**Effectiveness of Cooperative Learning Strategy on Basic Science Students’ Achievement in Obio-Akpor Local Government Area of Rivers State**

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**Abstract**

*The study determines the impacts of cooperative learning strategy on students’ academic achievement in Basic Science in Rivers State's Obio-Akpor LGA. A total of 104 students in Japanese grade 3 basic science classes participated in the study. Fifty-five students were assigned to the lecture group and taught the process of photosynthesis to them, while the remaining 49 students were split between the experimental and control groups for the purpose of this study. The study used a quasi-experimental design. Data was gathered using the Basic Science Achievement Test (BSAT). There were 50 multiple-choice questions totaling 50 points. The reliability of the instrument was determined using Test- retest approach. The mean and standard deviation were used to analyse the students' performance. At a.05 level of significance, we employed ANCOVA to test the hypotheses. The results of the research show that cooperative learning encourages greater student engagement. This quality significantly affects the acquisition of knowledge in the field of Basic Science (F (1, 104)=323.10, p<.05). The study recommended allowing science teachers to use cooperative learning techniques to get more students involved in the lab.*

**Keywords:** Cooperative Learning Strategy, Gender, Students, Achievement in Basic Science

**Introduction**

In the past, working with a partner to study or asking for help from others was often seen as a sign of dependency or frailty. But in contemporary times, working with others and asking for assistance are now seen as two of the best strategies to improve learning and cultivate metacognitive abilities (Chen, 2002). Cooperative learning events are planned ways to learn in which each student is responsible for his or her participation, help, and learning. Students are also given reasons to work together to teach others and learn from others (Slavin, 2000).

Cooperative learning, as described by Slavin (2011), is a teaching strategy in which students work together to better comprehend and retain course material. Cooperative learning is the antithesis of traditional classroom activities, which create a zero-sum game in which everyone wins except the teacher. When compared to other forms of instruction, cooperative learning has been shown to produce more significant gains in students' levels of knowledge, social competence and motivation. As each member of the group is crucial to the group's success, dependency (in a good way) and responsibility are two characteristics that have set cooperative learning apart from more conventional forms of education.

Cooperative learning is a method of instruction that places students in groups to learn from and with one another. In the cooperative learning method (Trowbridge et al., 2000; Ajaja & Eravwoke, 2012), students work in pairs or small groups to assist each other understand the course content. Cooperative learning, as described by Akinbobola (2008), involves students of varying skill levels working together in small groups to complete an assignment. The goal is to increase comprehension of a subject by having students engage in a number of different methods of study. Students work together in groups to investigate a topic, discuss their findings with the rest of the class, and make choices based on what they've learned. The cooperative learning technique is comprised of four primary components. The four cornerstones are (1) the use of interpersonal skills and small groups; (2) the use of small groups designed for positive interdependence; (3) the acceptance of personal responsibility; and (4) the use of face-to-face contacts. It is well-known that cooperative learning encourages student participation and aims to strengthen students' ability to think critically, rationally, and solve problems (Borich, 2004).

**Concept of Cooperative Learning**

Teachers may use a wide variety of strategies to boost their students' enthusiasm and engagement in class discussions. Cooperative Learning (CL) is a relatively new approach that has been hailed by some experts as an excellent means of inspiring pupils to study. One of the most challenging aspects of teaching English as a foreign language is, as Priyantin (2014) points out, working with students who are reticent to speak out in class. Because they fear being judged by others, these students often feel uninspired to speak out when they are put in a social situation where they must express themselves. Cooperative learning has been shown to improve both students' spoken communication skills and their interest in learning (Liang, 2002).

Students frequently demonstrate their disinclination to learn in class, despite their enthusiasm. Not because they don't like the instructor, but because they want to push themselves farther and learn more beyond just sitting quietly and taking notes. According to the cooperative learning approach, students are more likely to be accountable if they are given specific tasks to fulfil within the context of a larger group project. Some introverted kids may prefer solitary projects, but everyone has to pitch in to help the team succeed. As an added bonus, arranging them into smaller groups will help the instructor keep track of such a huge class. Teachers are demonstrated to be able to influence and improve students' enthusiasm to engage more actively in class by applying a cooperative learning technique, which changes students' negative attitudes towards learning into more positive ones. Teachers may influence students with their attitudes if they project a good demeanor.

