Verbal Interaction Patterns and Junior Secondary Students' Achievement in Basic Science and Technology in Uyo, Akwa Ibom, Nigeria

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ABSTRACT
This study investigated the effects of Dominative and Integrative Classroom Interaction Patterns on the performances of Basic Science and Technology students considering their gender, teachers’ qualifications, and teachers’ years of experiences and teachers gender. The study was a quasi-experimental research conducted in Uyo Local Government, Akwa Ibom, Nigeria. Nine hundred and ninety four (994) Junior Secondary two (JS2) students comprising 420 male and 574 female students; and twenty JS 2 Basic Science and Technology teachers selected from ten public co-educational schools through criterion sampling technique formed the study sample. Two researcher-made instruments, Basic Science and Technology Performance Test (BSTPT) with a reliability coefficient of .75 and Teachers' Classroom Interaction Analysis Checklist (TCIAC), adapted from Flanders’ Interaction Analysis Category System Checklist (FIACSC), with inter and intra item reliability coefficients of .80 and .75 were used in collecting data. Data generated were analysed using t-test and Analysis of Variance (ANOVA). The findings indicated a significant influence of teachers’ classroom interaction patterns on students’ performance with students in integrative classroom performing significantly better than those in the teacher-dominated classes. The result also indicated that students’ gender, teachers’ qualifications, teachers’ years of experience and teachers’ gender had no significant influence on students’ performance. Keywords: Classroom Interaction Patterns; Dominative; Integrative; students’ performance

INTRODUCTION
Basic Science and technology, formerly known as Integrated Science, was introduced in Nigerian schools as a science course for junior forms of Secondary Schools by the Science Teachers Association of Nigeria (STAN) with publication of STAN Curriculum Development Newsletter No. 1 (STAN, 1970; 1998). The Newsletter contained the philosophy, objectives, methodology, evaluation and content of the proposed two-year Integrated Science Programme. Following the adoption of the 1981 National Policy on Education which advocated two tier 3-3 system of secondary school education, there was an urgent need to design a core content curriculum on various subjects for the two levels of education (FME, 1985). Consequently the core curriculum for junior secondary school integrated science was developed by the Federal Ministry of Education. This resulted in the revision, reorganizations, up-dating and expansion of the old two-year integrated science curriculum into the new three-year junior secondary school programme, but the objectives, process skills, teaching approach, evaluation and method of implementation remained the same as those published in STAN Curriculum Newsletter No. 1.
With the adoption of the 2004 National Policy on Education the NERDC successfully developed and introduced the 9 – year Basic Education Curriculum. The primary curricula was in two levels – lower basic (primary 1 – 3) and middle basic (primary 4-6), while the junior secondary curriculum (JS1 – 3) constituted the upper basic curriculum. The primary curriculum was named Basic Science and Technology while the Junior Secondary Curriculum was named Basic Science. The overall objectives of this curriculum as enumerated in FME (2007) were to enable learners:

- develop interest in science and technology.
- apply their scientific and technological knowledge and skills to meet societal needs.
- take advantage of the numerous career opportunities offered by science and technology.
- Become prepared for further studies in science and technology.

To achieve a holistic presentation of science and technology contents to learners, the thematic approach to content organization was adopted and four themes – "You and Environment", "Living and Non-living things", "You and Technology" and "You and Energy" were used to cover knowledge, skills and attitudinal requirements. The use of guided inquiry method of teaching and learning has been adopted in order to promote learning by doing and skills development. To meet the needs of the contemporary society, the Basic Science curriculum was reviewed and renamed Basic Science and Technology Curriculum (FME, 2012).

Basic Science and Technology Curriculum first published 2006 (revised, 2012) is a product of the restructuring and integration of four primary and Junior Secondary School (JSS) Science curricula, namely, Basic Science, Basic Technology, Physical and Health Education and Computer Studies/Information and Communication Technology (ICT). The objectives of Basic Science and Technology Curriculum remains the same as Basic Science Curriculum, excepting the addition of two more objectives:

i. to avoid drug abuse and related vices; and
ii. to be safety and security conscious.

