Original Research Article

Comparative Effectiveness of Mastery and Peer-to-Peer Learning Strategies in Improving Junior Secondary Students' Learning Outcomes in Basic Science

Abstract

The study determined the effectiveness of each of Mastery Learning and Peer-to-peer Learning Strategies on students' performance in Basic Science. It also examined the effectiveness of the learning strategies in enhancing retention Basic Science concepts; and established their effectiveness in improving students' attitude to Basic Science. These were with a view to determining a better way of improving the learning outcomes of students in Basic Science. The study adopted the non-equivalent, pre-test, post-test quasi-experimental research design. The study sample consisted of 50 Junior Secondary School two (JSSII) students in intact Basic Science classes selected from Owo Local Government Area in Ondo State, Nigeria. The instruments used for data collection were, "Basic Science Achievement Test" (BSAT) and "Students Attitude in Basic Science Questionnaire" (SABSQ). The reliability coefficients of 0.79 and 0.63 were obtained for BSAT and SABSQ respectively. Data collected were analyzed using descriptive statistics and t-test analysis. The results showed that students in the experimental group PLS gained higher scores than those in the experimental group MLS, with the PLS being the most effective. Also, the result showed that PLS and MLS enhance students' retention of Basic Science concepts with the retention mean score of students taught using PLS being the greatest. Finally, it was revealed that PLS and MLS showed effectiveness in improving the students' attitude to Basic Science with PLS as the most effective. The study concluded that the PLS produce significantly better performance and retention of Basic Science by students than MLS; this is an indication that PLS is an effective mode of instruction for Basic Science students. The study recommends that teacher education programmes should emphasize PLS and MLS when in Basic Science class; also teacher should be provided with adequate training to enable them use PLS and MLS in Basic Science classroom so that learners would be guided to learn meaningfully and would be assisted to develop positive attitude towards Basic Science.

Keywords: Basic Science, Mastery Learning, Peer-To-Peer Learning, Learning Outcomes

1. Introduction

The growing awareness of the contributions of science to the political, socio-economic and technological development of a nation cannot be overemphasized. Science, according to Ogunleye and Babajide (2011) is an instrument for economic, technology and political development. Science and technology have greatly contributed to the convenience and comfort of man, the usefulness and relevance of science and technology to sustainable development is therefore not in doubt. Science is the concerted human effort to understand the history of the natural world and how the natural world works, with observable physical evidence as the basis of understanding. It is done through observation of natural phenomena and/or through experimentation that simulate natural processes under controlled conditions. It is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. Technology is a means of harnessing and exploiting it.

Man's present existence on the globe is highly predicated upon his knowledge and applications of scientific knowledge, principles and technological breakthrough. One of the key problems in evolving a development strategy for a developing country like Nigeria is lack of the capacity for appreciation and application of science and technology through developmental efforts (Aina, 2013). It is in recognition of this that science was introduced into the Nigerian school curriculum.

Basic Science (formally called Integrated Science) in particular was introduced as the basic foundation to the other sciences at the upper basic level. It is a course that integrates students into the world of science after being exposed to the rudiment of science called, primary science at the primary school level (Odetoyinbo, 2004). Agbo (2008) stated that, Basic Science is the bedrock to advanced studies in science, technology and engineering. It is seen as an approach to the teaching of science in which concepts and principles are presented so as to express the fundamental unity of scientific thought and avoid premature or undue stress on the distinction between the various scientific fields (Bajah, 1983). One of the objectives of Basic Science is to serve as a foundation for further study of science at higher level or bedrock for scientific literacy. This adds credence to the importance of the subject. The overall objectives of the Basic Science curriculum are to enable learners to:

- Develop interest in science and technology
- Acquire basic knowledge and skills in science and technology
- Apply their scientific and technological knowledge and skills to meet societal needs
- Take advantage of the numerous career opportunities offered by science and technology
- Become prepared for further studies in science and technology

In order to achieve the stated objectives, the thematic approach to content organisation was adopted. Hence, four themes covered knowledge, skills and attitudinal requirements. These are;

- You and Environment
- Living and non-living things
- You and technology
- You and Energy (FGN, 2007).