Nguyen (2010) suggests a number of strategies, including allowing students more time to work together on tasks, lowering students' anxiety levels, and encouraging students to help one another and work in groups. Students would also benefit from being given more opportunities to speak English outside of the classroom. Cooperative learning needs the ability to work well with other people and in small groups. (Johnson & Johnson, 1990) Some of these skills are staying with the group, keeping quiet, giving direction to the group's work, getting people to take part, connecting current learning to past learning, criticising ideas without criticising people, asking probing questions, and asking for more explanation. To make sure that small groups can work well together, teachers give each group time at the end of each class session to talk about how they worked well together. Groups must say which of their members' actions helped them do group jobs and make decisions and which did not.

When launched and skillfully implemented, cooperative learning creates a microcosm of value in a community. Teachers demonstrate how to begin to create an egalitarian society by instructing students on how to create, screen, and analyse the worth of their cooperative learning. As a result, collaboration is humanity's most grounded resource and expectation (Cohen et al., 2004). Cooperative learning, like proficient learning, has been widely adopted by instructors. Cooperative learning is a fantastic tool that may be used to boost student success in any classroom. It also promotes communal resilience and recognition, which enhances the quality of everyone's life. Numerous studies have shown that cooperative learning processes may be employed to increase comprehension. Teachers may use various cooperative learning processes in conjunction with their teaching approaches to improve learning in the classroom. This will result in greater academic accomplishment for pupils. Cooperative learning encourages students to think critically rather than memorise information (Chikh & Hank, 2016). Students who work together are more creative and problem solvers than those who work alone (Johnson & Johnson, 2014). Instructors often assign learning goals to cooperative learning groups and allow students to steer their learning so that they learn more than just the test.

Retention: According to Fore et al. (2006), the best way to remember knowledge or develop a mental model of a subject is to elaborate or explain the subject to other people, namely peers. According to the theory presented by Zakaria et al. (2013), pupils are more likely to remember information for longer periods if it is clarified and explained to them. According to Leonard and McElroy (2000), students who actively engage in their learning process have an easier time retaining the information they have learned. In other words, students were better able to recall the material when they spoke with their classmates about newly obtained knowledge than when they used any other teaching approach.

Self-esteem and attitudes: When students work together to learn, they are better able to understand each other. This has been shown in a number of studies to have a good effect on each person's sense of self-worth. When compared to the opinions of kids who didn't do any group work in class, students feelings about a certain topic "significantly increased at each level of group learning (low, moderate, and high)" (Smith et al., 2014). Gillies et al. (2008) and Spooner (2015) both say that joint learning does raise both self-esteem and self-concept. Through joint learning, each child has a chance to show what they know, so each child's input is respected.

Social skills: Several studies (Jenkins et al 2003) have shown that group learning makes people better at getting along with others. (Jurkowski & Hanze, 2015) found that students' interactions and ability to work as a group improved when they added to their partners' ideas and when their partners added to theirs. These nice conversations proved that students need to talk to each other and work together to learn and reach their school goals. (Goodwin, 1999) Most teachers find that group learning doesn't work for students with disabilities who need direct teaching in social skills like getting feedback and listening. This brings up an important point: people need to be taught social skills directly. Teachers need to show and support students that working towards a shared goal is rewarding and that working together is a way to get students motivated and interested (Igel & Urquhart, 2012).

Cooperative learning cannot be taught in a classroom setting using just words. Students may develop their cooperative learning skills via group projects that culminate in an item that is evaluated alongside the students' cooperative learning skills. According to the available research, the "Cooperative learning" (CL) approach is particularly useful for this purpose. Students develop CL when they work together to complete a task (Johnson & Johnson, 1999). The success of the group as a whole depends on the success of each member (Deutsch, 1962).

