Effects of Peer Tutoring and Reversed Jigsaw Instructional Strategies on Senior Secondary School Science Students’ Interest and Achievement in Katsina State, Nigeria

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ABSTRACT
This study examined the effect of Peer Tutoring and Reversed Jigsaw Instructional Strategies on senior secondary school science students’ interest and achievement. Quasi experimental research design was employed for the study. The sample for study comprised one hundred and fifteen SS II Science students from three intact classes randomly selected from three public coeducation schools in Katsina North Senatorial District of Katsina State, Nigeria. Two instruments were used for data collection namely; Students’ Interest in Science and rating scale (SISRAS) and Science Students’ Achievement Test (SSAT). SISRAS contained 20 items designed to determine students’ interest in Science. The reliability of SISRAS was determined using Cronbach Alpha and the coefficient obtained was 0.77 while Kuder-Richardson formula 21 (K-R21) was used to determine the reliability of SSAT and the reliability coefficient was found to be 0.80 implying that the instruments were reliable enough for the study. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. Findings from the study have revealed a significant difference between the achievement of Science students in Peer Tutoring, Reversed Jigsaw instructional strategies and conventional Demonstration method in favour of the two instructional strategies. This result indicates that the instructional strategies are more effective in enhancing Science students’ interest and achievement than the conventional demonstration method. Based on the findings of this study, it was recommended that: Science teachers should incorporate Peer Tutoring and Reversed Jigsaw instructional strategies into the teaching of Science in secondary schools in Kastina State.

Keywords: Achievement, Science, Peer Tutoring, Interest, Instructional Strategy and Reversed Jigsaw.

INTRODUCTION
Science education has become one of the best avenues to meet the global challenges facing the Nigerian nation. Despite the importance of Science and Technology in the country’s quest for technological advancement, there has been seeming ineffectiveness in the teaching and learning of the subject which in turn is strongly affecting the attainment of the country’s laudable objectives and goals of developing a scientific and technologically literate citizenry. Researchers such as Bukunola and Idowu (2012), Osokoya (2013), Alabi (2014), Oni (2014) Kabutu, Oloyede and Bandele (2015) and Samuel (2017) observed that poor instructional strategies employed in the teaching of science subjects by teachers
contribute to students under achievement. Students find it difficult to understand the basic concepts taught. In order to achieve the objectives of Basic Science and Technology education, the student-activity-based mode of teaching strategies have been recommended by the Federal Republic of Nigeria (FRN, 2014).

Moreno and Duran (2002) described peer tutoring as a method of cooperative learning based on the creation of pairs of students with a lopsided relationship; that is, the tutor and tutee do not have equal academic ability but they share a common goal. This goal must be achieved through a relationship framework organised by the teacher. Peer tutoring is regarded as an excellent resource for facilitating the mastery of interpersonal competencies. Fuchs, Fuchs, Mathes, and Martinez (2002) assert that socialisation experiences that occur during peer tutoring can benefit both the tutor and the tutee by encouraging students to learn and increase their social standing among peers. Peer tutoring was found to be helpful in socialization experience as the level of interaction among students both inside and outside the classroom improved significantly. Peer tutoring is also important for the tutor; that is, learning is encouraged through teaching. Hartman (2010) conducted an evaluation study and reported that peer tutoring increased students’ motivation to learn. This result is supported by Whitman (2012) and Annis (2013) who stated that peer tutoring can be the most intellectually rewarding experience of a student’s career. They found peer tutoring helped students perform better on higher order conceptual understanding scales than students who read the material simply for study purposes. Oviawe (2008) also asserts that peer tutoring serves as an effective way to improve self-esteem in students. Peer tutoring aids interaction among peers not only academically but also socially.

Reversed Jigsaw is one of the newest methods created by Timothy Hedeen under the cooperative learning techniques used in classroom settings. It follows the same principle as the original Jigsaw method. The jigsaw technique in the cooperative learning methods uses a small group structure to facilitate group discussion through which the learning takes place. The reverse jigsaw method also resembles the original jigsaw method in some way but has its own objectives to be fulfilled. While the jigsaw method focuses on the student’s comprehension of the Instructor’s material, the reverse jigsaw method focuses on the participant’s interpretations such as perceptions, judgements through a very active discussion. This method was mainly created to cater for the higher class students. It is best advised to give an explanation before the discussion on the topics take place. This not only ensures that the learners are more effective in their discussion but also saves time. It differs from the original Jigsaw during the teaching portion of the activity. In the Reverse Jigsaw technique, students in the expert groups teach the whole class rather than return to their home groups to teach the content (Heeden, 2003).

The process involved in the reverse Jigsaw method can be explained in 3 steps

1. Students gather in mixed groups where they are each given a case study with a number of questions or one complex question and allotted time of about 15 mins to discuss. Each member of the team is given a unique topic and hence a discussion is initiated within the mixed group and the main points and the outcomes are noted.
2. Each member gather in the expert group or topic group and the points and outcomes are compared. A report is prepared compiling all the common and divergent themes. The time allotted for this could be between 15 - 20 mins. A reporter is appointed to present the same before the class.
3. The class gathers as a whole and the reporters from the various topic group present their report to the whole class by ways of overheads, flipcharts or chalk broad, following which the instructor debriefs the whole exercise with review or evaluation of the process (Heeden, 2003).

