GENDER EFFECTS OF COOPERATIVE LEARNING ON ACADEMIC ACHIEVEMENTS OF STUDENTS IN BASIC SCIENCE IN RIVERS STATE, NIGERIA

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Abstract

This study determined the gender effects of cooperative learning on academic achievement of students in basic science in Rivers State, Nigeria. It also considered the effects of gender in a competitive lecture method. Six hundred and seven students from six junior secondary schools selected by simple balloting technique in the three senatorial districts in Rivers State were involved in the study. Two research questions and hypotheses were formulated and tested at 0.05 level of significance. The result showed that there was no significant difference between the academic achievement of the male and female students exposed to the cooperative learning strategy, but there was significant difference observed in the academic achievement of the male and female students taught with lecture method. The findings showed that cooperative learning is non-gender biased and more effective in promoting students' academic achievement than lecture method. Based on these findings it was remanded that new instructional strategy like cooperative learning be adopted in Nigerian secondary schools.

A. Introduction

Gender issue is an inconclusive case in science achievement. While some researchers see boys performing better than girls, others see girls performing better than boys. The interrelationship between gender and science achievement has been that which has received a wide research in the past.

A study carried out on gender differences by the International Centre for Educational Evaluation, University of Ibadan (ICEE) in 1985 with particular reference to the Nigeria population confirmed among others that male pupils consistently performed better than females at the primary level. Kelly (1987) in his work which focused on lack of girls’ interest to study the physical sciences stated that girls have sustained interest in sciences like boys. Scoffled (1994) and Erinosho (1995) believed that gender had a great influence on achievement and attitude of the females’ participation in sciences. Other research works have equally established significant gender difference in science education in favour of boys.

Potlethwaist and Wiley (1999) also reported that boys performed better than girls in science.

Onocha (1995) found sex of pupils as one of the variables that effectively predict primary school pupils’ attitude towards science and science achievement. This was confirmed by Obioma (1996), Okpala and Onocha (1998) who found gender as a significant determinant of students achievement in physics. Yoloye (1998), Jones (1999) and Kotte (2002) working n science achievement between boys and girls confirmed that boys tend to perform better than girls.

Wang and Andre (2001) investigated the relationship between conceptual change approaches and gender. They found an overall gender effect. The concept investigated was electricity. They hypothesized that an average man had a high level interest in electricity than women. On the other hand, Ige (2008) found no significant main effect on gender on students’ learning outcomes in secondary school ecology.

However, a significant interaction effect of teaching strategy (treatment) and gender on students’ cognitive achievement was found (Agboghoroma, 2005).

Iroegbu (2000) also found no significant main effect of gender on students’ achievement in energy concepts in physics, but reported interaction effects of treatment and gender as well as gender and ability on students’ achievement in energy concepts in physics. Mullis and Jenkins (1998) reported that, interest in science is high for both male and female
students in elementary schools, but declines particularly for females in the middle secondary school years. Funk (2004) states that in co-educational schools, the competitive manner in which science is typically done may contributed to females decreased interest. Ransom (2002) in his study discovered that gender actively, reinforced boundaries through perceptions of certain subjects as being male or female. Both boys and girls use each other as a negative reference group in the maintenance of gender boundaries. Sheperds (2003) is of the view that in order to improve the achievement and attitude of the female students in sciences feminine traits such as feeling and receptivity in studying science should be encouraged. This was supported by baker (2005).

Some people believed (without any empirical support) that because men are regarded as dominant and even superior sex, they intrinsically have better brains and learn much better than women (Mkpughe 1998 cited in Okoye, 2009). This view tend to be in line with that of Rosenthal and Rubin (1982) and Hyde (1981) that differences between male and female students in intellectual performance in schools have been demonstrated on a wide range of variables. Maccoby and Jacklin(1974) concluded that gender differences were well established. Girls have greater verbal ability than boys, and boys have better visual spatial ability than girls.

Other research studies show that observed differences had not always favored one gender. In Nigeria, considerable efforts can be implicated in the seeming poor performance of girls in integrated science (Ukwuagwu 2002 cited in Okoye 2009). Ariyo (2001) pointed out that the issue of gender differences need further examination since a number of studies especially in Africa have reported that girls are under represented in the fields of science and technology at secondary and tertiary institutions level (Adele-Williams,1999). Gender difference was first investigated by sociologist of education. The focus was largely on female under achievement at every level of the educational system. Therefore, there is the need to promote teaching and learning of science in schools especially among female students. Ajejalami (1990) identified the following factors as contributing to under representation of females in science and technology education in Africa;

- Lack of functional guidance and counseling services,
- Relationship of sex to occupational prestige,
- Influence of schooling,
- Interest,
- Family background,
- Training opportunities
- Lack of adequate orientation programme,
- Societal discrimination against females in education,
- Occupational choice and adaption of science and technology.

