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DEPARTMENT OF SCIENCE EDUCATION

USING COOPERATIVE LEARNING APPROACH TO IMPROVE ON THE PERFORMANCE OF FORM TWO INTEGRATED SCIENCE STUDENTS AT OBRACHIRE SENIOR HIGH SCHOOL IN THE CENTRAL REGION OF GHANA

RUTH ABBAN

DECEMBER, 2012

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A Dissertation in the Department of SCIENCE EDUCATION, Faculty of SCIENCE EDUCATION, submitted to the school of Research and Graduate studies, University of Education, Winneba, in partial fulfilment of the requirements for the award of the Degree of MASTER in SCIENCE EDUCATION at the UNIVERSITY OF EDUCATION, WINNEBA.

DECEMBER, 2012

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DECLARATION

Candidate's Declaration

I, RUTH ABBAN DECLARE THAT THIS DISSERTATION, WITH THE EXCEPTION OF QUOTATIONS AND REFERENCES CONTAINED IN PUBLISHED WORKS WHICH HAVE ALL BEEN IDENTIFIED AND DULY ACKNOWLEDGED, IS ENTIRELY MY OWN ORIGINAL WORK, AND IT HAS NOT BEEN SUBMITTED, EITHER IN PART OR WHOLE, FOR ANOTHER DEGREE ELSE WHERE.

SIGNATURE: ……

DATE: ……....

Supervisor's Declaration

I HEREBY DECLARE THAT THE PREPARATION AND PRESENTATION OF THIS WORK WAS SUPERVISED IN ACCORDANCE WITH THE GUIDELINES FOR SUPERVISION OF DISSERTATION AS LAID DOWN BY THE UNIVERSITY OF EDUCATION, WINNEBA.

NAME OF SUPERVISOR: DR. ISHMAEL K. ANDERSON

SIGNATURE……

DATE……

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My appreciation to Dr. Ishmael Anderson, a Senior Lecturer at the Department of Science Education, University of Education, Winneba, whose supervision has led me to present this work. For his invaluable contributions and corrections to ensure I present a quality work, I say a big thank you.

To the teachers of the Science Department of Obrachire Senior High School, as well as the Form Two General Arts students, I wish to express my profound gratitude for supporting and assisting me during my data collection. God richly bless you.

My greatest acknowledgement is to the Almighty God. Thus far, has His Grace brought me!

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DEDICATION

This thesis is dedicated to Woraba Dansua Abban, Simah Enyimpa Abban, Nyimdzee Kizzie Abban and Nyamedze Essel Abban.

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ABSTRACT

This study presents the use of cooperative learning method that improved Integrated Science teaching in a comfortable non-threatening setting. It assessed the effects of cooperative learning and traditional learning methods on achievement of form two students in Integrated Science . This is an experimental study in which cooperative learning method - Student Team Achievement Division, developed by Slavin is selected as a teaching method and as a form of intervention and compared to the traditonal method of teaching for a period of three weeks. The study applied a pre-test and post-test equivalent groups design. Purposive sampling technique was used to select the sample for the study comprising sixty-four students studying Integrated Science in form two at the Senior High School level at Obrachire in the Central Region of Ghana. These students were divided into two groups and allotted to control and experimental groups. Pre-test scores of the sample served as data to equate the control and experimental groups. Data were analyzed using Statistical Package for Social Sciences (SPSS) Software package version 16. A paired sample t-test was used to compare the means of pre-test and post-test scores of the subjects after the treatment. With a t-value of 0.02, results of post-test showed that the experimental group performed significantly better than the control group, indicating that cooperative learning method was more effective for teaching Integrated Science compared to the traditional method of teaching. Cooperative learning method was useful for improving the performance of students in Integrated Science at Obrachire Senior High School.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A teacher is perceived to always look out for innovative ways to stimulate and encourage learning in students, since learning depends on the method of instruction used by the teacher. Education is also seen as a teaching and learning process hence the instructional method must provoke learner‟s interest as well as motivate them to learn. Educators of Science in Ghana usually use the traditional method of instruction as the main method of instruction (Mabrouk, 2007).

