Analysis of Classroom Interaction Patterns and Students' Learning Outcomes in Physics in Kogi State, Nigeria

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***Abstract*—** The paper is a research investigation on the analysis of classroom interaction pattern and students' learning outcomes in physics in Ankpa education zone of Kogi state, Nigeria. The study was guided by three research questions. The study adopted descriptive survey design. The population of the study comprised of all the secondary schools and all the physics teachers in Ankpa education zone of Kogi state. A sample of 344 SSI students was used as respondents (227 males and 117 females) and 10 physics teachers (9males and 1 female). Total sample size for the study was 354 for both students and teachers drawn from 10 intact classes of SS1 physics in 10 secondary schools in the zone using purposive sampling technique. The instrument used for the collation of data was direct observation manual (DOM), a modified Flanders interaction analysis category. The instrument was face-validated by 2 experts in physics education and one expert in measurement and evaluation both from Kogi State University, Anyigba. The reliability coefficient of the instrument DOM was determined using Pearson product-moment correlations to be 0.78. Data collected were analyzed using simple percentage. The raw scores are converted into percentages. The results of the findings are coded based on the average percentages of the boys (males), girls (females) and choral responses (the whole class) to the teachers' question. The findings of the studies revealed that questions that elicit answer and repetition purpose were mostly answered chorally in both single and mixed schools and that the feedback of the teacher affects the pattern and extent of classroom interaction in physics lesson. The study revealed that teachers use only one style of feedback, affirmation, more, neglecting other forms of feedback styles that can enhance positive interaction among teachers and learners for better learning outcomes in physics teaching and learning. The study equally revealed that feminine gender interacts positively among themselves than the masculine gender in the physics lesson. This indicates that girls are shy of interacting with the teacher and the boys during classroom instruction in physics. Analysis of the research revealed that the teachers do not interact actively with their students and most of the physics teachers lack the qualities of a good teacher. Teachers adopt only one method of teaching which was mainly for the lecture method. The opportunity to interact more among themselves and quality of classroom interaction was very poor. Boys had a greater proportional share of positive interaction pattern than the girls during physics lessons. Based on the findings, recommendations were made, that physics teacher should avoid discrimination in their classroom interaction with male and female students. Girls should be motivated in whatever way possible to participate in classroom interaction since it helps them to learn better among others.

***Keywords*—** Analysis of Classroom Interaction, Pattern of Interaction, Students' Learning Outcomes and Physics.

INTRODUCTION

Science as an instrument of development plays a dominant role in bringing about changes by advancing technological development. We live in a scientific and technological age where science and technology has proved useful in man's everyday life to control the environment and live in a comfortable world. This assertion is supported by the national policy of science and technology which states that, science and technology have become critical factors of economic and social development. Though resources of nature have been transformed into goods and services for a better quality of life. Thus inspite of the tremendous growth of world population, the application of science and technology to agriculture has sustained the population. Balogun asserted that advances in science and technology have assured man of comfortable living, improved thinking process and very importantly conserved his energy for other activities. This means that science and technology provides a basis of all round development of a country. Science and technology provides basic infrastructures that enable man to live comfortably, among which are shelters, good medicare, communication, drinking water and nourishing food. For man to live comfortably in the society or age of science and technology, man therefore has to acquire the knowledge of science to live productively and skillfully, so that he can have dominant social and economic

forces. Thus the importance of functional science education programme cannot be overemphasized.

In stating the importance of science programme for any society, Achor (2015) emphasized that, the influence of science on national policy, on the economic and political problems, and on the life of each person means that everyone needs an understanding of science. Men and women who are devoid of science background will be excluded from the intellectual life of time and blindly buffeted by the forces that give direction and meaningful living. This means that the knowledge of science and technology is very vital, irrespective of gender. It therefore implies that the government should make effort to promote science and technology in the society (Akpan, 2016). The government should encourage the enrolment of science in schools especially physics, which is the basis for development of a country.