At the upper basic level however, theme three “you and technology” was changed to “science and development”. The topics under each theme were sequenced in a spiral form beginning with the simple to the complex across the 9- years of basic education.

Research reports have revealed that students of Integrated or Basic Science leave much to be desired in terms of their achievement in Junior Secondary School Certificate Examinations (Nwachukwu & Nwosu, 2007). For the past two decades, students’ achievement in science subjects are consistently reported to be very poor (Akubuilo, 2004; Ahmed, 2007; Asuafor, 2008). A survey of the JSSCE results of Ondo state for five years (2011-2015) revealed that students’ performance had been on the decline. This could be a reflection of the fact that the students have not demonstrated the necessary cognitive reasoning skills needed for good performance in their three years of junior secondary school. It could even be that the appropriate teaching strategy was not used or teaching aids not available or worse still that the students were probably not taught the required Basic Science concepts. According to Holbrook (2011), students learn science to gain factual knowledge and skills as well as passing subject knowledge examination.

Learning, according to Taber (2009), is a personal activity and each student has to construct his or her own knowledge. For learning to be personalized, it demands that learners should show commitment and interest, as well as actively participating in the learning process for meaningful understanding and assimilation of facts. This implies that learning could be meaningful and effective when students reflect on what is taught; develop interest on the subject matter and construct new knowledge based on their understanding of the concepts. In view of this, science teaching ought to be proactive and student-centred for meaningful learning and understanding. However, Njoku (2004) observed that science teaching in Nigeria is still done expository even when the method used by the teacher neither promotes students interest nor academic achievement; partly because of the teachers' inadequacies and partly because of their reluctance to adopt innovative teaching approaches which had been proved effective in enhancing learning outcomes.

Traditional lecture creates an atmosphere in which students become passive and unconnected from their own learning, simply being required to record what the teacher says with minimal chance for interaction (Bittinger & Tan, 2015). Maintaining active engagement in a lesson is one of the most common behavioral concerns among school age children (Godfrey, Brown, Schuster & Hemmeter, 2003). Higher academic performance is directly linked to active students’ participation and engagement in the classroom (Skibo, Mims & Spooner, 2011). It would seem, then, that since increasing and maintaining active students’ participation in the classroom setting leads to higher academic performance, student-centered learning emphasizing active students’ participation should be at the forefront of what the classrooms teacher should strive to accomplish.

Student-centered learning can manifest in a variety of forms within the classroom. The appropriate manner through which to incorporate student-centered learning is entirely up to the teacher’s discretion. Teachers often attempt many strategies in order to engage their students so as to increase academic performance, such as small group instruction, mastery learning, reward systems, peer-to-peer, and proximity or response cards (Bittinger & Tan, 2015). Academic performance could increase when students are actively engaged. The aim of this study is to look into the effectiveness of mastery learning and peer-to-peer learning strategies in improving students’ learning outcomes in Basic Science.

Mastery learning is a remedial process aimed at bringing students to a level of mastering a concept. Adepeju (2003) viewed it as an innovative strategy designed to make students perform very well in academic task. It involves the learners in relevant hands-on, hearts-on and heads-on activities; frequent assessment and feedback; corrections with emphasis on cues; motivation; allotment of more time on tasks; and reinforcement through assignments. It could be deduced therefore that mastery learning strategy focuses on students reaching a pre-determined level of mastering a unit before moving to another task. Abakpa and Iji (2011) opined that mastery learning strategy can provide quality instruction, immediate feedback and remedial lessons for the attainment of lesson objectives. They also affirmed that mastery learning strategy enhances students' academic achievement and retention in Mathematics than the conventional method. Oluwatosin and Bello (2015) in their study stressed the usefulness of mastery learning in improving students' academic performance in Physics than traditional method.