Interest is considered to be the feeling of an individual towards a particular object or an activity. It means that a child will develop interest in any object or activity that is found to be attractive or stimulating. Therefore, in a classroom situation, the learner will be attentive during a lesson only if the instruction is appealing to the learner (Danjuma, 2015).

Achievement is the action of accomplishing an academic task successfully. Its purpose is to find out the stand of a student at a given moment (Akani, 2017). It has to do with testing the knowledge acquired by
the student which helps the teacher and the student to evaluate and predict the degree of learning attained. It is useful in testing the retention of information and skill. It is also a determinant of the efficacy and efficiency of a given instruction (Kabutu, Oloyede & Bandele, 2015).

The persistent underachievement of students in Science is alarming. The aim of the present study was to determine the extent to which classroom exposures of students to Peer tutoring and Reversed Jigsaw Instructional Strategies could enhance Science students’ interest and achievement. Specifically, the study sought to find out:


Research Questions
1. What is the effect of Peer Tutoring and Reversed Jigsaw Instructional Strategies on students’ interest in Science?
2. What is the effect of Peer Tutoring and Reversed Jigsaw Instructional Strategies on students’ achievement in Science?

Research Hypotheses

H₀₁: There is no significant difference in the mean interest scores of students taught Science using Peer Tutoring and Reversed Jigsaw Instructional Strategies.

H₀₂: There is no significant difference in the mean achievement scores of students taught Science using Peer Tutoring and Reversed Jigsaw Instructional Strategies.

METHODOLOGY

Quasi-experimental, non-equivalent pretest, post-test, control group design was employed for the study. The sample for study comprised one hundred and fifteen SS II Science students from three intact classes randomly selected from three public coeducation schools in Katsina North Senatorial District of Katsina State, Nigeria. The experimental groups I (n=35) and II (n=38) were taught using Peer Tutoring and Reversed Jigsaw Instructional Strategies respectively while the control group was taught using the conventional demonstration method (n=42).

Two instruments were used for data collection namely; Students’ Interest in Science and rating scale (SISRAS) and Science Students’ Achievement Test (SSAT). SISRAS contained 20 items designed to determine students’ interest in Science. SIBSATRAS was rated using a four-point rating scale. The options were; Strongly agreed (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagreed (SD) = 1 point. Science Students’ Achievement Test (SSAT) was developed as instrument for data collection. SSAT was a 25 itemed instrument with options A – E that tested the students’ knowledge, comprehension, application of selected topics in Science namely; Ecology, Optics and Waves and Chemical Equilibrium. The items were allotted 2 marks each, culminating to the total score of 50 marks. The instruments were validated by experts in Science and trial tested. The reliability of SISRAS was determined using Cronbach Alpha and the coefficient obtained was 0.77 while Kuder-Richardson formula 21 (K-R21) was used to determine the reliability of SSAT and the reliability coefficient was found to be 0.80 implying that the instruments were reliable enough for the study. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance.
RESULTS

Research Question One: What is the effect of Peer Tutoring and Reversed Jigsaw Instructional Strategies on students’ interest in Science?

The data used to answer this research question is presented in Table 1.

Table 1: Means and Standard Deviation of Science Students’ Interest Scores Exposed to Peer Tutoring, Reversed Jigsaw Instructional Strategies and Conventional Demonstration Method

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of Test</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Tutoring Instructional Strategy</td>
<td>Pre-interest</td>
<td>35</td>
<td>15.11</td>
<td>2.89</td>
<td>22.40</td>
</tr>
<tr>
<td></td>
<td>Post-interest</td>
<td>35</td>
<td>37.51</td>
<td>2.02</td>
<td></td>
</tr>
<tr>
<td>Reversed Jigsaw Instructional Strategy</td>
<td>Pre-interest</td>
<td>38</td>
<td>12.01</td>
<td>3.01</td>
<td>19.09</td>
</tr>
<tr>
<td></td>
<td>Post-interest</td>
<td>38</td>
<td>31.10</td>
<td>2.06</td>
<td></td>
</tr>
<tr>
<td>Conventional Demonstration Method</td>
<td>Pre-interest</td>
<td>42</td>
<td>11.09</td>
<td>3.08</td>
<td>11.89</td>
</tr>
<tr>
<td></td>
<td>Post-interest</td>
<td>42</td>
<td>22.98</td>
<td>2.16</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 shows that mean gain of the interest scores of Science students exposed to Peer Tutoring instructional strategy is highest (22.40) followed by those exposed to Reversed Jigsaw (19.09) and those exposed to the Conventional Demonstration Method had the least (11.89).

Research Question Two: What is the effect of Peer Tutoring and Reversed Jigsaw Instructional Strategies on students’ achievement in Science?

The data used to answer this research question is presented in Table 2.