Physics is the heart of science and the heartbeat of most technological activities to develop modern technological activities. To develop a modern technology, the study of physics is inevitable, since it explains the study of forces of nature and it is armour against superstition (Egglestore, Galton & Jones, 2013). This prompted technological advancement anywhere there is sound knowledge of physics. Unfortunately, it is only few students who enroll for the subject and these few do not have sound knowledge of the subject as shown by their consistent poor performance in school certificate examination in physics.

The poor performance or outcome in school certificate examination in physics as evident in chief examiners' report (2010 – 2018) are indications that something is definitely wrong with the study of physics education in our secondary schools. In line with this, Ezewu (2012) had earlier identified the area of deficiency of teaching and learning process occasioned by lack of laboratory facilities and materials which make the teaching and learning of physics basically theoretical. Onwuka (2013) described the situation of poor teaching of physics more bluntly when he stated that science teaching in most Nigerian schools is abominably dull and intellectually deadening as a memorizing moral aphorism out of the scripture. This implies that teaching of sciences especially physics in secondary schools is unsatisfactory. Physics should be taught in the aspects of imagination, investigation and experimentation using appropriate teaching method that can enhance fruitful and positive interaction between both genders in the physics classroom for better outcome (Olarewaju, 2014).

Another observable and discouraging aspect of physics education, both in Nigeria and even in advanced countries is the relative under representation and un-achievement of girls in physics (Jones & Wheatley, 2011). For instance, a survey of seven secondary schools in Enugu North local government area, out of the total of 1990 girls and 1129 boys that registered for senior secondary certificate examination in 2010/2011 and 2011/2012 academic sessions, only about 448(22%) girls and 289 (25%) boys enrolled for physics and out of those that enrolled, only 74 girls (16%) and 81 boys (30%) obtained a credit pass in the school certificate physics examination (Abuh, 2021). Hence the need for the study to examine the interaction that takes place in the actual classroom during physics lessons. Akele Williams (2014) has asserted that girls are discouraged from participation in science and mathematics education by the dominantly male STM teachers.

Classroom interaction has been defined as the total of all teaching learning activities taking place in the classroom between the teacher, the learner and the learning materials during teaching – learning process (Okafor, 2014) such activities could be verbal or non-verbal. Okebukola (2012) stated that interaction patterns were designed used and they fall under the cooperative, competitive and individualistic patterns. The basic element of co-operative learners is positive interdependence, face to face interactions, individual accountability, interpersonal and small group skills. Competitive interactions, is where students work individually or as a group, so that goals are achieved. In individualistic learning situations, the students' goals are independent, therefore cannot be related to another students' goal (Johnson & Johnson, 2016).

Classroom interaction help the students socialize, develop desirable learning attitudes and help them develop problem solving skills (Uzuegwu, 2015). The effective use of interaction patterns in physics lesson enhances better achievement and increase the rate of development scientifically in the country. The question then is what type of interaction exists in physics classrooms? Are these interaction patterns dependent on the sex of the students or qualification and experience of the teacher? Therefore, this study seeks to explore the classroom interaction pattern in physics lessons and how it influences students' learning outcome in physics.

Each teacher prefers to conduct the class in a pattern that suites him/her best. The students in the classroom quickly adjust to the pattern of the interaction and establish a kind of attitude to coincide with the pattern. Therefore, classroom pattern depends on the teacher teaching the subject. Okafor (2014) investigated the pattern of classroom interaction in Biology classroom and found that teachers lecture 45.5%, ask question

5.2% and criticize 3.2%. He also found that students spent 16.5% of the class time taking down notes and responding to the teacher's questions. The study revealed that teachers spend most of the time talking to the students than the students talking to their teachers. The study carried out by Udueani (2014) revealed that the teacher contributes mainly to the learning outcome as a result of classroom interaction. The study further revealed that experience, which is one of the characteristics of the acquisition of skills and the qualification of the teachers also affect the interaction activities in the classroom.