Peer tutoring is an instructional strategy that consists of pairing students together to learn or practice an academic task. The pairs of students can be of the same or differing ability and/or age range. Peer tutoring encompasses a variety of instructional approaches including Cross-Age Tutoring, Peer-Assisted Learning Strategies (PALS), and Reciprocal Peer Tutoring (RPT). Variations exist among instructional approaches; however, the underlying theory is consistent: peer interaction can have a powerful influence on academic motivation and achievement (Light & Littleton, 1999). Studies had also shown that socialization experiences that occur during peer tutoring can benefit both the tutor and tutee by motivating students to learn and increasing their social standing among peers (Rohrbeck, Block, Fantuzzo & Miller, 2003). When students understand the benefits of peer tutoring and have the tools to become effective tutors and tutees, they make greater progress than those who are not given any instruction on how to work together (Fuchs, Fuchs, Hamlett, Phillips, Karns & Dutka, 1997). In addition, peer tutoring allows teachers to accommodate a classroom of diverse learners including students with learning disabilities. This instructional strategy increases response opportunities for students, provides additional time for positive feedback, and increases the amount of time a student is on-task (Maheady, 2001). Regardless of achievement level, content area, or classroom arrangement, peer tutoring demonstrates effectiveness in facilitating progress in the general education curriculum (Cook, Scruggs, Mastropieri & Casto, 1985).

Science classrooms are becoming more diverse with differences in terms of learning environment, students' background, students' interest, and abilities. As earlier noted, interest is a key driving force for students to learn meaningfully. Simply stated, it is a feeling of like or dislike towards an activity. Imoko and Agwagah (2006) defined interest as persistent tendency to pay attention and enjoy learning. Studies by Campe (2006), and Okoyefi and Nzewi (2013) showed that students perform well when they are exposed to methods that interest them during the teaching-learning process. Agboola & Oloyede (2007) opined that, one of the objectives of science education is to develop students' interest in science and technology. Hence, innovative instructional strategy, as the mastery learning and peer-to-peer learning strategies could be used to reduce the decline of students' interest in Basic Science.

Attitudes associated with science appear to affect students' participation in science as a subject and impact performance in science (Akinwumi & Bello, 2015). It is generally believed that students' attitude towards a subject determines their success in that subject. In other words, favourable attitude result to good achievement in a subject. A student's constant failure in a school subject can make him/her to believe that he/she can never do well on the subject thus accepting defeat. On the other hand, his/her successful experience can make him/her to develop a positive attitude towards learning the subject. To change attitudes, new attitudes must serve the same function as the old one. This suggests that student's attitude towards science subjects could be enhanced through effective teaching strategies.

One problem often described by educators is that students do not retain information. Cooper, Nye, Charlton and Lindsay (1996) expressed their concern about teachers by relaying that students forget a large amount of material during summer breaks. Poor students' retention is widely acknowledged anecdotally. Most students have spent thousands of hours in the classroom learning, their results after examination is often surprisingly disappointing, and forgetfulness believed to be the cause. Mazzeo and Dossey (1997) observed that the educational failure among students are partly explained by the fact that students after learning the information in the first place tend to forget the learnt concept. The truth is, the beauty of learning is lost when learnt material is forgotten, and this is particularly common for knowledge acquired in school. Since poor retention lowers the bar of students' performance, promoting better achievement in students becomes a challenge teachers face day to day, for instance, teachers have to spend extra time re-teaching concepts that has once been taught in previous lessons or previous year, this cycle of learning, forgetting and re-learning affects students' achievement and can contribute to students' frustration.

The need therefore arises to investigate how much these learning strategies will help in improving academic performance of students in Basic Science, enhance retention of Basic Science concept and change in students' attitude toward Basic Science.

1.1 Objective of the Study

The study compare the relative effectiveness of mastery learning and peer-to-peer learning strategies in improving students learning outcomes in Basic Science with the aim of determining which of them will be more effective. Therefore the specific objectives of the study are to:

i. determine the effectiveness of each of mastery learning and peer-to-peer learning strategies in improving students' academic performance in Basic Science;

ii. examine the effectiveness of mastery learning and peer-to-peer learning strategies in enhancing retention of Basic Science concept; and

iii. determine the effectiveness of mastery learning and peer-to-peer learning strategies in improving students' attitude to Basic Science.