Table 2: Means and Standard Deviation of Science Students’ Achievement Scores Exposed to Peer Tutoring, Reversed Jigsaw Instructional Strategies and Conventional Demonstration Method

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of Test</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Tutoring Instructional Strategy</td>
<td>Pre-test</td>
<td>35</td>
<td>17.31</td>
<td>2.25</td>
<td>22.55</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>35</td>
<td>39.85</td>
<td>3.10</td>
<td></td>
</tr>
<tr>
<td>Reversed Jigsaw Instructional Strategy</td>
<td>Pre-test</td>
<td>38</td>
<td>15.16</td>
<td>2.19</td>
<td>17.86</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>38</td>
<td>33.02</td>
<td>2.98</td>
<td></td>
</tr>
<tr>
<td>Conventional Demonstration Method</td>
<td>Pre-test</td>
<td>42</td>
<td>11.65</td>
<td>2.31</td>
<td>12.91</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>42</td>
<td>24.56</td>
<td>2.71</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows that mean gain of the achievement scores of Science students exposed to Peer Tutoring instructional strategy is highest (22.55) followed by those exposed to Reversed Jigsaw (17.86) and those exposed to the Conventional Demonstration Method had the least (12.91).

Hypothesis One

There is no significant difference in the mean achievement scores of students taught Science using Peer Tutoring and Reversed Jigsaw Instructional Strategies.

Data to test the hypothesis is presented in Table 3.
Table 3: Result of Analysis of Covariance of Science Students' Interest Using SISRAS

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Square</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>5915.209</td>
<td>2</td>
<td>1250.10</td>
<td>55.09</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>7390.371</td>
<td>1</td>
<td>1056.01</td>
<td>213.12</td>
<td>.000</td>
</tr>
<tr>
<td>Pre-interest</td>
<td>4102.317</td>
<td>1</td>
<td>3507.10</td>
<td>75.17</td>
<td>.000</td>
</tr>
<tr>
<td>Group</td>
<td>944.021</td>
<td>1</td>
<td>944.021</td>
<td>128.11</td>
<td>.000</td>
</tr>
<tr>
<td>Error</td>
<td>3101.221</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21453.139</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows that the ANCOVA test is $F = 128.11, p <0.05$. This implies that there is a significant difference in the interest mean scores of Science students exposed to Peer Tutoring, Reversed Jigsaw instructional strategies and the Conventional Demonstration method. Therefore, the hypothesis was rejected.

**Hypothesis Two**

There is no significant difference in the mean interest scores of students taught Science using Peer Tutoring and Reversed Jigsaw Instructional Strategies.

Data to test the hypothesis is presented in Table 4.

Table 4: Result of Analysis of Covariance of Science Students’ Interest Using SSAT

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Square</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>9535.138</td>
<td>2</td>
<td>1180.91</td>
<td>512.31</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>8643.008</td>
<td>1</td>
<td>2218.55</td>
<td>138.92</td>
<td>.000</td>
</tr>
<tr>
<td>Pre-test</td>
<td>5259.217</td>
<td>1</td>
<td>1313.71</td>
<td>95.41</td>
<td>.000</td>
</tr>
<tr>
<td>Group</td>
<td>1021.011</td>
<td>1</td>
<td>4534.52</td>
<td>151.81</td>
<td>.000</td>
</tr>
<tr>
<td>Error</td>
<td>3101.221</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27559.595</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 shows that the ANCOVA test is $F = 151.81, p <0.05$. This implies that there is a significant difference in the mean achievement scores of Science students exposed to Peer Tutoring, Reversed Jigsaw instructional strategies and the Conventional Demonstration method. Therefore, the hypothesis was rejected.

**DISCUSSION**

Findings from the study have revealed a significant difference between the achievement of Science students in Peer Tutoring, Reversed Jigsaw instructional strategies and conventional Demonstration method in favour of the two instructional strategies. This result indicates that the instructional strategies are more effective in enhancing Science students’ interest and achievement than the conventional demonstration method. The findings of the study are consistent with the findings of (Heeden, 2003;...
Oviawe, 2008; Bukunola & Idowu, 2012; Whitman, 2012; Kabutu, Oloyede & Bandele, 2015; Gambari & Yusuf, 2017; Agu & Samuel, 2018 and Samuel, 2018), who in their various researches reported that students taught using Peer Tutoring, Reversed Jigsaw and other cooperative instructional strategies achieved better academically than those taught using the conventional methods. In relation to interest, the same researchers also found out that the instructional strategies had greater ability to increase the interest of Science students compared to the conventional demonstration method. This is further in line with the findings of Agu and Samuel (2018) and Danjuma (2015) who found that cooperative instructional strategies have positive effect on students’ interest in Science.

CONCLUSION
The findings of this study revealed that Peer Tutoring and Reversed Jigsaw instructional strategies have significant effect on students’ interest and achievement in Science.

RECOMMENDATION
Based on the findings of this study, it was recommended that; Science teachers should incorporate Peer Tutoring and Reversed Jigsaw instructional strategies into the teaching of Science in secondary schools in Katsina State.

REFERENCES