Fakorede (1999), in his own contribution posited that poor enrolment of girls in science subjects in due to:

- In adequate opportunity for girls to study science,
- Inadequate achievement of girls in science,
- Unfavorable attitude of girls to science learning and,
- Inadequate knowledge of girls on the true nature of science.

The critical belief of biological theorists is that gender differences are natural and therefore unalterable (Olubunmi,2001 cited in Ariyo, 2011). It would be right and proper to treat boys and girls in school differently because their natural inclinations are different roles. The above studies had not investigated the effect of gender on students’ achievement in a cooperative learning class which is the purpose of this work. It is important to review some of the studies in this regard.

Kolawole (2007) in a study on the effects of competitive and cooperative learning strategies on academic performance of Nigerian students in science stated that the male students performed significantly better than their female counter parts in learning science with cooperative and competitive learning strategies. There are gender influence with respect to
performance in science through cooperative and competitive learning strategies.

Akinbobola (2006) showed that boys performed significantly better than girls in cooperative learning strategy. Studies by Johnson, and Stanne (1986); Glassman (1989); Trowbridge and Bybee (1996) and Egwanwor (2013) on cooperative learning found cooperative learning groups to equalize the status and respect for all members, regardless of gender. Research by Klein (1985) cited in Ajaja and Erawoke (2010) revealed that competitively structured classroom have the affect of favoring boys or reinforcing sex role stereotypes that may limit opportunities for girls.

In cooperative learning this usually is not the case; where interaction among students is intend and prolonged and students gradually take responsibility for each others learning (Borich, 2004).

Humphrey, Johnson and Johnson (1982) and Akinbobola (2006) in different studies on cooperatives learning strategy indicated that boys performed significantly better than girls in cooperative and competitive learning strategies. This report was also in live with report of Adeyemi (2003) and Kolawole (2007). Students’ gender can influence interaction in cooperative learning groups when groups are not balanced according to this variable, Webb (1982, 1989) found gender influence on interaction and achievement in sixth and seventh-grade students in mathematics. In groups with girls in majority, girls allotted most of their messages to boys and they had lower achievement than boys. In groups where boys were in majority, boys showed the tendency to ignore girls and at the same time, boys had higher achievement. It was also found that there is a higher possibility to get an elaborate answer and explanation when the question is directed to a girl. These differences were not found in the groups of students that were balanced according to gender.

Peterson, Johnson and Johnson (1991) found similar result for sixth-grade students in science. In groups, balanced according to gender, there were no differences in achievement, group interaction and perceived status. But boys got higher results in predominantly female groups and achieved higher results in predominantly male groups. Boys in female groups also got instruction how to finish task than boys in male groups.

Garduno (2001) investigated gender differences in cooperative problem solving in gifted students. She found no statistically differences in achievement or self –efficacy in seventh and eighth-grade students in mathematics in single or mixed –gender groups but female from mixed-gender groups reported better attitudes towards mathematics than males from mixed-gender groups.

Other studies have also examined the influence of gender on students’ achievement. For example, Adekoya and Olatoye(2011) found no gender differences in academic achievement of students exposed to different teaching strategies in science. Okebukola (1985) found no gender differences in academic achievement in cooperative and competitive learning groups. However, Oyedeji (1991) reported a significant influence of gender on academic achievement with boys having better scores than girls in the study. Olatoye, Aderogba and Aanu (2011) found non-significant effect of gender on students’ achievement and also non-interaction effect of gender with treatment of cooperative learning strategy.

B. Statement of the Problem

Over the years, the method of science teaching has been the lecture method. This is a method where content material are presented to students in their final forms. The results of students in science and particularly basic science have not been encouraging especially when compared between the performances of the boys and girls as reported by Ale, 2008. This development indicated an instructional method failure and a need for an alternative method which can guarantee effective learning by students.

Following the qualities ascribed to cooperative learning by researches as being able to enhance science learning, its use as an alternative instructional approach for basic science teaching becomes a possibility. The problem which this study seeks to solve is will the application of cooperative learning strategy in the teaching of basic science produce better learning outcomes and guarantee equal achievement of students of different sexes?
Research Questions
This study was guided by the following research questions.
1. Will there be any difference in achievement test scores in basic science between male and female students exposed to cooperative learning strategy?
2. Will there be any differences in achievement test scores in basic science between male and female students exposed to lecture method?