1.2 Hypotheses

The following research hypotheses were formulated to guide the study:

Ho_1: There is no significant difference in the academic performance of students' exposed to mastery learning and peer-to-peer learning strategies in Basic Science.

Ho_2: There is no significant difference in the retention ability of students' exposed to mastery learning and peer-to-peer learning strategies in Basic Science.

Ho_3: There is no significant difference in the attitude of students' exposed to mastery learning and peer-to-peer learning strategies in Basic Science.

2. Methodology

2.1 Research Design

The study employed non-equivalent pre-test, post-test, quasi-experimental research design as described by Cambell & Stanlly (1966). The non-equivalent pretest, posttest, control group design is a type of quasi-experimental research design which is similar to experimental design except for the lack of randomization into groups. The non-equivalent pre-test post-test design is used for this study because secondary school exists in intact classes and the randomization of students into groups for experimental purpose is simply not allowed to avoid the disintegration of the classes, this is to ensure that the experiment has a strong level of internal and external validity. The pre-test and post-test suggested that measurements are taken before and after the introduction of the treatment. The pre-test helps in assessing the differences between the experimental groups and to establish a baseline for the effect of the treatment.

The design is represented schematically as follows:

Pre-test	Treatment	Post-test	Retention test
O_1	X_a	O_2	O_3
O_4	X_b	O_5	O_6

Where O_1 and O_4 are the pre-test scores of the experimental groups A and B; O_2 and O_5 are their respective post-test scores, while O_3 and O_6 are the retention scores for experimental groups A and B.

X_a represent Treatment 1- Mastery Learning Strategy (MLS)

X_b represent Treatment 2-Peer-to-peer Learning Strategy (PLS)

2.2 Population, Sample and Sampling Techniques

The population for the study comprised Junior Secondary School Two (JSSII) Students in Owo Local Government Area of Ondo State. The choice of JSS II students is considered base on the fact that the class is not preparing for an external examination at this level. Another consideration of the choice of the class is that at this stage the students are expected to have been exposed to basic science concepts and must have acquired some manipulative skills.

The study sample consisted of 50 JSS II students in intact Basic Science classes in the Local Government Area (LGA). Two schools were randomly selected from the LGA. One arm of JSS II students was selected in each of the two schools using the simple random sampling technique. Each arm of students was randomly assigned to each of the experimental groups.

2.3 Research Instruments

Two research instruments were used for data collection, they are: Basic Science Achievement Test (BSAT): this was used for pre-test, post-test and retention test and Students' Attitude in Basic Science Questionnaire (SABSQ): this was used to assess the attitude of the students' before and after the treatment. The BSAT was a 25 items; 4-option structured multiple choice tests drawn from the concepts of Energy, Work and Power. The SABSQ was a 25 items rated on the 5-point modified Likert-type scale of Strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2; Strongly Disagree (DS) = 1; and Undecided (U) = 0, developed for assessing students' attitude in Basic Science.

2.4 Validation of Research Instruments

The draft of the two instruments - BSAT and SABSQ, which contained 35 and 30 items respectively, were submitted to experienced Basic Science teachers in junior secondary schools, the supervisor and expert in test and measurement for face and content validation. They were requested to check for the appropriateness of the items and content coverage considering the grade level and the objectives of the study. Based on their comments and suggestions, which included revising some of the items and dropping some, the number of items was reduced in BSAT from 35 to 25 items and in SABSQ from 30 to 25 items. Pilot testing was carried out by administering the instruments on some JSSII students' from an intact class of a co-educational secondary school selected outside the study area but had similar characteristics as the sample schools. Test retest method was used to generate two set of scores for the students and Pearson Product Moment Correlation (PPMC) was used to calculate the reliability coefficient of the instruments, BSAT was found to be 0.79 and SABSQ was found to be 0.63. This shows that the instruments are reliable and were used for the study.