Problems teachers face in large science classrooms are mainly management, affective and pedagogical (Alozzine & Ysseldyke, 2006). Management problems included marking and corrections of large number of write-ups after experiments, difficulties in attending to all students‟ problems as well as difficulties in returning home on time. Affective problems include difficulties in the following ways: learning students‟ names, difficulty in establishing good rapport with students, difficulty in attending to weaker students and in assessing students‟ interests and moods. In the same study, it was noted that some of the pedagogical problems are difficulties in understanding tasks, monitoring and providing feedback, difficulty in getting around the classroom as well as poor attention of students during lesson presentation (Banks, 2005).

Collaborative learning is a low structured group learning approach. This is based on the idea that learning is a natural social act in which participants group and communicate. This makes learning lively and encourages peer-assisted learning (Jolliffe, 2007). Cooperative learning is a subcategory of collaborative learning in which there is face-to-face and highly structured learning. Here, there are very clear

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instructions and procedures to be followed by a teacher (Jolliffe, 2007). In collaborative learning, although students are assigned to a group, one student in the group can do almost all the work. However in cooperative learning, each child is given a segment of the task to make the group effort a success (Slavin, 2001).

A growing body of research confirms the effectiveness of cooperative learning in higher education in relation to students taught traditionally (Ramaswamy, Harris & Tschirner, 2007), (Mabrouk, 2007). Cooperative learning claims to help students of a large class size to bridge a gap between weak and able students, since it offers an opportunity to give individual attention to all students (Chaffee, 2010).

A lot of studies have shown that cooperative learning in higher education does not only improves academic achievement, but also improves students‟ social and communication skills as well as increase tolerance and acceptance of diversity (Peterson & Miller, 2004). One reason for improved academic achievement for students who engage in cooperative learning is that they are active in the learning process. Students work together to maximize their own and each other‟s learning. It may be contrasted with competitive learning in which students work against each other to achieve an academic goal and individualistic learning in which students work by themselves to accomplish academic goals (Lin, 2006). Cooperative learning in higher education is based on the fact that students learn through association and activity. Through the interactions of the students, their mental horizon is widened (Fosnot, 2005). Cooperative learning in higher education invokes a sense of responsibility, self activity and initiative in the student, as well as cultivates the habit of creative thinking in the learning of Integrated Science (Nash, 2008).

Research found that students of various ethnicities and varying races as well as those with special needs related better when they learnt in cooperative groups.

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Students get the opportunity to work together on specific tasks or projects in such a way that all students in the group benefit from the interactive experience (Johnson & Johnson, 2008).

When students used cooperative learning, they were able to retain at least 75% of the material in contrast to a classroom lecture were students retained 5% of the material after 24 hours (Moore, 2005). In a high school study, students who used the cooperative learning approach tended to exhibit higher academic achievement, higher-level reasoning , critical thinking skills, greater persistence through graduation, exhibited less disruptive behaviour, tended to produce deeper understanding of learnt material as well as exhibited lower levels of anxiety and stress in contrast to students whose method of instruction was the traditional learning method (Nash, 2008). With the cooperative method of instruction, students developed a greater intrinsic motivation to learn. They develop a positive attitude toward subject areas, and higher self-esteem (Mabrouk, 2007). A research on teaching practice that produced higher grades in students, promoted cognitive development, problem solving ability as well as academic achievement involved the use of cooperative learning (Pintrich & Schunk, 2007).

Cooperative learning allows Science teachers to achieve three major instructional objectives. These objectives are that :

- It improves students thinking in a scientific contest since they learn to share ideas, explore and question new ideas (Chin & Brown, 2000).
- It also improves students‟ involvement and engagement (Powell, 2009). This might mean that, students tend to learn more by doing something actively than by simply watching and listening. This has long been known to both cognitive psychologists and effective teachers (Mabrouk, 2007). Weak students who work

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individually are likely to give up easily when they get stuck. However, when they work cooperatively, they keep going. Strong students tend to get a firmer grasp as they teach the weak ones (Mabrouk, 2007).

- It provides the social setting that helps improve communication skills as well as scientific thinking process. (Chin & Brown, 2000).

