**

Table 1: Mean Achievement scores and Standard Deviation of Students in Basic Electricity in Previous Classroom Interaction Categorization test (PCIC)

Data on table one shows that students of group 1 in Teacher Active, Students Mainly Receptive in Previous Classroom interaction category test had a mean achievement score of 28.33 and standard deviation Of 5.25. Students of group 2 in Teacher Active, Students Equally Active in Previous classroom interaction category test had a mean achievement score of 26.35 and standard deviation of 6.28. While students of group 3 in Students Active, Teacher's Partly Receptive in Previous classroom interaction category test had a mean achievement score of 23.65 and standard deviation of 5.15. PCIC 1, 2, 3 are the rating scales of Previous Basic Electricity Classroom Interaction Categorization Test which was developed and adapted by the researcher.

Hypothesis

HO: Classroom interaction patterns have no significant influence on the mean achievement scores of students in Basic Electricity.

To test this hypothesis a one-way Analysis of Variance was done.

Source	Df	Sum of squares	Mean Squares	F	Sig	Decision
Between Groups	2	871.7333	399.8220	9.2883	0000	S
Within Groups	120	11324.6273	43.3043			
Total	**122**	**12196.3606**				

Table 2: One-way Analysis of Variance (ANOVA) of students' means Achievement scores in Basic Electricity in Previous Classroom Interaction Categorization Test (PCIC)

The data on table 2 shows that students' mean achievement scores in Basic Electricity in the previous classroom interaction category differ significantly in achievements. This is indicated by the calculated F-value of 9.2883, which is significant at .0000, which is less than 0.05 level of probability. Therefore, the null hypothesis of no significant influence of classroom interaction patterns on the mean achievement scores of students' in Basic Electricity is rejected. This suggest that there is a significant influence of classroom interaction patterns on the mean achievement scores of students in Basic Electricity in the previous classroom interaction category test, which consists of three categories namely; Teacher Active, Students Mainly Receptive (group 1), Teacher Active, Students Equally Active (group 2) and Students Active, Teacher Partly Receptive (group 3) respectively. To find out the direction of difference, a Scheffe post hoc multiple comparison tests between two means, at 0.05 level of significance were carried out and presented in table 3.

Table 3: Scheffe Post-hoc Multiple Comparison Test between two mean scores in Previous Classroom Interaction Category.

The difference between two means is significant if
Mean (J) — Mean (I) > = 3.7562 *RANGE *
SOQT ($1/_N$ (I) + $^1/_N$ (J) with the following value(s) for Range 2.85
*indicates significance differences which are shown in the table below

Mean	PCIC
23.65	Grp 3
26.35	Grp 2*
28.33	Grp 1*

(*) indicates group significant difference at 0.05 level of significance.

The results as shown in table 3 revealed that each group in previous classroom interaction category differed significantly from each other. The result showed that students in group 3 had a mean score of 23.65 which differed significantly from group 2 and group 1 respectively. The students in group 2 had a mean score of 26.35 which differed significantly from group 1 and group 3 respectively. While the students in group 1 had a mean score of 28.33 which differed significantly from group 2 and group 3.

This implies that students in group 1 performed better than group 2 and group 3 respectively. While the group 2 students performed better than group 3 students in Basic Electricity achievement test. Therefore, classroom interaction pattern had a significant influence on the mean achievement scores of students in Basic Electricity.

Discussion

The results of the data analysis presented on table one revealed that the mean score of students in Teacher Active, Students Mainly Receptive group 1 in Previous Interaction Classroom was 28.33, while the mean score of students in Teacher Active, Students Equally Active group 2, was 26.35. The same table also indicated the mean score of students in Students Active, Teacher's Partly Receptive group 3 as 23.65. A test of hypothesis of no significant influence of classroom interaction patterns on the mean achievement scores of students in Basic Electricity was rejected (calculated F-value 9.2883 which is significant at .0000, but is not significant at 0.05 level of probability). This implies that there is a significant influence of classroom interaction patterns on students' means achievement scores in Basic Electricity.

The relative effectiveness of classroom interaction patterns in enhancing students' achievements could be due to the unique characteristics in the teacher-student interaction pattern. The teacher guides and directs the classroom talk towards a specific target (Viiri and Sari, 2006). The teacher in playing this guidance role moderates students' effort such that where there is a mistake or a digression, the teacher puts the students' right, so that students can make meaningful contributions. This result is also in line with the findings of Hogan, Nastasi and Pressley (1999), that, teacher-guided discussions are more efficient means of attaining high levels of reasoning and higher quality of explanations.