2.5 Procedure for Data Collection

This was done in phases. In the first phase, the researcher visited the chosen schools to seek for permission in using the students as well as some facilities in the schools. This was followed by the administration of the BSAT and SABSQ as a pretest to the students in the two experimental groups to ascertain the equivalence in ability of the students and attitude of the students. In the second phase, the treatments were introduced to the experimental groups. Students in experimental group A were taught using the MLS while those in experimental group B were taught using the PLS. Three topics (Energy Work and Power) were taught concurrently in the two schools using the appropriate treatment in each school for a period of six weeks. Then the BSAT and SABSQ were administered to the two groups as post-test. In the third phase, the BSAT was re-shuffled and administered to the two groups after two weeks of the post-test to serve as a retention test.

The students that were used for the study have prior knowledge in Basic Science and in topics related to those that were used in the study. The researcher ascertained that schools with students that have same prior knowledge were used; this was done by visiting the schools and interacting with the Basic Science teacher in each school and by the use of the pre-test which was administered to the students. Also, the researcher carried out the teaching in these schools so as to have all the students exposed to the same Basic Science teacher but with different learning strategies. The teacher is a degree holder in Integrated Science education and has undergone training in pedagogy of teaching in his subject area. His skill in this area is very good. This was exhibited in the lesson note and learning materials that were used.

(i) Pre-test Administration

The pre-test consisted of "Basic Science Achievement Test" (BSAT) and "Student Attitude in Basic Science Questionnaire" (SABSQ) which were administered on all the participants. The researcher personally administered the pre-test for all the participants.

(ii) Procedure for Application of Treatment

The application of treatments in the two experimental groups lasted six weeks to be completed. Two periods were given per week. The lesson guides containing the three topics were used by the researcher for six weeks of the treatments (Mastery Learning and Peer-to-peer Learning Strategies). Completions of the treatments were done with clear-cut instructional guides that directed the researcher's activities during the treatments. The twelve demonstrations which contained three topics derived from the JSS Two Syllabus based on (i) Energy (potential energy, kinetic energy and thermal energy), (ii) work (concept of work) and (iii) Power (Machines and mechanical Advantage) were performed by the pupils.

The procedural steps that were used to carry out the demonstrations were provided for each treatment, that is: Mastery learning and Peer-to-peer learning as follows:

Procedure for Experimental Group 1: Mastery Learning Strategy (MLS)

Phase I: The Introduction Phase

Step 1: Researcher reviews the last lesson.

Step II: Researcher sets the scene (apparatus, objects or materials) for the practical work.

Step III: Researcher cues judiciously and carefully structured the sequence of demonstration.

Phase 2: The Presentation Phase

Step 1**:** Researcher leads the students to perform some activities on the concept to be taught

Step II: Individual student was presented with some questions on the chalkboard and they provided answers in written form.

Step III: Students write the answers to some questions inside their note.

Step IV: Researcher marks the class work and proceeded to do the correction.

Step V: Researcher leads the students to solve some problems as related to the topic.

Step VI: Researcher gives class work to the students, marks the class work and proceeded to do the correction.

The last Phase

Step I: Researcher evaluates the lesson

Step II: Researcher gives the students assignment based on what they learnt and next lesson.

Procedure for Experimental Group 2: Peer-to-peer Learning Strategy (PLS)

Phase I: Presentation Stage

Step 1: Researcher reviews the last lesson.

Step 1I: Researcher leads the students to perform some activities on the concept to be taught.

Step III: Individual student was presented with some quiz and they were asked to provide

answers in written form in their note.
Step IV: Researcher marks the class work and proceeded to do the correction.
Step V: Researcher divides the students into groups and peer the fast learners with slow learners.
Step VI: Researcher gives the students group work and move round the class to supervise the group work.