The guided inquiry and activity based teaching and learning using locally sourced materials remain (FME, 2012) the recommended teaching approach. This approach ensures that the learners are adequately engaged in meaningful head-on, heart-on and hands-on activities. It should be noted that the teaching – learning process is an interactive process with different patterns. Interaction may be teacher-student, student-student, small group or entire classroom. The verbal interactions between the teacher and students are vital to the teaching-learning process and could be classified into two major patterns-dominative and integrative patterns. To measure the verbal interaction patterns that exist in a classroom, Flanders developed instruments known as Flanders’ Interaction Analysis Category System (FIACS) for coding and decoding only the verbal interactions between teacher and students. Flanders classified verbal behaviour into teachers’ talk, students' talk and silence or confusion. In teaching of science in the upper basic (Junior Secondary school), teachers use different interactive patterns to achieve maximum results.

In the junior secondary school, most basic science teachers are graduates of physics, biology and chemistry who are not adequately trained in the art of teaching and the content of basic science and technology, and therefore may not be able to identify and apply the most effective interaction patterns in all areas of basic science. Hence, students' performance will be adversely affected. Study report on teachers' qualification, class interaction patterns and students' performance in science by Goldhaber and Brewer (2000) showed that professional teachers with degrees applied integrative patterns which enhanced their students' performance better than that of their non-professional counterparts who used dominative approach. However, Emmah (1998) in a study on the impact of presage variables on verbal interaction patterns in social studies observed that academic qualification did not significantly affect the verbal interaction patterns of the teachers investigated. Domike's (2002) work on the impact of teacher – pupil interaction patterns on pupils’ science achievement in Imo State corroborated this observation, but also observed that students taught by teachers who used integrative had the best performances.
Consequently, it therefore became necessary to ask: What are the patterns of science teaching associated with higher academic performance in Basic Science and Technology? How do teachers' interaction patterns, and qualification, influence students' academic performance in Basic Science and Technology? This study was an attempt at finding plausible answers to these questions.

**Research Questions**

The following research questions were raised to give direction to the study:

1. Which of the interaction patterns, Dominative or Integrative, will have the best facilitative effect on students' performance in Basic Science and Technology?
2. How do teachers’ qualification and classroom interaction patterns differentiate students’ academic performance in Basic Science and Technology?

**Research Hypotheses**

The following research hypothesis was formulated for testing at .05 alpha level of significance:

1. There is no significant difference in the academic performance of Basic Science and Technology students when taught by teachers using dominative and when taught by teachers using integrative classroom interaction patterns.
2. There is no significant difference in the academic performance of students in Basic Science and Technology students based on teachers’ classroom interaction patterns and qualification.

**RESEARCH METHODS**

Ex-post facto research design was used for study. This design was considered appropriate since the teachers already had their classroom interaction patterns, hence, this variable could not be manipulated by the researcher. The study was carried out in selected co-educational secondary schools in Uyo Local Government of Akwa Ibom State, Nigeria. The population comprised 7185 JS 2 Basic Science and Technology students (SSEB, 2013) and 34 JSS 2 Basic Science and Technology teachers in all the 12 public co-educational secondary schools in the study area.

The sample of the study consisted of 20 JS 2 Basic Science and Technology teachers and 994 JS 2 Basic Science and Technology students drawn from two selected intact classes in ten selected co-educational secondary schools, out of the 12 public co-educational secondary schools in the study area. Simple random sampling technique was used in selecting the schools and the classes in the selected schools for the study.

Two researcher-made instruments were used for data collection. These were: Basic Science and Technology Performance Test (BSTPT) with a reliability coefficient of 0.75 and Teachers' Classroom Interaction Analysis Checklist (TCIAC) adapted from Flanders’ Interaction Analysis Category System Checklist (FIACSC), with inter and intra item reliability coefficients of 0.80 and 0.75.. TCIAC was used for obtaining data on teachers' classroom verbal interaction patterns and BSTPT was used to measure the performances of the students taught by the teachers observed. The reliability estimate of TCIAC was determined using Cronbach’s alpha reliability package in SPSS 20.0.