Research Hypotheses
The following null hypotheses were formulated for testing at the 0.05 level of significance.

H₀₁: There is no significant difference in basic science achievement test scores between male and female students exposed to cooperative learning strategy.

H₀₂: There is no significant difference in basic science achievement test scores between male and female students taught with lecture method.

Purpose of the study
The main purpose of this study is to determine how gender affects students’ achievement in basic science in a cooperative class. Also to determine if there will be differences in achievement test scores between the students exposed to cooperative strategy and those taught with lecture method.

C. Methodology
This study employed a 2x2 non-randomized pretest, post test control group quasi-experimental design. This consist of two instructional methods of cooperative learning and lecture method, gender at two levels of male and female.

The independent variable is the instructional method comprising the cooperative learning strategy and lecture method whereas the dependent variable is the scores or achievement in basic science achievement test (BSAT).

The population for the study consisted of all 259 government owned (UBE-9) secondary schools in Rivers State with a population of 35,521 students as at the time of this study.

Only two secondary schools were selected from each of the three senatorial districts in Rivers State, giving a total of six secondary schools using simple balloting technique for the selection.

Only the universal basic education (UBE-9) or the junior secondary class III of the mixed (co-education) schools were used for the study, two arms of UBE-9 (JSS3) of the selected secondary schools were used for the study, one of the JSS3 served as experimental group, while the other arm served as the control group. Two research instruments used for the study are basic science achievement test (BSAT) and cooperative learning manual.

The data generated were analyzed using both descriptive and inferential statistics. Descriptive statistics used were means, standard deviation, while inferential statistics used was analysis of covariance (ANCOVA), using pretest scores as covariates.

Result
The data and result of each research question and its corresponding hypothesis are presented on different tables.

Research question i:
Will there be any difference in achievement test scores in basic science between male and female students exposed to cooperative learning strategy?

Table I: Mean gain in achievement test scores between the male and female students of the cooperative learning group.

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Pre-test mean</th>
<th>SD</th>
<th>Post-test mean</th>
<th>SD</th>
<th>Mean gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>146</td>
<td>32.98</td>
<td>14.11</td>
<td>63.95</td>
<td>14.38</td>
<td>30.97</td>
</tr>
<tr>
<td>Female</td>
<td>172</td>
<td>28.80</td>
<td>12.84</td>
<td>59.51</td>
<td>14.07</td>
<td>30.71</td>
</tr>
</tbody>
</table>

Above table I shows the mean gain in achievement test scores of the male and female...
students of the cooperative learning (Experimental) group. The result indicates that gain in learning in both groups was almost the same for both gender.

**H01:** There is no significant difference in basic science achievement test scores between male and female students exposed to cooperative learning strategy.

**Table 2:** Summary of analysis of covariance (ANCOVA) on the significance of difference in basic science test scores between male and female students exposed to cooperative learning strategy.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>56715.494</td>
<td>3</td>
<td>18905.165</td>
<td>686.173</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>49237.772</td>
<td>1</td>
<td>49237.772</td>
<td>1787.111</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>11.781</td>
<td>1</td>
<td>11.781</td>
<td>.428</td>
<td>.514</td>
</tr>
<tr>
<td>Pre-Test</td>
<td>55097.069</td>
<td>1</td>
<td>55097.069</td>
<td>1999.778</td>
<td>.000</td>
</tr>
<tr>
<td>Gender * Pretest</td>
<td>25.464</td>
<td>1</td>
<td>25.464</td>
<td>.924</td>
<td>.337</td>
</tr>
<tr>
<td>Error</td>
<td>8651.201</td>
<td>314</td>
<td>27.552</td>
<td>.514</td>
<td>.000</td>
</tr>
<tr>
<td>Total</td>
<td>1270091.000</td>
<td>318</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>65366.695</td>
<td>317</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 above with (F (314) = 0.924 P>0.05) shows that there was no significant difference in basic science achievement test scores between the male and female students exposed to cooperative learning strategy. This implies that the treatment was a suitable method for both genders (sexes). It did not constitute any differential achievement test scores in basic science between the male and female students. Thus, the null hypothesis of non-significant difference was retained.

**Research question 2:**

Will there be any difference in achievement test scores in basic science between male and female students exposed to lecture method?

**Table 3:** Mean gain in achievement between male and female students exposed to the lecture method.

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Pre-test mean</th>
<th>SD</th>
<th>Post-test mean</th>
<th>SD</th>
<th>Mean gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>135</td>
<td>32.30</td>
<td>14.23</td>
<td>44.59</td>
<td>17.44</td>
<td>12.30</td>
</tr>
<tr>
<td>Female</td>
<td>154</td>
<td>26.97</td>
<td>13.75</td>
<td>33.71</td>
<td>16.20</td>
<td>6.74</td>
</tr>
</tbody>
</table>

Table 3 above shows the mean difference in achievement test scores between the male and female students of the control group. The result indicates that gain in learning in lecture method differed between males and females.