Phase 2: The Whole Class Presentation
Step I: Randomly selected students presented their findings to the whole class.
Step II: Other students critiqued the presentations for further improvement.
Step III: The researcher who is also the facilitator focused on students weak points and suggests solutions.

The last Phase
Step I: The researcher concludes by supplying the correct words for the activities and summarizes the activity on the chalkboard.
Step II: Researcher reshuffles the group and gives the students group assignment on what is learnt.

3 *Results*

3.1 Analysis of the Pretest Scores

To determine the possible differences in the background knowledge of the students in Basic Science, the pre-test scores were subjected to descriptive and t-test analysis. The result is presented in Table 1a

Table 1a: Two-tailed t-test of the Pretest (Achievement) Scores of Students

Groups	**Mean ($\bar{X}$)**	**Standard Deviation**	**N**	**Df**	**Standard Error**	**t-cal***	**t-crit****	**Sig**
Mastery learning	35.56	11.16	27	50	8.17	0.048	2.021	.089
Peer-to-peer learning	35.17	9.43	25					

*t-cal = calculated t-value**t-crit = critical or table t-value

From Table 1a, it was deduced that there is not much variation in the achievement mean score of both set of students with relatively close mean scores of 35.56 for mastery learning category and 35.17 for those in the peer-to-peer learning category. The result showed that there was no significant difference between the means of the two groups (t-value=0.048,p>0.05).Since the calculated t-value is less than the critical t-value. This means that the t-value is not significant at p=0.05 level. This result further showed that there was no significant difference in the pretest scores across the two groups; it was therefore assumed that the two groups started with equivalent means. This result ascertains the equivalent ability of the students in the two groups prior to the introduction of the treatments.

Analysis of the pre-attitudinal scores

To determine the possible differences in the background attitude of the students in Basic Science, the pre-attitudinal scores were subjected to descriptive and t-test analysis. The result is presented in Table 1b

Table 1b: Two-tailed t-test of the Pre-attitudinal Scores of Students

Groups	Mean ($\bar{X}$)	Standard Deviation	N	Df	Standard Error	t-cal*	t-crit**	Sig
Mastery learning	58.11	6.87	27	50	1.84	0.51	2.021	.099
Peer-to-peer learning	59.04	6.24	25					

*t-cal = calculated t-value**t-crit = critical or table t-value

From Table 1b, it can be deduced that there is not much variation in the attitudinal mean scores of both set of students with relatively close mean scores of 58.56 for mastery learning category and 58.04 for those in the peer-to-peer learning category. The result showed that there was no significant difference between the pre-attitudinal mean scores of the two groups (t-value=0.51, P>0.05).Since the calculated t-value is less than the critical t-value. This means that the t-value is not significant at p=0.05 level. This result showed that there was no significant difference in the pre-attitudinal scores across the two groups; it was therefore assumed that the two groups started with equivalent means. This result ascertains the equivalent in the attitude of the students in the two groups prior to the introduction of the treatments.

3.2 *Testing of the Hypotheses*

Hypothesis One (H_{o1}): There is no significant difference in the academic performance of students' exposed to MLS and PLS in Basic Science.

To test this hypothesis the post-test scores of the students in the two groups were collated, analysed using descriptive and t-test analysis. The result is presented in Table 2.

Table 2: Two-tailed t-test of the Post-test (Achievement) Scores of Students Exposed to MLS and PLS.

Groups	Mean ($\bar{X}$)	Standard Deviation	N	Df	Standard Error	t-cal*	t-crit**	Sig
Mastery learning	50.88	9.68	25	48	2.67	6.59	2.021	.001
Peer-to-peer learning	68.48	9.22	25					

*t-cal= calculated t-value **t-crit = critical or table t-value

In order to achieve the first aspect of the objective which bothers on determining the effectiveness of Mastery learning and Peer-to-peer learning strategies in enhancing students' academic performance in Basic Science, analysis of two tailed test was used. From Table2, the mean achievement scores of students taught with mastery learning (50.88) and those taught with peer-to-peer learning strategies (68.48) were different. The study revealed ($t= 6.59; p<0.05$).Since the calculated t-value is greater than the critical t-value, null hypothesis (H_o)is rejected at alpha level value 0.05 significant ($p < 0.05$).This shows that there was significant difference between the academic performance score of students taught with mastery learning strategy and those taught with peer-to-peer learning strategy. The result thus shows that the teaching with Peer-to-peer learning strategy is better at improving students' performance in Basic Science concepts taught than the Mastery learning strategy.