Delamount (2014) carried out an investigation on dimension of classroom interaction in physics, the study revealed that the method of teaching adopted by the teacher, teacher's qualification and attitude towards teaching have greater influence on patterns of classroom interaction in sciences especially in physics. However, Charters (2015) carried out research on sex related differences of the boys outperforming the girls; the result shows that there is no differences in sex-related patterns of development; the boys as well as the girls contribute in classroom activities. The study revealed that both boys and girls perform equally in classroom interaction. Staberg (2015) the finding of his study revealed that the girls (females) did not participate in classroom interactions as the boys.

The study further revealed that boys (males) initiated more positive and negative interaction than girls (females). Okafor (2014) on classroom interaction in relation to the students' achievement and academic performance found a positive relationship between classroom interaction and student's achievement level. The findings further revealed that classroom interaction accounted for about 74% and 71% variation of students' cognitive achievement and process skill acquisition respectively. Based on the diverse assertions on the influence of classroom interaction, there is a need to carry out this study titled analysis of classroom interaction patterns and students' learning outcomes in physics.

STATEMENT OF THE PROBLEM

In order to promote learning of science subjects such as physics, the federal government of Nigeria through the national policy of education has formulated a 60:40 percentage ratio for science to Arts university admissions in favour of science. However, universities have not met the 60% admission quota for science due to students' poor performance in science subjects especially in physics at qualifying external examinations such as senior secondary certificate examination, (SSCE), national examination council (NECO) and joint admission and matriculation board (JAMB).

Teaching is not a one-way traffic. The teacher must interact with the students to find out the extent through which educational goals are achieved. This implies that improved learning outcomes are achieved when there is proper classroom interaction. In physics classroom, the interaction develops much scientific skills and attitudes. The teacher determines what goes on in the classroom instruction during physics lessons.

Based on the above, there is need to therefore identify the nature of classroom interactions during physics lessons, the extent the teacher interacts with the students, the teaching strategies they adopt, how the teachers qualification and teaching experience affect classroom interaction during physics lessons and the effect of gender difference in classroom interaction during physics lessons. Specifically, the following objectives guided the study.

1. The pattern of interaction between teachers – students in physics lesson.
2. The pattern of interaction between students – students during physics lesson.
3. The extent of interaction between gender (male & female) in the physics lesson.

In line with purpose, the following research questions were posed:

1. What is the pattern of teacher-student interactions in physics lesson?
2. What is the pattern of interaction between students-students in physics lessons learning outcome?
3. To what extent does gender (male & female) difference affect classroom interactions in physics lessons?

RESEARCH METHODOLOGY

This study examines classroom interaction patterns and students' learning outcomes in physics in Ankpa education zone of Kogi state, Nigeria. The study adopted descriptive survey design. Descriptive survey road map was used as the study concerns the identification, analyses and description of the classroom interaction during physics lessons, as they already exist (Best, 2007 in Abuh & Emmanuel, 2019). The population of the study comprises of all the secondary schools and all the physics teachers in Ankpa education zone of Kogi state. SSI physics classrooms were selected for the study. The choice of SSI was to enable the researcher know the level of increase or decrease in students' enrolment in SSII and III physics classes. Since students start studying physics as a separate

subject in SS2, their decision to either continue with or drop physics in SS2 may be dependent on their experiences in SSI. The sample size for the study is 354 (236 males, 118 females). It consists of 10 intact classes of SSI physics students in 10 senior secondary schools, selected using purposive sampling techniques. Ten (10) physics teachers were randomly composed from ten (10) selected secondary schools in Ankpa education zone of Kogi state. The selected schools were constituted by purposive sampling technique. The schools are GSSA, St. CC, Ankpa, RSS, Ankpa, OCGS, Okpo, OCSS, Ogugu, CSS, Imane, Sule Iyaji MSS, Abejukolo, GSC, Agaliwo, GSSA, ISSA Ankpa.