**H02:** There is no significant difference in basic science achievement test scores between male and female students taught with lecture method.

**Table 4:** Summary of Analysis of Covariance (ANCOVA) for the significance of difference in basic science achievement test scores between the male and female students taught with lecture method.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>87533.050</td>
<td>3</td>
<td>29177.683</td>
<td>5849.016</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>738.606</td>
<td>1</td>
<td>738.606</td>
<td>148.063</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>124.630</td>
<td>1</td>
<td>124.630</td>
<td>24.984</td>
<td>.000</td>
</tr>
<tr>
<td>Pre-Test</td>
<td>79215.432</td>
<td>1</td>
<td>79215.432</td>
<td>15879.683</td>
<td>.000</td>
</tr>
<tr>
<td>Gender * Pretest</td>
<td>32.065</td>
<td>1</td>
<td>32.065</td>
<td>6.428</td>
<td>.012</td>
</tr>
<tr>
<td>Error</td>
<td>1416.727</td>
<td>284</td>
<td>4.988</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>520780.000</td>
<td>288</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>88949.778</td>
<td>287</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table 4 above indicates that there is significant difference in basic science
achievement test scores between male and female students taught with lecture method. There is also a difference in the mean gain of male and female students taught with lecture method (12.30 and 6.74) respectively (see table 3). This implies that using the lecture method, the male students benefitted more than their female counterparts. Thus, the null hypothesis of non-significant difference was rejected.

D. Discussion of Results

The study sought to determine the effects of gender on the achievement of basic science students in a cooperative learning class. The results observed showed that cooperative learning and lecture method were effective in enhancing students’ achievement as shown in the mean gain.

The result of this study shows that gender had no significant effects on students’ achievement in a cooperative learning class, but had significant effects in the control group. This is because, as show in table 3, the male had higher mean gain than their female counterparts in lecture method class. This finding corroborates the findings of Okebukola (1985), Peterson, Johnson and Johnson (1991), Garduno (2001), Cirila (2003), Wachang and Mwangi (2004) Ajaja and Eravwoke (2010), Adekoya and Olatoye (2011), Olatoye et al (2011) and Egwanwor (2013). They stated that all students irrespective of their sexes benefited in about the same margin from the use of cooperative learning strategy. This finding is in contrast with the findings of Humphrey, Johnson and Johnson (1982), Webb (1982, 1989), Adeyemi (2003), Akinbobola (2006) and Kolawole (2007), who stated that males performed significantly better than their female counterparts.

The observed finding that both sexes of the students benefited equally was achieved because, according to Aronson (2002), group members must work together as a team to accomplish a common goal and each person depends on one another. No student can achieve his or her individual goal of learning the material or getting a good grade unless everyone work together as a team.

The finding in hypothesis two state that there was significant difference found in the achievement test scores between the male and female students taught with lecture method. The finding corroborates with the result of Kelly (1987), Scoffled (1994), Erinoshio (1995), Yoloye (1998), Jone (1999), Postlethwaist and Willey (1999), Andre (2001), Kotte (2002) and Egwanwor (2013), but this contradicts the findings of Iroegbu (2000) and Ige (2008) who found no significant main effect of gender on students achievement in a lecture method.

The researchers believed that the ages of the learners and the duration of the treatment may be the factors resulting in the diversities (disagreement) of these findings.

E. Conclusion

It appears that cooperative learning as described in the study is a very viable option among other instructional methods for teaching science in secondary schools. Also, a student who actively engages in the collaborative skills involved in cooperative learning class will influence the learning material and knowledge content irrespective of his or her gender. This was not observed in a competitive lecture method setting. It could be concluded that cooperative learning strategy was not gender bias as there was no significant difference in the achievement of the students, either male or female contrary to the observed result in the lecture method.

Recommendations

Based on the findings of the study, it is recommended that:

1. Workshop should be organized for the science teachers on how to use cooperative learning approach as a way of improving their students’ achievement in the subject i.e. to expose the students to collaborative skills which will encourage social interaction among the learners.
2. Textbook writers should shift emphasis from teachers’ activities to students’ activities that will promote cooperative learning in their basic science textbooks.
3. Curriculum planners should ensure that there is implementation of the use of cooperative learning methods. In order to emphasis this, there should be for teachers a training and reference materials on how to implement the cooperative learning approach.
References


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