Hypothesis Two (Ho_2): There is no significant difference in the retention ability of students' exposed to mastery learning and peer-to-peer learning strategies in Basic Science.
To test this hypothesis the post-posttest mean scores of the achievement test of the two groups were collated, analysed using descriptive and t-test analysis and presented in Table 3.

Table 3: Two-tailed t-test of Retention (Ability) scores of Students exposed to MLS and PLS

Groups	**Mean ($\bar{X}$)**	**Standard Deviation**	**N**	**Df**	**Standard Error**	**t-cal***	**t-crit****	**Sig**
Mastery learning	55.84	5.46	25	48	2.37	2.03	2.021	.020
Peer-to-peer learning	60.64	10.54	25					

*t-cal = calculated t-value**t-crit = critical or table t-value

From Table 3, the mean achievement scores **($\bar{X}$)** of students taught with mastery learning (55.84) and those taught with peer-to-peer learning strategies (60.64) were different. The study revealed ($t = 2.03$; $p<0.05$). Since the calculated t-value is greater than the critical t-value, null hypothesis (H_o) is rejected at alpha level value 0.05 significant ($p < 0.05$). This shows that there was significant difference in the retention ability of those exposed to mastery learning strategy and those exposed to peer-to-peer learning strategy. It could then be deduced that the retention ability of the subjects taught using peer-to-peer learning strategy is significantly higher than those taught using mastery learning strategy.

Hypothesis Three (H_{03}): There is no significant difference in the attitude of students' exposed to mastery learning and peer-to-peer learning strategies in Basic Science.

To test this hypothesis the posttest attitudinal mean scores of the students in the two groups were collated, analysed using t-test statistics and presented in Table 4.

Table 4: Two-tailed t-test of the Attitudinal Scores of Students Exposed to MLS and PLS

Groups	**Mean ($\bar{X}$)**	**Standard Deviation**	**N**	**Df**	**Standard Error**	**t-cal***	**t-crit****	**Sig**

Mastery learning	59.04	9.39	25	48	2.33	1.24	2.021	.090
Peer-to-peer learning	61.92	6.91	25					

*t-cal = calculated t-value**t-crit = critical or table t-value

Table 4 showed the attitudinal mean scores of students taught with mastery learning strategy (59.04) and those taught with peer-to-peer learning strategy (61.92) respectively. The study revealed (t=1.24 p>0.05). Since the calculated t-value is less than the critical t-value, null hypothesis (H_o) is not rejected at alpha level of 0.05 significant (p > 0.05). This shows that there is no significant difference between the attitude of students taught with mastery learning strategy and those taught with peer-to-peer learning strategy. Any differences observed are such that they could have arisen from sampling errors.

3.3 Discussion

The findings showed that there was no significant difference in the performance of students exposed to mastery learning and peer-to-peer learning strategies before the intervention. This revealed that students in both groups have homogenous ability before the introduction of the intervention. It means that students used for this study have relatively equal background knowledge and attitude in Basic Science.

The findings of hypothesis one showed that there was significant difference in the academic performance of students exposed to peer-to-peer learning and those exposed to mastery learning. Further analysis shows that students exposed to peer-to-peer learning strategy performed better than their counterparts exposed to mastery learning strategy. This shows that peer-to-peer learning strategy helps to improve the academic performance of students in Basic Science than mastery learning strategy. This was in conformity with the study by Briggs (2013), who ascertained that students who are engaged in peer learning scored significantly higher in Quality Reading Inventory (QRI) test than those who were not exposed to peer-to-peer learning strategy. Also Cook, Scruggs, Mastropieri and Casto (1985) opined that regardless of achievement level, content area, or classroom arrangement, peer tutoring demonstrates effectiveness in facilitating progress in the general education curriculum. This also corroborated the findings of Rohrbeck, et.al. (2003) that demonstrated that socialization experiences that occur during peer tutoring can benefit both the tutor and tutee by motivating students to learn and increase their social standing among peers. The study confirms the findings of Irfan, Rabia and Muhammad (2018) that peers tutoring has significant effects on academic performance of students in Biology.