In a study, where cooperative learning was used in teaching Science, irrespective of the students background in English and the cognitive level of learners, Scientific information was exchanged (Chaffee, 2010). With time, students confidently voiced out their scientific ideas and accepted responsibility for their thoughts. Overall, students not only developed deep listening and thinking skills, but also cooperative group tactics. Cooperative learning situations are unique, in that, students experience learning as a collaborative process. Other students become resources and partners in learning, and the success of a student is, in part, dependent on the involvement of his or her peers (Lin, 2006).

1.2 Statement of the Problem

It is a fact that in the twenty-first centary, the youth is confronted with great critical scientific challenges. Technology is growing and alternative energy sources are being explored, lifestyle related diseases as well as HIV/AIDS is expanding (Anderman, Sinatra & Gray, 2012). Science education for the adolescent appears to be is an important crossroad since career choices that relate to Mathematics, Science, Technology and Enginnering seem to be determined by adolescents‟ interest and experience in Science.

For adolescents to develop key interest in Science, there is the need to motivate them to engage with Science content through Science instruction such that

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they may consider entering the Science disciplines (Anderman, Sinatra & Gray, 2012).

It is a common knowledge that in most of the Senior High Schools in Ghana, a teacher has to teach a large class in which sixty to seventy students learn together. The opportunity for a teacher to give individual attention to each student in a large class is minimal while using traditional learning method. Learners have difficulty expressing their answers and comprehending questions. This difficulty appears to receive little attention from policy makers and teacher trainers (Cummins, 2000). This must inform the teacher to develop classroom strategies that would assist learners to communicate and to develop conceptual understanding (Cummins, 2000). Cooperative learning is known to enhance scientific communication in a comfortable non-threatening setting (Lord, 2001). This study was to use cooperative learning approach as a form of intervention to improve upon the performance of Form Two Integrated Science students at Obrachire Senior High School.

1.3 Objectives of the Study

The main objectives of the study were to:

1. assess the effects of cooperative learning instruction on the achievement of students in Integrated Science.
2. assess the effects of the traditional learning instruction method on achievement of students in Integrated Science.
3. compare the effects of cooperative learning instruction to the tradition learning instuctional method on achievement of students in Integrated Science.

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1.3.1 Research questions

1. What is the effect of cooperative learning instruction on the achievement of students in Integrated Science?
2. What is the effect of the traditional learning instruction method on achievement of students in Integrated Science.
3. Which of these two instructional methods will improve on achievement of students in Integrated Science? Is it the cooperative learning instructional method or the traditional learning instuctional method?

1.4. Rationale of the Study

Integrated Science is a compulsary subject in Senior High Schools in Ghana. Primary studies performed in countries other than the United States report that there is a positive effect of cooperative learning instruction on students in Science education (Chen, 2005). This positive effect has been repeatedly confirmed in Science education. Study performed in Turkey, reported a statistically significant difference in students‟ performance in Biology for cooperative groups compared to control groups (analysis of covariance results: $F(1,86) = 65.289$, $p < .05$) (Makgato & Mji, 2006). A study in Isreal reported a statistically significant main effect of cooperative learning compared to the control groups on student achievement in Chemistry (multivariate analysis of variance results: $F(1,162) = 28.6$, $p < .001$ (Shachar & Fischer, 2004). Also, in Turkey, another study conducted reports statistically significant difference in students' understanding of chemical equilibrium in cooperative groups compared to control groups‟ academic achievement in Science (multivariate analysis of covariance results: Wilk's lambda = .483; $F(2,83) = 44.344$, $p < .05$).Treatment groups showed higher achievement (Bilgin & Geban, 2006).

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The studies listed above clearly demonstrates a positive relation between cooperative learning and high academic achievement in Science. There is the assumption that cooperative learning as an instructional approach in a traditional school context will promote active learning and meaningful interaction among learners (Nash, 2008). Cooperative learning encourages mutual interaction by increasing the number of opportunities for verbal expression, provides opportunities for a wider range of communicative functions than those found in teacher-fronted classroom (Sidiqqui, 2003). There is a need to examine if cooperative learning method will be more effective than traditional learning method in promoting the achievement in Integrated Science among learners. Hence, this study sought to address the following question:

Will cooperative learning instruction improve Obrachire Senior High School students‟ understanding and problem solving ability in Integrated Science compared to the traditional learning instruction method?

1.5 Purpose of Study

This study was to examine the effect of cooperative learning on Obrachire Senior High School students‟ achievement and interest in Integrated Science.