The teacher-student interaction pattern on the other hand is participatory and democratic in that the teacher allows the students to participate actively in the lesson; while at the same time the teacher gives the students' praises and encouragement when they make correct attempts. In addition, the teacher entertains questions and free interaction exists between the teacher and the students (Viiri and Saari, 2006); which encourages students to contribute freely on what they know or discovered during the learning process. Teacher-student participatory affairs, during lesson can be synonymous to a learner-centred approach in teaching. It is no doubt an essential ingredient in students' optimal academic achievement and good classroom climate (Onimisi, 2006). The promotion of good classroom interaction therefore lies with the teacher that provides the enabling social and psychosocial atmosphere through democratic leadership style during lessons and personal qualities that must be endearing (Onimisi, 2006).

The student-student interaction pattern or discussion pattern promotes co-operative learning; the participants strive for mutual benefits among group members (Agarka, 2002). The students' under this learning encounters work collaboratively in order to seek solution to a common problem by supporting each other. The low ability level students in the group are helped to improve through interactions with the other colleagues that are brighter. This could account for the observed improved achievement of students' in Basic Electricity.

The student-student learning discussion incorporates the elements of listening, talking, questioning, responding, reflecting, exchanging viewpoints, debating, writing answers and comments to questions and reading assignments for class discussion. Hence, students learn through social interaction which is a powerful learning tool in the educational system (Smith, 2000). This result is in line with Lee's (2000) finding, that only 11 out of 42 learners spoke during questions and answers discussion in the teacher fronted discussion, while 46 out of 46 learners spoke during the group discussion among students which showed participation of every students in a lesson. The finding of the study is also in line with that of Hogan, Nastasi and Pressley (1999) that peer discussion tended to be more generative and exploratory. The finding implied that students found out facts which helped them to contribute meaningfully to achieve better results.

The finding that students' mean achievements scores in Basic Electricity were significantly influenced by classroom interaction patterns is in agreement with the findings of Okoli (2006) and Anekwe (2006), that two interaction learning styles, co-operative and

competitive significantly enhanced students' achievement in Basic Electricity and chemistry, than conventional learning styles. The result also agreed with Kalu (2004) that classroom interaction patterns correlated significantly with students' academic achievement in physics.

However, the finding does not support the study of Okafor (2000) that finds no significant influence of classroom interaction patterns on students' mean achievement scores in Basic Electricity. Thus, Shomossi (2004) and Edet (2006) studies were in conformity with the findings that classroom - correlated significantly with students' academic achievement in physics. Udeani (1992) and Onimisi (2006) studies were in agreement with the findings that more democratic participatory interactions offer higher premium to integrated science students. In the same manner, the result is in agreement with Okebukola (2004), that cooperative learning experience facilitated achievement of students' learning in Basic Electricity and chemistry respectively. As a result of this relationship the findings of these studies were used to support the findings of this study. Therefore, the finding that classroom interaction patterns significantly influenced students' academic achievement in Basic Electricity is not misleading.

Conclusion

From the results of this study, it is clear that persistent poor students' achievement in Basic Electricity could be attributed to teachers' inability to look at classroom interaction patterns in the context of teaching. This is because with the use of this variable as main influence in this study, achievement of students improved greatly. It is hoped that mass adoption of classroom interaction patterns in teaching would bring about the much desired improvement on learning outcomes in Basic Electricity. It is a known fact that curriculum change is a gradual process which needs the input of experts in order to improve achievement in a given subject. With this fact in mind, classroom interaction patterns can skillfully and gradually be included in the Nigeria's school curriculum in order to achieve better results in Basic Electricity.

Recommendations

From the result of this study, the following recommendations are made:

1. It is evident that since the adoption of the classroom interaction patterns was found to be effective in improving students' achievement in Basic Electricity, teachers should use classroom interaction to facilitate their Basic Electricity teaching.
2. The curriculum of teacher education in the country should include the use of classroom interaction patterns during teaching to identify learners' problem in Basic Electricity.
3. Training workshops and seminars should be organized and made compulsory for practicing teachers to embrace the skills of classroom interaction patterns for effective implementation in teaching and learning process.

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