The instrument tagged Direct Observation Manual (DOM) was used for data collection. This instrument is a modification of Flanders' interaction analysis categories. The Direct Observation Manual was designed to know the initiation of classroom interaction by the teachers, the response of the students and the feedback by the teacher. The response of the students are seen from three perspectives, the response from boys only, the response from the girls only and the response from the both (that is, choral). The instrument was face-validated by 2 experts in physics education and one expert in measurement and evaluation from Kogi state university, Anyigba. To determine the reliability of the instrument, a pilot test was done using 3 physics teachers and three (3) classes from three schools outside the sampled schools for the study to find out what happens in the classroom during physics lessons.

The method of data collection in this study was the direct observation method. The researcher and the video cameraman went round to observe the pattern of interaction in five randomly sampled schools out of the ten sampled schools using Direct Observation Manual which is a modification of Flanders's interaction analysis categories. The observation manual consists of a definition sheet which directs the researchers on what to observe and record. The observation was recorded by tallying under the suitable spaces provided in the manual. Each of the schools (classroom) was observed for four lesson periods spaced over a period of 8 weeks, starting from the third week of the second term when lessons on the focal topics were taught in the schools. Only interaction during physics lessons were observed and coded. The observed events were coded every five (5) seconds. At the end of the eight-week observational period, the researcher played the video typed events and crosschecked with the recorded events of the interaction in the classroom on the Direct Observation Manual.

The main analysis techniques employed was the simple percentage. The raw scores converted into percentages. The results of the findings are coded based on the average percentages of the boys (males), girls (female) and choral responses to the teachers' questions. See figure1 in appendix A.

RESULTS

The results of the analysis are presented below in the order of the research questions:

Research Question One: What is the pattern of teacher – student interactions in physics?

Table 1: Raw Scores and Equivalent Percentage of Direct Observation

School	Initiation	Responses			Feedback								
		Boys RS/%	Girls RS/%	Choral RS/%	None RS/%	Affirms RS/%	Praise RS/%	Critical RS/%	Asks Others RS/%	Gives Answer RS/%	Probes RS/%	Comment RS/%	Uptake RS/%
Girls only	A(31/55) R(24/45)	– –	11(37) 0(0)	19(63) 25(100)	4(14) 10(40)	20(67) 11(47)	0(0) 0(0)	0(0) 0(0)	0(0) 0(0)	5(17) 2(8)	0(0) 0(0)	9(30) 6(24)	4(14) 2(8)
Boys only	A(45/67) R(25/33)	14(40) 0(0)	– –	17(48) 17(100)	2(6) 2(12)	17(49) 11(69)	4(12) 1(6)	5(15) 0(0)	7(20) 0(0)	10(29) 0(0)	0(0) 0(0)	5(15) 5(29)	2(6) 1(6)
Mixed school	A(135/74) R(84/26)	46(50) 1(4)	28(32) 1(4)	16(28) 25(92)	2(3) 2(7)	53(65) 20(66)	9(11) 7(23)	11(13) 0(0)	20(24) 0(0)	10(12) 0(0)	6(8) 0(0)	30(36) 6(20)	13(16) 5(16)