1.6 Significance of Study

This study is to present a teaching methodology that will improve Obrachire Senior High School students‟ understanding in Integrated Science as well as remove the phobia that comes with presenting Science lessons to students. Students will have the opportunity to construct their own ideas, which may prove helpful in bringing innovations in the classroom. Also, Integrated Science teachers working in the field can utilize the concept of cooperative learning method for improving practice in

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Science education. This study is likely to help Science teachers to improve upon the academic achievements of their students in Obrachire Senior High School. It may also prove helpful in bringing a positive change in the cooperative behaviour of the students towards classroom activities. This study may influence policy makers and stakeholders involved in the planning of the educational curriculum in Ghana during decision-making about appropriateness of teaching methods in Integrated Science lesson presentations.

1.7. Limitations

Secondary schools were in session from September to December 2012, which was the only feasible time for the study.

1.8. Delimitations

Some students with a peer orientation are more predisposed to engage in cooperative learning than competitively oriented students and this may influence students performance in such groups (Champein, Sherwood & Cezikturk, 2003).

The study was delimited to students of Form Two General Arts class at Obrachire Senior High School. Only the academic achievements of the students in Integrated Science were included in the study. The researcher used tests to measure the students" achievements in Integrated Science.

1.9. Assumptions

The present study was based on the assumption that students of control group and experimental group had equal opportunity and motivational level to learn Integrated Science in the school.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This study reviewed the effectiveness of cooperative learning instruction method. In connection with this study, this chapter focused mainly on the ideas of various authors on cooperative learning. The chapter begins with the nature of cooperative learning and its application over the years. It continues with studies that support cooperative learning, as well as some elements that maximize cooperative learning, including cooperative learning strategies. The chapter further looks at learning theories that cooperative learning hinges on in Science education as well as disadvantages associated with the cooperative learning instruction method. It also brings to the fore, an introduction to the traditional method of instruction as well as some disadvantages associated with the traditional method of instruction. It ends with differences between the cooperative learning instruction method and the traditional method of instruction.

2.1. What is Cooperative Learning?

The word "cooperate" may mean to work or act together for a common purpose. The educational meaning of cooperation is an approach to teaching and learning in which classrooms are organized so that students work together in small groups to achieve a common goal under the guidance of a teacher (Lin, 2006). Johnson, Johnson and Smith (2005), define cooperative learning as a structured form of small group work based on interdependence, social skills, accountability and group processing where students work together to achieve a common goal, master a concept, solve a problem, or accomplish an academic task, and in doing so, they will maximize

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their own and each other‟s learning. Students in cooperative learning perceive that they can reach their learning goals if and only if the students in the learning group also reach their goals. Cooperative learning implies cooperative interaction and negotiation of meaning among heterogeneous members, as they engage in tasks in which each group member has both something to contribute to and learn from other members (Bilgin & Geban, 2006).

Cooperative learning must be well structured. According to Johnson and Johnson (2008), simply placing students in groups and telling them to work together does not produce a cooperative effect by itself.

2.2. Cooperative Learning over the years

Originally, researches on cooperative learning started examining the effectiveness of cooperative learning by comparing it to traditional method of instruction. Training of teachers in the use of cooperative learning began at the University of Minnesota (Woolfolk, 2001). This resulted in efforts to put together existing knowledge concerning cooperative, competitive and individualistic efforts (Johnson & Johnson, 2008). Also, theoretical models concerning the nature of cooperation and its essential components were formulated and a systematic program of research was conducted to test, to translate as well as to validate theories into a set of concrete strategies and procedures for using cooperation in classrooms, schools, and school districts (Johnson & Johnson, 2008). A network of schools and colleges was built to implement and maintain cooperative strategies and procedures throughout North America and many other countries (Johnson & Johnson, 2008). In the 1980s, many other individuals worked further to develop a number of scripts on cooperative learning procedures (Johnson, Johnson & Smith, 2005). However, later studies

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focused on the conditions under which cooperative learning could be most effective (Johnson & Johnson, 2008).