**Method of Data Collection**

After obtaining permission from the schools’ authorities to use their schools for the study, the Basic Science and Technology teachers of the selected classes were observed by the researcher as they taught during the normal Basic Science and Technology classes with the help of a trained research assistant. The teachers’ interaction patterns were recorded using the Teachers' Classroom Interaction Analysis Checklist (TCIAC). An audio recording of the classroom interactions was also taken for cross checking the observers’ records. The data obtained from this measurement was used in categorizing the teachers’ interaction patterns as either dominant or integrative. A week after the assessment of the teachers’ classroom interactions Basic Science and Technology Performance Test (BSTPT) was administered to the students in all the schools investigated and the data obtained were used in measuring the students’ performance in the area taught during the investigation. Independent t-test statistics was used in data analysis.
RESULTS

Research Question 1: Which of the interaction patterns, Dominative or Integrative, will have the best facilitative effect on students' performance in Basic Science and Technology?

Table 1: Mean and standard deviation of the students' scores on Basic Science and Technology Achievement Test (BSATAT) classified by teachers' interaction patterns

<table>
<thead>
<tr>
<th>Interaction Pattern</th>
<th>Groups</th>
<th>Sample Size</th>
<th>Score</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrative Pattern</td>
<td></td>
<td>594</td>
<td>58.87</td>
<td>10.41</td>
</tr>
<tr>
<td>Dominative Pattern</td>
<td></td>
<td>400</td>
<td>51.14</td>
<td>10.97</td>
</tr>
</tbody>
</table>

In Table 1, the mean scores of 58.87 and 51.14 for students under teachers with Integrative and Dominative patterns of classroom interactions, respectively, show that students taught by teachers with Integrative pattern performed better than those under teachers with Dominative patterns of classroom interactions. This observation shows that integrative pattern facilitate students' performance in Basic Science and Technology better than the dominative pattern.

Hypothesis 1: There is no significant difference in the academic performance of Basic Science and Technology students when taught by teachers using dominative and when taught by teachers using integrative classroom interaction patterns.

Table 2: Independent t-test summary of students' scores on Basic Science and Technology Performance Test (BSTPT) classified by Interaction groups

<table>
<thead>
<tr>
<th>Interaction Patterns</th>
<th>n</th>
<th>Std. Deviation</th>
<th>df</th>
<th>t</th>
<th>Sig.</th>
<th>Decision at p&lt;.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrative Pattern</td>
<td>594</td>
<td>58.87</td>
<td>992</td>
<td>11.24</td>
<td>.00</td>
<td>s</td>
</tr>
<tr>
<td>Dominative Pattern</td>
<td>400</td>
<td>51.14</td>
<td>992</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

In Table 2, the calculated t-value at df 992 is 11.24 while the observed significant level (sig.) is .00 alpha. The observed significant level (.00) is less than .05. This observation shows that there is a significant difference in the academic achievement of Basic Science and Technology students taught with dominative and integrative classroom interaction patterns in favour of those taught using Integrative Pattern. Hence, the null hypothesis was rejected.
Research Question 2: How do teachers’ qualification and classroom interaction patterns differentiate students’ academic performance in Basic Science and Technology?

Table 3: Mean and standard deviation scores of the students on Basic Science and Technology Performance Test (BSTPT) classified by Interaction groups and teachers’ qualification

<table>
<thead>
<tr>
<th>Interaction Pattern Groups</th>
<th>Teachers' Qualification</th>
<th>Sample Size</th>
<th>Score mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrative Pattern</td>
<td>B.Sc.</td>
<td>2</td>
<td>63.57</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>B.Sc. (Ed.)</td>
<td>307</td>
<td>58.41</td>
<td>10.45</td>
</tr>
<tr>
<td></td>
<td>B.Sc./PGDE</td>
<td>285</td>
<td>59.34</td>
<td>10.42</td>
</tr>
<tr>
<td>Dominative Pattern</td>
<td>B.Sc</td>
<td>200</td>
<td>49.91</td>
<td>10.42</td>
</tr>
<tr>
<td></td>
<td>B.Sc. (Ed.)</td>
<td>100</td>
<td>52.32</td>
<td>11.33</td>
</tr>
<tr>
<td></td>
<td>B.Sc./PGDE</td>
<td>100</td>
<td>52.43</td>
<td>11.49</td>
</tr>
</tbody>
</table>