Table 1 show that the questions which elicit answer in school were found to be mostly in the choral response by 63% and 37% for the individual girls. The questions for repetition purposes were answered in the girls' school by choral (the whole class) by 100%. In the boys' schools, the boys answered questions that elicit answer more in choral response by 40%, the individual boys by 40% and 12% could not be answered by any of the group. The questions for repetition purposes were answered by choral alone by 100%. In mixed schools, the individual boys 50% mostly answered questions that elicit answer than for the individual girls 32%, and 28% by choral response. The questions that are for repetition purpose were answered more by choral by 92%, the individual boys and girls by 4% each. In the feedback by teachers, for the girls' school, affirmation (67%) gives answer (17%), comment (30%), uptake (14%), and none (14%) each, there were no feedback under probes, critical, praise, and ask others for questions that elicit answer. In questions for repetition purposes, 47% was the highest for affirmation, 49% for none, 24% for comment, 8% for girls' answer and uptake respectively; there was no percentage for praises, critical, ask others and probes. In the feedback from the teacher, in the boys' school, the questions that elicit answer have the highest feedback on affirmation 49%, gives answer 29%, 20% for ask others, 15% for critical and comment each, 12% for praises, 6% for none and 0% for probes. Questions for repetition purposes has the highest percentage on 69% on affirmation, 29% for comment, 12% for none, 6% each for uptake question and praises and 0% each for critical, ask others, give answer and probes. For feedback in mixed schools, feedback on questions that elicit answer leads with 65% on affirmation, 36% for comment, 24% ask others, 16% for uptake, 13% for praises, 8% for probes and 3% for none. For questions that elicit repetition, 66% leads on affirmation, 23% on praise4s, 20% on comment, 16% on uptake, 17% for none, 0% each for critical ask others, give answer and probes respectively.

Research question two: What is the pattern of interaction between students-students in physics lessons and their learning outcome?

Table 2: Percentage of Students-Students' Interaction Pattern

Types of School	Percentage of student-student interaction
Boys	42.69
Girls	46.54
Mixed	40.77

Table 2 shows that the percentage of students-students' interaction pattern is most higher in girls' school with 46.54%, followed by boys' school 42.69 and least among mixed schools 40.77%. This implies that the same sex classroom encourages maximum classroom interaction.

Research question 3: To what extent does gender (male & female) difference affect classroom interaction in physics lesson?

Table 3: Percentage of Students Who Answered the Questions in the Respective Schools by Gender

S/No.	School	Teachers' Gender	No. of Students	No. of Boys	No. of Girls	Teachers' Question	Students' Response %		
							Boys	Girls	Choral
1.	OCGSO	Male	35	20	15	30	46	17	31
2.	CSSI	Male	30	30		23	45		30
3.	GSSO	Male	35	20	15	31	21	49	30
4.	SCCA	Male	40	25	15	29	40	30	30
5.	GSSA	Male	41	30	11	31	42	18	40
6.	SIMSSA	Male	38	23	15	28	41	22	31
7.	CSSO	Male	38	38		25	40		28
8.	ISSA	Male	32	22	10	26	38	12	30
9.	RSSO	Male	30		30	24		15	30
10.	CMSSA	Male	25		25	21		21	24

Table 3 shows that the percentage of boys' response in OCGSO (46%), CSSI (45%), GSSO (21%), SCCA (40%), GSSA (42%), SIMSS (41%), CSSO (40%) and ISSA (38%), while girls percentage are OCGS (17%), GSSO (49%), SCCA (30%), GSSA (18%), SIMSSA (22%), ISSA (12%), RSSO (15%) and CMSSA (21%). Choral percentage in OCGSO (31%), CSSI (30%),

SCCA (30%), GSSA (40%), SIMSS (31%), CSSA (28%), IWWQ (30%), RSSO (30%) and CMSSA (24%). The table also revealed that nine of the teachers are males, only one is a female physics teacher. The table equally shows that boys' response is higher in classrooms taught by male teacher while the response of the girls (49%) is higher than boys (21%) taught by the only female physics teacher. The method of teaching adopted by the teachers is shown on table 5.

