

USE OF COLLABORATIVE LEARNING STRATEGIES IN MATHEMATICS AND SCIENCES IN SECONDARY SCHOOLS IN MUBI EDUCATION ZONE, ADAMAWA STATE, NIGERIA

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Abstract

This research investigated the use of collaborative learning strategies in secondary schools by teachers of mathematics and sciences. The study is a survey type by design and was limited to Mubi educational zone of Adamawa state Nigeria. A sample of 210 teachers was obtained by random sampling technique from 21 secondary schools including private and public schools. A 15 item structured questionnaire was used to gather data and was analyzed by frequency counts, percentages and chi-square statistics. The results revealed that the male and female mathematics and science teachers, from private and public schools do engage their students in collaborative learning strategies. Suggestions on how to further encourage the full participation of teachers in the use of collaborative learning have been made.

Keywords: collaborative learning, learning strategies, mathematics, sciences.

Introduction

Education is the bedrock for national development and is therefore required by every child of school age especially in this era of scientific and technological development. It is in the realization of this fact that various nations of the world placed emphasis on science, technology and mathematics in order to have a place among the developed nations. However, technological development cannot be attained without proper acquisition of science and mathematics knowledge by students. One of the challenges facing teaching and learning in Nigerian secondary schools is the improvement of students' performance especially in mathematics and sciences. The teachers have a great role to play in order to improve students' performances in these subjects. The knowledge of how students learn is a very crucial component of teaching. Therefore, teachers, in addition to their competences in their respective fields, must have a sound knowledge of the pedagogical strategies which empower them to deliver instruction successfully.

One of the strategies which have been found very vital is collaborative learning. This is evident in the fact that researches have overwhelmingly favoured collaborative learning as the most effective way of learning (Aronson, Blaney, Stephen, Sikes & Snapp, 1978; Johnson, Johnson & Holubec, 1984; cited in Panitz and Panitz, 1996; Zakaria & Iksan, 2007; Miller & Castellanos, 2010). It has also been reported by a pool of research that successful learning involves an interaction of learners, the materials, the content and the teachers (Tizmann, Jones, Fennimore, Bakker, Fine & Pierce, 1990). Collaborative learning which is also called cooperative learning refers to an instructional method through which learners work together as a team. In other words, it is a group or team learning process where members of the group harmoniously work together, support and rely on one another for the accomplishment of a set task or agreed upon learning goal. It is an interactive method where the members share ideas and experiences by contributing their understanding of the problem or task at hand by way of giving insights or solutions.

Students are at liberty to apply, criticize, analyze and synthesize the required knowledge. It encourages high level cognitive skills, increase in students' retention, and promote positive attitude and self-concept. When doing the group work, each member is required to participate actively and those who seem to be shy are encouraged by others to speak or say something and contribute. By this method also, the weaknesses of each other are usually appreciated as no one is embarrassed or laughed at when mistakes are made. In the opinion of Brufee (1993), collaborative learning involves giving more matured students control of the learning process. These include establishing criteria for grading and group procedures, defining final products, and presenting the group's results.

The major role of the teacher in collaborative learning is facilitating the learning process. It is the teacher who forms the groups which should have three to four members in each. Kamkwis & Kojigili (2010) observed that groups with large members do not provide adequate opportunity for every member to participate actively. In using collaborative approach, teachers involve students in real-world tasks, engage them in relevant and holistic tasks at every level of their school years. For effective performance therefore, this approach requires collaboration among teachers and students in the teaching-learning process. Through collaboration students become knowledgeable, strategic, self-determined and empathetic (Tizmann et al, 1990). Collaboration stresses the social approach to learning and as such there is need to encourage students to appreciate the need on how to work collaboratively so as to achieve the desired learning outcomes. It is based on that this study aims to determine if teachers engage their students in collaborative learning in their schools.

Statement of the Problem

The performance of secondary school students in mathematics and science subjects in Nigeria is poor. This is caused by so many

factors among which are the teaching methods employed by teachers (Akale, 1997; Olawojaiye, 2000; Butty, 2001; Akinsola & Olawojaiye, 2008). Research has shown that collaborative learning approach is the most effective way of learning (Johnson, Johnson & Holubec, 1984). However, it has been reported that despite the numerous advantages of collaborative learning approach, teachers hardly use the method but instead stick to the traditional lecture method which is teacher-centered. Also, it is not certain whether school authorities of private and public secondary schools encourage their teachers to employ collaborative learning strategy in their subject areas.

