

Inquiry Role Approach as an Effective Method of Teaching Integrated Science among 200 Level NCE Students in Aminu Saleh College of Education Azare, Bauchi State, Nigeria

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Abstract

Experimental research design was used to determine the effectiveness of inquiry role approach in teaching Integrated Science at the NCE level. One hundred (100) students were randomly selected and used for the study. The students were divided into two groups (control and Experimental) of fifty Students each and pre – test was administered to both. One group (control) was taught with lecture method while the other group (experimental) was taught using inquiry role approach. The fifty students in the experimental group were further divided into ten groups of five students each and roles were assigned to every member of the group. Post-test was administered to each group after three weeks of teaching. Tests scores obtained were used to assess the performance of the students. The findings revealed 10.880 and 17.980 as the mean scores of the students that were taught with lecture method and inquiry role approach respectively. The Results of the analysis using t-test showed significant difference at 95% ($P = 0.05$) level of significance between the performance of the students. The students taught with the inquiry role approach performed better than the students taught with the lecture method. The paper recommends among others that integrated science teachers should employ inquiry role approach in their teaching. Students should be encouraged to work in groups in order to gain science skills and knowledge at higher cognitive level.

Keywords: Inquiry Role Approach, Effective Method, Teaching, Integrated Science.

Introduction

The search for better teaching methods to provide the best learning outcomes has been the goal of education for many decades. To facilitate the process of knowledge transmission, teachers are required to apply appropriate teaching methods that best suit specific objectives and learners' level of education.

Today's teachers must develop instructional styles that work well in diverse classrooms. Effective teaching methods engage gifted students, as well as slow-learning children and those with attention deficit tendencies. This is where differentiated instruction and a balanced mix of teaching styles can help reach all students in a given classroom not just the few who respond well to one particular style of teaching. Teachers are to try different styles to meet different objectives, and always challenge themselves to find ways to reach each student.

Agboghoroma (2018) observed that correct use of an appropriate teaching method is critical to successful teaching and learning. Knowledge of how teaching methods affect students' learning may help educators to select methods that improve teaching quality, effectiveness, and accountability to learners and the public. It may also help them keep up with information technology, globalization and to avoid the status quo.

Statement of the Research Problem

Inquiry role approach has been mentioned by many researchers (Furfuri and Ukiri, 2016; Danjuma *et al.*, 2017) as one of the activity-based method of teaching, but there is no evidence of its use by science teachers in the classrooms. The continued usage of lecture method and non-usage of inquiry role method of teaching could be one of the reasons why students perform below expectation in integrated science courses. It is against this background that this study was conducted to investigate the effectiveness of inquiry role method of teaching in integrated science in comparison with the frequently used lecture method.

Objectives of the Study

1. To determine the effectiveness of inquiry role approach and lecture method in teaching integrated science at the NCE level
2. To compare the effectiveness of lecture method with that of the inquiry role approach in improving students' performance
3. To determine if there is significant difference between the two methods of teaching.

Research Question

What is the difference between lecture method and inquiry role method of teaching in terms of their effectiveness?

Hypothesis

There is no significant difference between the mean scores of inquiry role approach and the lecture method of teaching.

Literature Review

Methods of teaching in use today include lecture, discussion, storytelling, play-way, demonstration, fieldtrip, project, inquiry, discovery methods just to mention few (Ganyaupfu, 2013).

Furfuri and Ukiri (2016) broadly categorized science teaching methods/styles under two main divisions: the traditional teaching methods examples lecture; tutoring; expository; discussion etc and the progressive approaches which are practical, exploratory and experimental. The authors further listed active teaching strategies to include: discovery method; inquiry method; demonstration method; project/problem instruction; field trips/excursion; computer-assisted instruction; co-operative/small group interaction; simulation/game; role playing/drama and debate/presentations. Process Oriented Guided Inquiry Learning (POGIL) method calls for groups of three or four students who work in a team on process-oriented guided inquiry activities in which students construct their knowledge through interactions with others. Traditional POGIL roles for group members are provided below (POGIL, 2016).

- **Manager or Facilitator:** Manages the group by helping to ensure that the group stays on task, is focused, and that there is room for everyone in the conversation.
- **Recorder:** Keeps a record of those who were in the group, and the roles that they play in the group. The recorder also records critical points from the small group's discussion along with findings or answers.
- **Spokesperson or Presenter:** Presents the group's ideas to the rest of the class. The Spokesperson should rely on the recorder's notes to guide their report.

- **Reflector or Strategy Analyst:** Observes team dynamics and guides the consensus-building process (helps group members come to a common conclusion).
- **Timekeeper:** Watches the clock and keeps the group aware of the time limits.

Teaching Methods and Students' Academic Performance

Findings of several studies have shown that there is strong relationship between teacher's method of teaching and academic achievement of the students. In their report, Johnson, Johnson & Smith (2006); Danjuma, Joseph, Kabutu and Keziah (2017) revealed that students perform better when they are put in small groups for academic work.

Studies conducted by Umar and Shehu (2017) indicated that students taught Social Studies using active involvement and active participation performed better than those taught using the conventional method in Junior Secondary Schools in Bauchi.

Nwaobilor, Blessing and Okoro (2016) opined that teachers' variables including their methods of teaching are predictors of academic achievement. The study conducted by Daya and Mohammed (2016) showed that students taught with demonstration method performed better than those taught with problem solving techniques.

Omwirhiren and Ibrahim (2016); Kamisu and Adebimpe (2017) reported that there is significant difference in learning outcome on students exposed to demonstration and lecture strategies used to teach chemistry. Their findings showed that demonstration teaching method has positive effects in enhancing learning outcomes. Ganyaupfu (2013) found out that combining both teacher-centered and student-centered teaching methods in teaching learners is the most effective approach that produces best student results.