Table 4: Percentage of Strategies of Teaching by Physics Teachers

Method of Teaching	OCGSO %	CSSI %	CSSO %	SCCA %	GSSA %	SIMSSA %	CSSA %	ISSA %	RSSO %	CMSSA %
Discussion	3.50	2.50	12.00	15.00	18.00	10.00	4.16	5.05	10.00	2.60
Lecture	70.00	68.00	58.00	62.00	60.00	61.0	51.00	49.00	48.00	54%
Field trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Demonstration	12.00	3.00	15.00	11.00	14.00	2.00	1.00	2.00	4.00	3.00
Question	30.00	23.00	31.00	29.00	31.00	21.00	11.00	12.00	10.00	9.10
Concept mapping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Co-operative	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.01	0.20	0.01
Stimulation	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Discovery	15.00	16.00	17.00	15.00	13.00	11.00	12.00	9.00	8.00	6.00
Experimentation	1.00	0.00	0.00	2.00	3.00	0.00	0.01	0.02	0.00	0.00

Table 4 shows that the lecture method was the major teaching approach adopted by most of the schools under survey, with OCGSO (70%), CSSI (68%), CSSO (58), SCCA (62%), GSSA (60%), SIMSSA (61%), CSSA (51%), ISSA (49%), RSSO (48%) and CMSSA (54%). Followed by focused question strategy, OCGS (30%), CSSO (31%), GSSA (31%), SCCA (29%), CSSI (23%), SIMSSA (21%), ISSA (12%), CSSA (11%), RSSO (10%), and CMSSA (9%). For discovery strategy CSSO (17%), CSSI (16%), OCGSO (15%), SCCA (15%), GSSA (13%), CSSA (12%), SIMSSA (11%), ISSAS (9%), RSSO (8%) and CMSSA (6%). Demonstration strategy had CSSO (15%), GSSA (14%), OCGS (12%), SCCA (11%), RSSO (4%), CSSI (3%), CMSSA (3%), ISSA (2%) and CSSA (1%). Almost all the schools turn down the use of modern teaching techniques like field trip, concept mapping, cooperative, stimulation and experimentation are almost 0%.

DISCUSSION OF FINDINGS

Patterns of teacher – student interaction in physic class room

In table 1, the pattern of teacher-students' interaction depends on the type of question asked, the group or individual student who responded to the teacher's question and the type of feedback given by the teacher. The questions that elicit answer and repetition purpose were mostly answered chorally in both single and mixed schools. This choral response does not give enough evidence to the teacher that all the students understood the lesson. Some of the learners may join the choral to respond to teachers' questions without having the knowledge of what they are responding to. This conflict the finding of Johnson and Johnson (2016) which recommended that the teachers should direct their questions to individual student rather than throwing it open to choral responses. The findings also conflict the assertion of Clark and Star (2010) described teaching as an attempt to assist students in acquiring or changing some skills, knowledge, ideas, attitudes or appreciation. So if no change is found in the learner, it means that learning has not taken place.

The boys in table 1 contributed more to choral question for repetition purposes than individual questions that elicit answer. While in the mixed schools (co-educational schools), boys were observed to contribute more in questions that elicit answer than the choral response and the girls were observed to give choral answers more in questions for repetition purposes. Questions for repletion purposes are meant to draw the attention of the students, so that classroom interaction is established and maintained. The teacher should be able to identify those students who are not contributing or not attentive in class. The attention of students is brought back by asking the students to repeat the answer to the question. In the mixed schools (co-educational schools) where the boys are found to respond to teachers' questions more than the girls, the teacher should ask questions proportionately in order to carry every student along during classroom interaction, so that the instructional aims and objectives will be achieved.

The feedback of the teacher affects the pattern of classroom interaction in physics lesson. As seen in the girls' school in table 1, the affirmation of response by