Purpose of the Study

This study aims to determine whether male and female teachers of mathematics and sciences use collaborative learning strategy. It is also to find out if secondary schools (private and public) encourage the use of collaborative learning strategies.

Research Questions

1. Do secondary school teachers of mathematics and sciences engage their students in collaborative learning?
2. Do secondary schools encourage the use of collaborative learning?
3. What is the opinion of the science and mathematics teachers about the effectiveness of collaborative learning?

Hypotheses

1. There is no significant difference between the private and public secondary school teachers' opinion about their involvement in collaborative learning strategies.
2. The level of agreement of the teachers on the effectiveness of collaborative learning is not significantly dependent on ownership of school.
3. There is no significant difference in the opinion of male and female teachers about the effectiveness of collaborative learning.

Method

This study is a survey by design. The population of the study comprises all senior secondary school teachers of mathematics and sciences (biology, chemistry, physics and agriculture, geography) in Mubi educational zone of Adamawa State, Nigeria. From the population, a sample of 210 teachers teaching mathematics and sciences was obtained from 21 schools by random sampling technique. In each of the sampled schools, 10 teachers were selected for the study. Of the total number of samples, 40 were females while the remaining 170 were males. The only instrument employed for the study was Collaborative Learning Questionnaire (CLQ) designed by the researchers in Likert's four point scale of strongly agreed to strongly disagree. The 15 - item questionnaire was constructed along positive direction. The instrument was validated by experts in measurement and

evaluation and curriculum with a reliability coefficient of 0.83.

The questionnaire was administered personally by the researchers to the respondents in each of the sampled schools they were collected immediately to decrease mortality. The Strongly Agreed (SA) and the Agreed (A) responses were merged for positive responses while the Strongly Disagreed (SD) and Disagreed (D) were merged for negative responses. Frequency counts, percentages and chi-square statistics were used for the analysis of data. The null hypotheses are tested at 0.05 level of significance.

Results

Research Question 1: Do secondary school teachers of mathematics and sciences engage their students in collaborative learning?

Table 1: Percentage Responses of Teachers on Engaging Students in Collaborative Learning

S/No	Statement	Yes (%)	No (%)
1	I engage my students in group work	160 (76.19)	50(23.81)

Table1 shows that 76.19 % of teachers agreed that they engage their students in collaborative learning while 23.81% disagreed.

Research Question 2: Do secondary school encourage the use of collaborative learning?

Table 2: Number and Percentage of Teachers whose Schools Encourage the use of Collaborative Learning

S/N	Statement	Yes (%)	No (%)
11	My school encourages collaborative learning strategies	160(76.19)	50(23.81)

Table 2 shows that 76.19% of the teachers agreed that their schools encourage collaborative learning strategies while 23.81% did not.

Research Question 3: What is the opinion of science and mathematics teachers on the effectiveness of collaborative learning?

Table 3: Number and Percentage of Teachers with their Opinion on Collaborative Learning

S/No	Statement	Yes (%)	No (%)
2	My students enjoy group learning	186(88.57)	24(11.43)
3	Group learning encourages active participation among students	166(79.05)	44(20.95)
6	Students taught by collaborative teaching perform better	156(74.29)	54 (25.71)

From Table 3, 88.57% of the teachers agreed that their students enjoy group work while 11.43% did not. Also, 79.05% agreed that group learning encourages active participation among students while 20.95% did not. Furthermore, 74.29% of the respondents agreed that students taught using collabora-

tive learning strategy perform better while 25.71% did not agree to the statement.

Research Hypothesis One: There is no significant difference between the private and public secondary school teachers' opinion about their use of collaborative learning strategies.

Table 4: Chi-square Analysis of Private and Public School Teachers' Opinion about their use of Collaborative Learning Strategies

School Type	N	α	df	χ^2 cal.	χ^2 crit.	Remark
Private	105	0.05	3	1.36	7.82	Not Signif.
Public	105					

Table 4 shows that the chi-square calculated of 1.36 is less than the critical value of 7.82. Then, the null hypothesis is not rejected. The opinion of teachers from private and public schools about their use of collaborative learning does not differ.