The mean scores in Table 3 are: 63.00, 58.41 and 59.34, respectively, for students taught by B.Sc, B.Sc. (Ed.) and B.Sc./PGDE teachers with Integrative pattern of classroom interaction; and for students taught by B.Sc, B.Sc. (Ed.) and B.Sc./PGDE teachers with Dominative pattern of classroom interactions, the scores are: 49.91, 52.30 and 52.43, respectively. This observations show that: generally, students in the Integrative pattern group did better than their counterparts in the Dominative pattern group; and that, the best performance came from the B.Sc. teachers, followed by B.Sc./PGDE and B.Sc. (Ed.) in decreasing order.

Hypothesis Two (Ho2): There is no significant influence of teachers' qualification on the academic performance of Basic Science students exposed to dominative and integrative classroom interaction patterns.

Table 4: Analysis of Variance (ANOVA) of students' scores on Basic Science and Technology Performance Test (BSTPT) classified by Interaction groups and teachers' qualification

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-cal</th>
<th>Sig.</th>
<th>Decision at p&lt;.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction Patterns</td>
<td>1281.92</td>
<td>1</td>
<td>1281.92</td>
<td>11.35</td>
<td>.00</td>
<td>s</td>
</tr>
<tr>
<td>Teachers' Qualification</td>
<td>47.218</td>
<td>2</td>
<td>23.61</td>
<td>.21</td>
<td>.81</td>
<td>ns</td>
</tr>
<tr>
<td>Interaction Effect:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction Patterns</td>
<td>108.24</td>
<td>2</td>
<td>54.12</td>
<td>.48</td>
<td>.62</td>
<td>ns</td>
</tr>
<tr>
<td>Teachers' Qualification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>111599.51</td>
<td>990</td>
<td>112.96</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>126658.49</td>
<td>993</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

R Squared = .119 (Adjusted R Squared = .114)

In Table 4, the calculated F-ratio for the main effect of Teachers' Qualification at df 1, 990 is .21, while its corresponding significant level is .81 alpha. This significant level is greater than .05, indicating that teachers’ qualification had no significant effect on the performance of basic science students exposed to dominative and integrative classroom interaction patterns. The results with respect to Classroom Interaction Patterns* Teachers' Qualification interaction indicates an F-cal value of .48 and observed
significant level of .62 at df 2, 990, also indicating a no significant effect. With these observations, null hypothesis 2 was upheld.

DISCUSSION
The findings with respect to classroom interaction patterns and basic science students’ academic performance indicated a statistically significant influence of teachers' classroom interaction patterns on the students' performance in Basic Science and Technology. This observation underscores the importance of teacher-student interaction in any classroom situation. As observed, students in integrative classroom performed significantly better than those in teacher dominative pattern classes. Kalu (2013) also observed that there was a significant positive relationship between interaction pattern and students’ post instructional attitude and academic task achievement. The observation is attributed to active participation of students in the integrative classroom.

On the influence of teachers' qualification on the performance of students in Basic Science and Technology when exposed to dominative and integrative classroom interaction patterns, the findings indicated that there was no significant difference in the mean scores of the students based on teachers' qualification. This observation corroborated that of Emmah (1998), but disagreed with that of Awolabi and Adedayo (2012) who observed that students taught by teachers with higher qualification performed better than those taught by teachers with low qualification; and that students perform better when taught by professional teachers.

CONCLUSION
Consequent upon the findings it is hereby concluded that integrative classroom pattern facilitates the learning of concepts in Basic Science and Technology; and that teachers’ qualification is not a significant determinant of students’ learning outcome.

REFERENCES
FME (2007) 9-year Basic Education Curriculum Basic Science for Junior Secondary 1-3 NERDC.
FME (2012). 9-year Basic Education Curriculum Basic Science and Technology for Junior Secondary 1-3, NERDC.