Johnson *et al.* (2006) opined that while collaborative learning through group work has been proven to have the potential to produce stronger academic achievement than other kinds of learning environments, it can be challenging to implement successfully because many students come to college without the tools they need to automatically succeed in collaborative learning contexts. The authors suggested that one way of providing supportive structures to students in a collaborative learning environment is through assigning roles within group work.

Inquiry Role Approach (IRA)

An inquiry teaching method involves the use of small groups with the assigning of roles to every student in the group. Roles are assigned to help students assume more responsibility for planning, managing and evaluating laboratory experiences. The small groups and role procedures enable students to develop social skills, problem solving skills and attitudes for self-direction. The teacher becomes more of a facilitator and a guide of a learning process.

The method can be used from elementary level up to university level. The names (which connote the role) are assigned to various roles and would have to be changed according to the level and the understanding of the students. For elementary level, names such as chairman, secretary, monitor etc. can be used. For secondary and university names such as team coordinator, data recorder, data processor etc may be suitable. The activities would also change in sophistication according to the level of students.

Methodology

Integrated science students of school of science, Aminu Saleh College of Education Azare (ASCOEA) were used for the study. The study was experimental in nature. Two hundred (200) level NCE

students of integrated science department, ASCOES formed the population for the study. One hundred (100) students were randomly selected to serve as the sample.

The students were divided into two groups of fifty students each and pre – test was administered to them. One group was taught with lecture method (control) and the other group was taught with inquiry role approach (experimental) for the period of three weeks each on the topics: Atomic structure and titration. The fifty students in the experimental group were further divided into ten groups of five students each. Roles were assigned to every member of the group to help the students assume more responsibility for planning, managing and evaluating laboratory experiences. The names (roles/responsibilities) that were assigned to the members in a group in this study were:

- **Team coordinator:** To coordinate the group by helping to ensure that the group stays on task, is focused, and that there is room for everyone to participate;
- **Data processor:** To handle equipment and tasks like running titration, drawing of structures and helping group members come to a common conclusion).
- **Data recorder:** To keep record of those who are in the group, and the roles that they play in the group. The recorder also records critical points from the small group's discussion along with findings or answers.
- **Spokesperson or Presenter:** To present the group's ideas to the rest of the class. The Spokesperson to rely on the recorder's notes to guide their report.
- **Time keeper:** To watch the clock and keep the group aware of the time limits.

Integrated science achievement tests (post-test) were administered at the end of the period of teaching to each of the group. The test scores obtained were used to assess the performance of the students and the effectiveness of the two methods of teaching used.

Results and Discussion

Table 1: T – Test Table Comparing the Means of Pre-test Result

	N	Mean	df	tcal	tcrit	Remark
Control group	50	0.780	98	0.127	1.962	No Sig.
Experimental	50	10.880				

Decision rule: $t_{cal} < t_{crit}$. At 95% L, H_0 Accepted

Table 2: t – test table comparing the Post-test of Control and Experimental group

	N	Mean	df	tcal	tcrit	Remark
Control group	50	10.880	98	9.543	1.984	Sig. diff
Experimental	50	17.980				

Decision rule: $t_{cal} > t_{crit}$. at 95% L, H_0 rejected

Results shown in Table 1 indicated closeness between mean scores of the control group and experimental group before treatment. The calculated value of t was found to be less than the tabulated value hence the null hypothesis is accepted meaning that there is no significant difference in the Students' academic performance at 95% ($P = 0.05$) level of significance. The students in the control group and the experimental group are therefore the same.

Answering the Research Question: What is the difference between lecture method and inquiry role method of teaching in terms of their effectiveness?

Table 2 compares the performance of the Students in the control group (who were taught with lecture method) with that of the students in the experimental group (who were taught with inquiry role approach). The mean scores of the students taught with lecture method was 10.880 while those that were taught with inquiry role approach had the mean scores of 17.980. Results of the t -test analysis showed that there was significant difference at 95% level of significance in the performance of the students. The students taught with the inquiry role approach performed better than the students taught with the lecture method. This also implies that lecture method of teaching as found from this study is ineffective in influencing Students' performance.

The findings of this study confirm the reports of Ganyaupfu (2013); Daya and Mohammed (2016); Omwirhiren and Ibrahim (2016); Nwaobilor *et al.*, (2016); Danjuma *et al.*, (2017) and Kamisu and Adebimpe (2017) who observed that there is relationship between teacher's methods of teaching and the Students' academic performance.

The effectiveness of inquiry role approach of teaching found out in this research is in line with the findings of Johnson *et al.* (2006) and Danjuma *et al.* (2017) who noted that collaborative learning through group work has been proven to have the potential to produce stronger academic achievement.

Conclusion

The findings of this investigation revealed that students perform differently when taught with different methods of teaching. The inquiry role approach of teaching proved to be effective in teaching NCE 200 level students of integrated science department, school of science, Aminu Saleh College of Education Azare, Bauchi State, Nigeria.

Recommendations

1. Integrated science teachers should employ inquiry role method of teaching in their classroom lesson delivery.
2. Students should be encouraged to work together in groups so as to enable them to imbibe the culture of working together cooperatively in order to promote their gaining science skills and knowledge.
3. Teachers should be trained and re-trained on how to use the modern methods of instruction in teaching Science.
4. Teachers are to try different styles to meet different objectives, and always challenge themselves to find ways to reach each student.

Suggestion for Further Studies

Studies of this nature should be repeated in integrated science department and/or other departments of school of science using other NCE levels to either support the findings or refute it.

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