Research Hypothesis Two: The level of agreement of the teachers on the effectiveness of collaborative learning is not significantly dependent on ownership of school

Table 5: Chi-square Analysis of Teachers' Opinion about the Effectiveness of Collaborative Learning based on School Ownership

School Type	N	α	df	χ^2 cal.	χ^2 crit.	Remark
Private	105	0.05	3	4.99	7.82	Not Significant
Public	105					

From Table 5, the chi-square calculated value of 4.99 is less than the critical value of 7.82. Thus, we did not reject the null hypothesis. Therefore, the opinion of teachers from private and public schools on the effectiveness of collaborative learning does not differ significantly.

Research Hypothesis Three: There is no significant difference in the opinion of male and female teachers about the effectiveness of collaborative learning.

Table 6: Chi-square Analysis of Male and Female Teachers' Opinion about the Effectiveness of Collaborative Learning

Sex	N	α	df	χ^2 cal.	χ^2 crit.	Remark
Male	170	0.05	3	4.33	7.82	Not significant
Female	40					

Table 6 indicates that the chi-square calculated of 4.33 is less than the critical value of 7.82. Thus, we fail to reject the null hypothesis. Therefore, the opinion of male and female teachers on the effectiveness of collaborative learning does not differ.

Discussion of findings

From the results of this study, it can be seen that majority of the teachers (76.19%) agreed that they engage their students in collaborative learning. However, some (23.81%) indicated that they do not engage students in collaborative learning. This finding is similar to what Panitz (1996) reported that a good number of teachers do not use collaborative learning strategies. This number though not very high is worrisome because of the importance of this strategy. In any case, the teachers' positive responses (74.28%) are an indication of the acceptance of the statement by the majority that students taught by collaborative learning tend to perform better. This is because learning in collaborative group is enjoyable (88.57%), lively and makes the students active (79.05%).

The teachers (76.19%) accepted that their schools encourage the use of collaborative learning strategies while only 23.81% disagreed. From the chi-square analyses of Table 4, it is shown that there is no significant difference ($P > .05$) between private and public secondary school teachers'

opinion (χ^2 cal. of 1.36 $<$ χ^2 crit. of 7.82) about their use of collaborative learning strategies in their schools. Also, from Tables 5 and 6, the chi-square analyses shows that there is no significant difference in opinion ($P > .05$) between private and public secondary school (χ^2 cal. of 4.99 $<$ χ^2 crit. of 7.82) science and mathematics teachers and male and female (χ^2 cal. of 4.33 $<$ χ^2 crit. of 7.82) teachers respectively about the effectiveness of collaborative learning strategies. This shows that science and mathematics teachers have acknowledged their use of collaborative learning and its effectiveness and usefulness in learning irrespective of school ownership and gender. This finding is in line with the statement of Johnson and Johnson (1984) that collaborative learning is the most effective form of learning. A lot of research also reported the advantages of collaborative learning over the competitive and individualized learning on a wide range of learning tasks (Tizmann, Jones, Fennimore, Bakker, Fine & Pierce, 1990; and Davis, 1993).

Recommendations and Conclusion

Based on the results of the study and considering the significance of the collaborative learning strategies in the school setting, the following recommendations are made:

1. Various school heads at the secondary school level should ensure that in science and mathematics teachers adopt the use of collaborative strategies in teaching and learning process.
2. Inservice teachers should be retrained on the various methods of applying collaborative learning to facilitate understanding of concepts and improve performance by secondary students through workshops which could be organized by the Science Teachers Association of Nigeria, the National Mathematics Center, Abuja and other agencies.

3. Trainers of preservice teachers in various teacher training institutions should expose them to strategies of collaborative learning so that they will be able to practice it successfully when they graduate.

In conclusion, collaborative learning has tremendous impact in the teaching and learning process. Results from the studies have shown that the teachers males and females alike and from private and public schools like collaborative learning and the majority practice it in their teaching and learning process. However, the effect of the claim by teachers of their use of collaborative learning is hardly seen in the performance of students in science and mathematics. Therefore, it is recommended that in service teachers be retrained through workshop to enable them apply this method properly. It is hoped that this will improve student's performance.

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