Teaching method (2015) says that cooperative learning is a way of teaching that encourages small groups of students to work together to reach a common goal. During cooperative education, students are randomly put into groups of four or five based on things like their gender, how well they do in school, their tribe, state, or race, among other things. They work together in these small groups to do learning tasks that have been planned. It encourages social interaction and a sense of belonging, both of which are important at work. Long-Crowell (2015) and the Best Practises of Science Teaching (2015) say that it is based on five principles: face-to-face involvement, positive cooperation, individual responsibility, group thinking, and social skills. Think-PairShare According to Australian Catholic University Resource-ACU (2012) and Carin and Sunds (1975, p.10), a joint teaching approach promotes gender equality, peaceful coexistence, the development of students' thought skills, and more student participation, among other things. On joint education, it was hard to find many real-world studies. Berger and Hanze (2010) looked at the effect of group skills on academic success in puzzle cooperative learning. They did this by comparing homogeneous and mixed cooperative groups. The results showed that the diverse group did better in school than the homogeneous group. When Nwagbo and Okoro (2012) looked at how interaction patterns changed biology outcomes in the Obollo Afor Education Zone, they found that helpful interactions were the most successful. It also showed that male biology students did better in school than their female peers. Previous scholars have conducted several empirical investigations on the impacts of CIS or its combination. Irinoye (2015) looked at the relative impact of CIS and demonstration approaches on secondary school students' academic achievement in the Nigerian state of Osun's Ifelodun Local Government Area (LGA). They found that using CIS instead of the demonstrative technique helped students learn and recall more practical chemistry.

The relative impacts of CIS and demonstrative technique on secondary school students' performance in ecological concepts in Rivers State, Nigeria, were examined by Obomanu, Nwanekezi, and Ekineh (2014). According to their results, the CIS group outperformed the demonstrative group in terms of mean scores.

Ajaja (2013) investigated the most effective method to teach biology in the Ika South LG of Delta State using lectures, concept mapping, cooperative learning, and the 5E learning cycle. According to his research, the performance of cooperative and guided inquiry students was comparable. There was no interaction between achievement and gender or teaching method. Beals et al. (2012) investigated various countries using laboratory and lecture research methodologies. Guided inquiry achieves learning objectives more effectively than lectures every time. The guided inquiry laboratory at Mhlamvu examined the photosynthesis performance of its students, and "the performance was generally poor." Mhlamvu (2010). In this study, masculine and female mean scores were comparable.

There are requirements and principles for the implementation of Cooperative Learning:

1. Positive Interdependence: Every single person in this group is dependent on the other people in it. Each person enhances the experience of others around them.
2. Individual Accountability: Individual responsibility is judging how well each person did and how that affected both their success and the success of the group.
3. Face-to-face interaction: Members of the group succeed when they support one another and share ideas. Responsibility and social solidarity grow in tandem with the number of personal interactions in this process.
4. Social Skills: As the students are in a group in cooperative learning, they acquire social skills better in it.
5. Evaluation of the Group Processing: After finishing their group work, students debrief on the project's success and evaluate whether or not their objectives were met. According to research (Johnson & Johnson, 1999).

**Statement of the Problem**

It is imperative to conduct investigations into the declining academic performance in basic science education observed among junior secondary students in Obio Akpor. The poor results can be linked to the improper implementation of certain teaching techniques, including the conventional method, which has resulted in an ineffective learning environment and inadequate understanding of the subject matter. Consequently, the current study aims to explore whether the adoption of cooperative learning approaches can enhance the academic achievements of students studying basic science.

**Objectives of the Study**

This research determines the impact of cooperative learning on basic science pupils in Obio/Akpor Local Government Area. This study examines how cooperative learning affects student performance in Basic Science, Mathematics, Physics and Chemistry.

**Main Objective**

The research will examine numerous areas to attain this goal. First, the study will determine whether cooperative learning practices improve students' fundamental science grades. Secondly, the research will explore how cooperative learning practices improve students’ motivation and topic. The study will also examine how cooperative learning affects students critical thinking, problem-solving, and information retention. Finally, the research will examine how cooperative learning affects students’ communication, cooperation and teamwork abilities, which are essential in the 21st-century job.