Furthermore, results from hypothesis two showed that there was significant difference between the retention ability of those exposed to mastery learning and those exposed to peer-to-peer learning strategies. Further observation from the mean scores of both strategies revealed that students taught with peer-to-peer learning strategy had higher scores than those taught with mastery learning strategy. It could then be deduced that those exposed to peer-to-peer learning strategy have higher retention ability than those exposed to mastery learning strategy hence, indicating that peer-to-peer learning strategy enhances longer retention of Basic Science concepts in students than the mastery learning strategy. This is supported by study carried out by Kunsch, Jitendra and Sood (2007), and Vasquez and Slocum (2012), who opined that the retention of concepts learnt under peer-to-peer learning, is better retained. The high retention of learnt concepts in the current investigation further demonstrates this phenomenon. Also Spencer,et.al. (2003) noted that the materials used by peer groups like Cue cards, small pieces of cardstock upon which are printed on a list of tutoring steps, help students remember learnt concepts. Therefore, since concepts being taught in Basic Science is something that needs to be remembered over longer periods of time, as it is in most information taught in other subjects, peer-to-peer learning strategy is the best strategy to use.

In addition, the results from hypothesis three revealed that there was no significant difference between the attitude of students taught with mastery learning strategy and those taught with peer-to-peer learning strategy. This is in not line with Kibler, et.al. (1981) who opined that mastery learning yields greater interest and more positive attitudes in various subjects than non mastery learning approaches. Also Scruggs, Mastropieri and Berkeley, (2007) observed that there are social benefits of peer tutoring in improving students' self-esteem and self-efficacy, improving attitude toward school, and improving interpersonal functioning. It was further noted that peer-to-peer learning strategy not only improves students attitude toward content being tutored but also improves students' attitude toward their tutoring partner. Attitudes toward science are, in general, highly favoured, indicating strong support for science and the learning of science.

3.4 Conclusion

The findings of this study had ascertained the effectiveness of mastery learning strategy and peer-to-peer learning strategy in enhancing performance of students' in Basic Science, retention of Basic Science concepts and in improving their attitude toward Basic Science. Based on this finding, it can be concluded that Peer-to-peer learning strategy is more effective in improving academic performance of students in Basic Science when compare with Mastery learning strategy. Also Peer-to-peer learning strategy is more effective in enhancing the retention ability of students in Basic Science. Lastly both the two learning strategies improved students' attitude toward Basic Science.

3.5 Recommendations

Based on the findings of this study, the following recommendations are proposed to assist the teachers on the ways to use activity-oriented form of instruction in the Basic Science classroom, so that the students' could acquire scientific skills especially in the science for total transformation as this will also help the young learners to cultivate scientific culture and acquire such skills and competence that will make them future scientists.

- Basic Science teachers should be trained on the effective use of Peer-to-peer learning and Mastery learning strategies through exposure to workshops and seminars.
- Basic Science teachers should adopt the use of peer-to-peer learning strategy in teaching some difficult concepts in Basic science at JSS level.
- The teaching with peer assisted learning strategy should be incorporated into teacher education curriculum and be taught as other teaching methods being taught since it is relatively a new technique with many stages for its successful implementation.
- Teachers should use structured peer-to-peer learning because such learning strategy improves communication and cooperation among students, enhances the team spirit and helps socialization.
- The pre-service teachers in Universities/Colleges of Education should be thoroughly trained in the effective usage of mastery learning and peer-to-peer learning strategies.

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