2.3. Studies to Support Cooperative Learning

Few studies on cooperative learning have been conducted in Secondary Schools compared to Primary Schools. However, results of these studies show that cooperative learning method enhances problem solving skills (Mohan, 2007). Cooperative learning has been advocated as a set of teaching methods or techniques which embody the spirit of communicative language teaching. In general, researchers found that cooperative learning promotes higher achievement than other learning situations (Johnson & Johnson, 2008).

Students‟ outcome measures were taken through scores on quizzes and tests (Peterson & Miller, 2004), which brought about accumulating evidence that cooperative learning can enhance students achievement. A study conducted by Csikszenmihalyi and Shieneider(2000), showed significant differences in the way students experienced concentration, challenge and enjoyment. Mean levels of these experiences were higher for small group work than for the lecture method. However, perception of importance to future goals was higher for the lecture method than for small group work. This study concluded that small group work, tests as well as individual work resulted in higher quality work than the lecture method. The study concluded further that the learners‟ experiences using different instructional methods brings out differences in students‟ learning experiences (Shepherd & Pizzini, 2006). Cooperative learning instructional method cannot be guaranteed as effective for all students. Some students are more predisposed than others to engage in cooperative learning and this may influence students performance in such groups. Students with a

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peer orientation attain higher performance in cooperating learning groups whereas competitively oriented students perform better in competitive learning structures (Csikszenmihalyi & Shieneider, 2000).

Johnson and Johnson (2005), reviewed 122 studies conducted between 1924 and 1981 that yielded 286 findings. The three methods of meta-analysis were used which were voting method, effect-size method, and z-score method. The result indicated that cooperative learning experiences tended to promote higher achievement than did competitive and individualistic learning experiences. The average person working within a cooperative situation achieved about the 80th percentile of the students achievement grades. Slavin in 2001, examined several studies that lasted four or more weeks. These studies used a variety of cooperative learning methods. Sixty-three percent of the ninety-nine experimental-control comparisons favoured cooperative learning. Only five percent students significantly favoured the control group. Overall, students in cooperative learning groups scored about one fourth of a standard deviation higher on achievement test than did students who were taught conventionally (Slavin,2001) .

According to Siddiqui (2003), increasing the frequency and variety of the verbal interaction during cooperative learning in which learners participate is an important goal of any instruction. Based on this principle, the teacher-fronted approach often ends up preventing students from having genuine interactions with the teacher and fellow students because the teacher initiates and controls the interaction (Siddiqui, 2003). Cooperative learning encourages mutual interaction by increasing the number of opportunities available for students to express themselves verbally, providing opportunities for a wider range of communicative functions than those found in teaching a class using the lecture method. Cooperation and interaction

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among the students are the main components of cooperative learning methods (McPherson, 2011).

According to Gronlund(2006), group work gave students far more chance to interact with each other and express themselves. Working in groups encouraged students to be more involved and to concentrate on the task. The students felt less anxiety when they were working in-groups than when they worked individually. Group work even helped shy students who said nothing during the class activities to share their ideas and knowledge (Gronlund, 2006). Similarly, in another study, Slavin reported that in cooperative learning, students took more responsibility in helping each other in assignments and problems. This alleviated some of the stress on the teacher in maintaining order and in keeping the students on task (Slavin, 2001). Slavin observed further that cooperation can be achieved by establishing a condusive situation to promote it. It is not sufficient, however, to simply assign students to groups, as in a collaborative learning situation. True cooperation does not take place when one child in a committee does almost all the work. Each child should be responsible for a given segment of the task to make a group effort a success. This is the main idea behind cooperative learning. In a cooperative learning situation, the teacher ensures that the group functions as an inter-dependent unit (Slavin, 2001).

Cooperative learning has been found to be a highly effective instructional approach in education in general and this has been confirmed with regard to learning Science (Nash, 2008). The researcher investigates reasons for the success of cooperative learning from a psychological perspective, focusing on two interrelated processes: the unique group dynamics of cooperative learning classes and the motivational system generated by peer cooperation. Cooperative efforts result in better problem solving abilities than competitive efforts do. This is true at all grade

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levels (Johnson & Johnson, 2008). Another study discovered that cooperative groups spent more time engaged in the task, checked their concept learning more often and scored higher on post-tests than students who worked individually. They concluded further that peer collaboration encourages maximum student participation, resulting in more flexible thinking, multiple solutions, and a clearer understanding of the steps leading up to those solutions (Gronlund, 2006).