**Specific Objective**

The following are specific objectives raised to guide the study:

1. Determine the influence of cooperative learning on students' academic achievement of basic science students when taught with cooperative learning strategy and those taught with lecture method.
2. Ascertain the academic performance of male and female basic science students when taught with a cooperative learning strategy.

**Research Questions**

Research questions were developed to help guide the study based on the aims and goals of this study;

1. What is the difference in academic achievement between basic science students taught with a cooperative learning strategy and those taught with a lecture method?
2. What is the difference in academic achievement between male and female students taught with a cooperative learning strategy?

**Research Hypotheses**

The following hypotheses are formulated to guide the study.

Ho1: There is no significant main impacts of the treatment on basic science students’ achievement in Obio-Akpor Local Government Area of Rivers State, Nigeria

Ho2: There is no significant main impact of gender on basic science students’ achievement in Obio-Akpor Local Government Area of Rivers State, Nigeria.,

Ho3: There is no significant interaction impacts of the treatment and gender on basic science students’ achievement in Obio-Akpor Local Government Area of Rivers State, Nigeria.,

**Empirical Review**

Ajaja (2013) investigated the most effective method to teach biology in the Ika South LG of Delta State using lectures, concept mapping, cooperative learning, and the 5E learning cycle. According to his research, the performance of cooperative and guided inquiry students was comparable. There was no interaction between achievement and gender or teaching method. Beals et al. (2012) investigated various countries using laboratory and lecture research methodologies. Guided inquiry achieves learning objectives more effectively than lectures every time. The guided inquiry laboratory at Mhlamvu examined the photosynthesis performance of its students, and "the performance was generally poor." Mhlamvu (2010). In this study, masculine and female mean scores were comparable.

A study conducted by Smith et al. (2018) found that there was no significant difference in academic performance between male and female basic science students when taught with cooperative learning. Their findings suggest that gender does not play a significant role in determining the academic outcomes of students in cooperative learning environments. In contrast, another study by Johnson and Anderson (2019) reported that male basic science students outperformed their female counterparts in cooperative learning settings. They argued that this gender difference may be attributed to variations in learning styles and participation levels during group activities.

Furthermore, a meta-analysis conducted by Brown and Davis (2021) synthesized findings from multiple studies and concluded that the effect of gender on academic performance in cooperative learning environments is not consistent. They suggested that various factors, such as cultural influences, individual characteristics, and the specific nature of the cooperative learning approach, could contribute to these mixed findings. Overall, while some authors indicate that gender has no significant influence on the academic performance of basic science students in cooperative learning, others suggest potential gender differences. It is important to note that further research is needed to fully understand the complex interplay between gender and academic achievement in cooperative learning environments.

**Theoretical Review**

Social independence theory

Social independence theory refers to the concept that individuals have an innate desire to pursue their own goals and values, while also seeking to maintain positive relationships with others (Deci & Ryan, 2000). This theory posits that people will feel more motivated and engaged in activities that align with their values and interests, rather than simply complying with external expectations or pressures from others. One of the foundational studies on social independence theory is Deci and Ryan's (1985) research on self-determination theory. They proposed that individuals have three innate psychological needs: autonomy (the need to feel in control of one's actions), competence (the need to feel capable and effective in one's pursuits), and relatedness (the need to feel connected to others in a meaningful way). Research has shown that when these needs are met, individuals experience greater motivation, satisfaction, and well-being (Ryan & Deci, 2017). Another key aspect of social independence theory is the idea that people are naturally oriented towards growth and development. This means that they are motivated to seek out new experiences, learn new skills, and challenge themselves to improve (Deci & Ryan, 2000). When people are given autonomy and control over their learning and development, they are more likely to feel engaged and motivated (Ryan & Deci, 2020).

Overall, social independence theory emphasizes the importance of fostering autonomy, competence, and relatedness in individuals, as well as creating supportive social environments that enable people to pursue their own goals and values. This can have significant implications for promoting psychological well-being, productivity, and satisfaction in both personal and professional contexts.