the teacher scored the highest percentage of 67%. Affirmation of response, teacher simply acknowledges the response is correct either by nodding his head, repeats answer, says 'yes', or 'ok'. It shows that the students are making efforts in the teachers' question and this build confidence in the students. It also motivates the students to answer more questions, therefore, learning takes place. The finding is in line with Penick and Shymansky (2012) that, achievement motivation of the students influences the quality and quantity of teacher-students' interaction in the classroom. There was no feedback in praises, critical, ask others and probes for questions that elicit answer and question for repetition purposes in girls' school. In boys' school, the highest percentage is on affirms (69%) and no percentage for probes in questions that elicit answer, questions for repetitive purpose and affirmation. In the mixed schools, for both questions pattern, the teachers mostly use affirmation in their feedback. Teachers should endeavour to approximately use other types of feedback other than affirmation. Affirmation was seen only by nodding the head, repeating the answer, saying yes, ok etc. this does not allow efficient classroom interaction of teacher-students. Comments on answer were not really adopted as a feedback by the teacher because as seen in table 1, the percentage of comment is below average. The teacher needs to elaborate the answer so that students who do not know how the others arrived at that answer can learn from the elaboration by the teacher. If the teacher should adopt the other types of feedback that had no percentage, example, the probes, answer, ask others etc in appropriate proportions, then classroom interaction of teacher-students will not only be quantitative but qualitative. The percentage for none, as no feedback provided by the teacher was found higher than some other types of feedback. The non-feedback should almost be 0% for classroom interaction to be effective.

The teacher should endeavor to site at least two types of feedback in each question he asked, so there should be no question without a feedback. Classroom evaluation or feedback is used to determine the level of student learning and gives the teacher the information that can be used in planning future lessons.

Pattern of interaction between student-student in physics lesson

Table 2 shows positive operation pattern between student-student in physics lesson. The operation is more among single sex schools or students with highest percentage was found in the girls (46.54%) followed by the boys' school (42.69%) and the mixed schools (40.77%). Positive interaction pattern enhances students' achievement and consequently on the final outcome in physics teaching and learning. The physics teacher should ensure that they group the students and give them work, so that they can interact with themselves as a group. Galton and William (2012) strongly advocate training in group work skill, because they might entail knowledge on how to listen to questions or challenge a group discussion. In mixed schools, boys should be mixed up with girls and the teacher should ensure that the girls also contribute maximally in the group work. The physics teacher should help the students to understand and manipulate the apparatus or equipment given to them in group work.

Extent do gender differences affect classroom interaction?

Table 3 shows that the total percentage of student that respond to teachers' question is higher among the boys taught by male teachers than girls taught by the only female teacher had higher percentage (49%) response than the boys taught by the same female teacher. The boys were found to answer questions more than the girls and the choral response. These means that, in the classroom interaction in mixed schools, the boys were found to participate more than the girls. Olanrewaju (2014) in a whole class research shows that boys contribute more elaborate answers than the girls by partly hand raising or boys' reputation for misbehavior. Boys contribute towards the materials been taught than the girls, so they receive more feedback during the whole class work than girls. Since the teacher provides the elicitation and feedback during the whole class work, girls are effectively silenced in the setting. Staberg (2015) observed the solution of boys and girls in the classroom interaction through group and individual using an observation schedule which creates opportunities of ticking teachers-pupil interaction and taking note of question and incidents, he found that boys participate more by asking questions than girls and are more active than girls. This implies that boys interact more than girls because of their critical nature. This finding is in line with the findings of Staberg (2012) that girls do not participate in classroom interaction as the boys. This was seen especially in grade 3 and 7, in grade 3, boys ask questions more than girls in the ratio 2:1. In grade 9, few girls are attentive and active while others are passive. Boys had some contact with the teacher and were consistently fewer than girls but were more concerned with pupil initiated interaction.

Kalu (2010) finding is in line with the finding of this study that boys receive greater portion of interaction in classroom more than girls. It was observed from the result that boys interact in the classroom or participate

in classroom interaction more than the girl because of their critical nature. The teacher should point hand at the girls to answer the question, even when their hands are down. In table 4, the sex of physics teachers used in the ten secondary schools, nine were males while only one was female.

The sex-ratio of the teacher affects the classroom interaction in physics lessons. As observed, the male students were found to have higher percentage response in all the schools taught by the male teachers while female were found to have higher percentage response in school taught by the only female teacher. This means that classroom interaction is affected by the sex of the teachers.