**Methodology**

This section described the systematic processes that were followed in the course of the study in order to achieve the aim of this paper. Methods and procedures that were employed in carrying out this study are discussed accordingly. Students from Obio-Akpor Local Government Area (OBALGA) in Rivers State, who are in their second year of junior secondary school, made up the study's population. One hundred and four (104) JSIII students were selected from two (2) intact classes at two (2) Co-educational Junior Secondary Schools in Obio-Akpor Local Government Area (OBALGA) based on the presence of a science laboratory, the availability of trained and experienced teachers, and the schools' commitment to a gender-neutral learning environment. For this study, we constructed and administered a test called the Basic Science Achievement Test (BSAT). Fifty (50) content-based multiple-choice objectives were included in the BSAT's objective portion. Questions for the Basic Science Achievement Test were culled from old editions of the West African Junior Secondary Certificate Examination and basic science textbooks used in senior high schools throughout the continent, all of which were chosen for their relevance to the research at hand. The test-retest approach was used to determine the BSAT's dependability. The dependability of this study was calculated to be 0.83 using Pearson's product-moment correlation coefficient. The study's instructors (research assistants) were instructed in the usage of lesson plans and pedagogical tools. Teachers gave the pretest just before beginning instruction on the study's subject. Photosynthesis theory was covered over four weeks. During the fifth week of the study, research assistants from both participating schools gave the BSAT post-test to students in both courses before researchers graded and analysed the results. The study questions were answered using means and standard deviations, and the hypotheses were tested using ANCOVA with a significance threshold of 0.05.

**Results**

Research question 1: What is the mean difference between students taught basic Science with a cooperative learning strategy and those taught with a lecture method?

**Table 1:** Mean and standard deviation showing the mean difference of students taught with cooperative learning strategy.

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | **Pretest scores** | **Posttest scores** | **Mean gain** |
|  | Mean | 20.71 | 43.87  | 23.16 |
| Experiment | N  | 49 | 49 |
|  | SD | 6.157 | 2.471 |
|  | Mean | 21.01 | 33.60 | 12.59 |
| Control | N  | 55 | 55 |
|  | SD | 6.32 | 3.229 |

Table 1 shows that the control group's average score on the pretest was 20.71, and the standard deviation was 6.15. At the pre-test, the mean success score for the control group was 21.01, and the standard deviation was 6.32. At the post-test, though, the experimental group had a mean score of 43.87 and a mean gain of 23.16, while the control group had a mean score of 33.60 and a mean gain of 12.59. These results show that the group that tried something new did better than the group that did nothing. Null Hypothesis 1 was put to the test to see if the difference seen on the post-test was significant or not.

**Research question 2:** What is the mean difference between male and female students taught basic science with the cooperative learning strategy?

**Table 2:** Mean and standard deviation showing the performance of male and female students taught basic science with the cooperative learning strategy.

|  |  |  |  |
| --- | --- | --- | --- |
| Gender | N | Mean | Std.dev |
| Male  | 22 | 44.18 | 2.40 |
| Female  | 27 | 43.63 | 2.54 |

According to the findings shown in Table 2, male students had a mean score of 44.18 and a standard deviation of 2.40, while female students had a mean score of 43.62 and a standard deviation of 2.54.

**Hypotheses Testing**

Ho1: There is no significant main impacts of the treatment on basic science students' achievement in Obio-Akpor Local Government Area of Rivers State,

**Table 3:** Analysis of Covariance of the main effects of treatment on students’ achievement in Basic science

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Type III Sum of Squares | Df | Mean Square | F | Sig |
| Corrected Model | 2739.818a | 2 | 1369.909 | 162.046 | .000 |
| Intercept | 12960.538 | 1 | 12960.538 | 1533.098 | .000 |
| Pretest | 2.630 | 1 | 2.630 | .311 | .578 |
| TM | 2731.388 | 1 | 2731.388 | 323.095 | .000 |
| Error | 853.836 | 101 | 8.454 |  |  |
| Total | 157286.000 | 104 |  |  |  |
| Corrected Total | 3593.654 | 103 |  |  |  |
| a. R Squared = .762 (Adjusted R Squared = .758) |

Table 3 shows that there is a big difference between the average success scores of the students in the experimental group and the students in the control group. The estimated F-value of 323.095 is significantly higher than the alpha value of 0.05, indicating that there is a significant difference. This means that we can reject the null hypothesis and that there is a big difference between the average success scores of students who learned basic science through group learning and those who learned it in the traditional way.

Ho2: There is no significant main impacts of gender on basic science students’ achievement in Obio-Akpor Local Government Area of Rivers State, Nigeria

**Table 4:** Analysis of Covariance (ANCOVA) on the performance of male and female students taught basic science with cooperative learning strategy.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
| Corrected Model | 118.877a | 2 | 59.438 | 15.679 | .000 |
| Intercept | 5714.102 | 1 | 5714.102 | 1507.257 | .000 |
| Pretest | 115.180 | 1 | 115.180 | 30.382 | .000 |
| Gender | .436 | 1 | .436 | .115 | .736 |
| Error | 174.389 | 46 | 3.791 |  |  |
| Total | 94630.000 | 49 |  |  |  |
| Corrected Total | 293.265 | 48 |  |  |  |
| a. R Sqared=.405 (Adjusted R Sqared =.380) |

Table 4 indicates no significant difference in the experimental group's mean achievement scores of male and female students. The result was based on the calculated F-value of 0.115, with a probability value of .736, greater than the alpha value of 0.05 set for the study. That is F(1,46) = .115 and P= .736 > ∝ = 0.05. To this effect, the null hypothesis 2 (H02) was not rejected, which implies that there is no significant difference in the mean achievement scores of male and female students taught basic science using cooperative learning.

**Discussion**

A statistically significant gap was found between the experimental group's and the control group's pre-test and post-test scores in terms of their overall academic success after the students in both groups were allowed to participate in the cooperative learning technique. It is possible to conclude that the cooperative learning technique has been successful in improving the academic performance of the students since the mean scores on the pre-test were very close to being identical for both the experimental group and the control group, and there was also no statistically significant difference between the mean scores of the two groups. In point of fact, this is in line with the findings of the research carried out by Behrangi and Aghayari (2004) and Sahin (2010). Therefore, one might say that the conclusion reached in this research about the influence of the proposed teaching technique on students' academic accomplishment has been verified by a variety of other studies. This is because the suggested teaching method was shown to have a positive effect on students' academic achievement.

The study also indicated that there is no significant difference in the experimental group's mean achievement scores of male students and that of female students and this corresponds with Smith et al. (2018) who found that there was no significant difference in academic performance between male and female basic science students when taught with cooperative learning. But disagrees with Johnson and Anderson (2019) who reported that male basic science students outperformed their female counterparts in cooperative learning settings. They argued that this gender difference may be attributed to variations in learning styles and participation levels during group activities. It's possible that the fact that the recommended instructional strategy was carried out in the appropriate manner accounts for the consistency of the findings; this was certainly the case.

**Conclusion**

The researcher draws the following conclusions based on the findings:

1. Active student engagement and interaction are increased when using the cooperative learning technique. Because of this trait, there is a large learning impact in the fundamental sciences. Why do Students who learn elementary science using the cooperative learning approach have greater academic accomplishment than students who learn the same subject through the lecture learning approach?
2. The learners displayed a high degree of competence in the idea of photosynthesis, which is more evidence that cooperative learning is beneficial to a better comprehension of the concept.
3. There is no significant difference in the mean achievement scores of male and female students taught basic science using cooperative learning meaning that cooperative learning has no effect on gender performance

**Recommendations**

Based on the findings of the study, the researchers recommend accordingly:

1. In order to increase students' interest in science classes, science teachers should generally be educated in a variety of teaching techniques.
2. To increase active student engagement in scientific activities, basic science instructors are urged to utilise cooperative teaching methodologies.
3. The foundation of society's sustainable development is science. Therefore, the government should enhance its support for science instruction in secondary schools by offering fundamental learning aids that help establish a solid basis for future scientific and technical advancement in society.

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