The finding is in line with the assertion of Allele-Williams (2014) that girls are discouraged from participating in science and technology and mathematics education by the dominantly male teachers. The teacher should therefore prepare his lesson very well and build confidence in himself to face both the boys and the girls in the class, so that there will be quantitative classroom interaction that can enhance equal achievement or outcome by both genders.

On table 4, it was observed that most of the teachers use lecture method because the percentage of the strategy was ranked highest among all the strategies adopted by the teachers and that most of the teachers do not adopt the modern and innovative strategies in teaching physics in schools. Instructional strategies such as discussion method, demonstration method, focused question teaching method etc. that would have enhanced classroom interaction were not use maximally based on the lower percentage recorded.

This means that teacher should use teaching strategies that are student centered that can enhance more interaction between teachers-student and student-student interaction. This can enhance positive interaction that can boast student achievement or outcome in physics lesson.

It was also observed that the teachers spent most of their time teaching and giving notes while the students spent their time copying notes and listening to the teacher. They was no time given in between the classroom instruction to allow student ask question.

CONCLUSION

The interaction patterns and its influence on student's learning outcomes in physics in Ankpa education zone of Kogi state have been examined. It was concluded that the teacher lacks the quality of a good teacher such as a good management of the blackboard, then classroom voice, clear presentation of terms and classroom, management and organization. The teachers adopted only one method of teaching which was mainly the lecture method that does not encourage maximal interaction between teachers-student, student-student interaction.

In mixed schools boys are more active than girls and they interact with teachers more frequently than girls. The teachers spent most of the class time, teaching and writing notes without allowing the students to ask specific questions.

And the students also spent most of their time copying notes and listening to the teachers. The outcome of this study revealed that teachers and students' gender affect classroom interaction. Female students are shy of interacting freely with the male teachers and vice visa.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made by the researcher:

1. Physics teachers should avoid discrimination in their classroom interaction with male and female students. Girls should be motivated in whatever way possible to participate in classroom interaction since it helps them to learn better.
2. Teachers should be given opportunities to attend seminars, workshops and in-service training programmes to update their knowledge and sharpen their skills. Such programmes should emphasize on appropriate use of questioning techniques, teaching methods, classroom management as recommended by the national senior secondary school physics curriculum.
3. Teachers should demonstrate the physical phenomena in physics to students in order to enhance their understanding of physics concepts and principles.
4. Students should be encouraged to interact among themselves whenever a class work or other activities are given in the classroom so as to enhance equal participation irrespective of gender make everybody participate in the lesson.
5. Government and stakeholders in the education sector should ensure gender equity in the recruitment of science teachers especially in physics.

APPENDIX

6. Distribution of schools teachers and students

S/No.	Name of School	School Type	No. of Physics Teachers	No. of Physics Students SSI	Students' Gender	
1.	Olamaboro Community Grammar School, Okpo (OCGSO)	Co-Educational	1	35	20	15
2.	Community Secondary School, Ofante (CSSO)	Boys	1	38	38	
3.	Islamic Secondary School, Ankpa (ISSA)	Boys	1	32	32	
4.	Redeemer Secondary School, Abejukolo (RSSA)	Girls	1	30		30
5.	Catholic Mission Secondary School, Agbaduma (CMSSA)	Girls	1	30		30
6.	Community Secondary School, Imane	Co-Educational	1	30	20	10
7.	UEC Secondary School, Ogugu (UECSSO)	Co-Educational	1	35	20	15
8.	St. Charles College, Ankpa (SCCA)	Co-Educational	1	40	25	15
9.	Sule Iyaji Memorial Secondary School, Abejukolo (SIMSSA)	Co-Educational	1	38	23	15
10.	Government Secondary School, Abejukolo (GSSA)	Co-Educational	1	41	30	11
	Total		10	344	208	136

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