2.4. Elements essential for Maximizing Cooperative Learning

To apply the cooperative learning effectively to classroom teaching, both teachers and students need to avoid some misunderstandings: Cooperation is not just having students sit side-by-side to talk with each other as they do their individual assignment or assigning a report to a group of students; here one student is likely to do all the work (Johnson & Johnson, 2008). Johnson and Johnson described elements of cooperative learning under five components.

According to the component theory currently in use, the following five are essential for the success of the group since they clearly differentiate a well-structured cooperative learning from a poorly-structured one (Johnson & Johnson, 2008).

These involve positive goal interdependence, individual accountability, equal participation, team work as well as group processing.

2.4.1. Positive goal interdependence

This is where a mutual goal is assigned to every group. This is the heart of cooperative learning. Students must believe in each other. They are linked with others in a way such that, one cannot succeed unless the other members of the group succeed. In other words, students must perceive that they fail or win together (Gillies,

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Ashman & Terwei, 2010). When forming the group, positive interdependence may be structured by asking group members to:

- agree on an answer for the group (group product/goal interdependence).
- make sure each member can explain the groups‟ answer (learning goal interdependence).
- fulfil assigned role responsibilities (role interdependence).

Other ways of structuring positive interdependence include establishing common rewards for group members. Joint rewards such as bonus marks or points are given for each group member as the group meets a particular criterion. Educators provide students with limited resources that must be shared for the entire group. Also, each group member is assigned complementary roles for the benefit of the entire group (Johnson & Johnson, 2005). The group encourages each other as well as facilitates each member‟s efforts to achieve group objectives. The teacher, after establishing positive interdependence, must ensure that students interact to help each other accomplish the task and promote each other‟s success (Johnson & Johnson, 2005). Students in turn are expected to explain to each other how to solve problems, discuss with each other the nature of the concepts and strategies being learnt, teach their knowledge to classmates, explain to each other the connections between present and past learning, help, encourage and support each other‟s efforts to learn (Johnson & Johnson, 2005).

2.4.2. Individual accountability or Personal responsibility

In this, each students‟ performance is evaluated and feedback is given to the individual who shares it with the entire group. This either elates the group or brings

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the performance of the group down. Individual accountability is still promoted as the group size is kept small. Individuals in the group are called randomly to present the work of the entire group. After all, the ultimate goal of cooperative learning groups is to make each member a stronger individual in his or her own right. Students learn together so that they can subsequently perform better as individuals. To ensure that each member is strengthened, students are held individually accountable to do their share of the work. The performance of each individual student is assessed and the result given back to the individual and this is translated to the entire group. The group needs to know who needs more assistance in completing the assignment. Also, group members need to know they cannot fully hang onto the work of other members of the group (Gillies, Ashman & Terwei, 2010). Common ways to structure individual accountability include giving an individual examination to each student, randomly calling on individual students to present their group's answer as well as giving an individual oral examination or tests while monitoring group work. Individual accountability must be structured by requiring each person to learn and teach a small portion of conceptual material to two or three classmates. A member of the group may be asked to explain a concept to the entire group and also to enquire what a member of the group learnt from other group members (Jonassen, 2010).

2.4.3. Equal participation

Equal participation refers to the fact that no student should be allowed to dominate a group, either socially or academically. There are two techniques to ensure equal participation. The first is turn allocation, which means that students are expected to take turns while speaking and to contribute to the discussion when their

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turn comes. The second is division of labour, which means that each group member is assigned a specified role to play in the group (Jonassen, 2010).

2.4.4. Team work or Social skills

According to Jonassen (2010), it must not be assumed that every student can work effectively with other members of the group. Many students have never worked cooperatively in learning situations. Therefore, they lack the needed skills for doing team work effectively (Jonassen, 2010). So teachers must often introduce and emphasize teamwork skills. Students must be introduced to the needed leadership, decision-making, trust-building, communication and conflict management skills (Jonassen, 2010). These skills have to be taught just as purposefully and precisely as academic skills by assigning differentiated roles to each group member. For example, students may be assigned to learn about how to document group work by serving as the task recorder, how important it is to develop strategies, to talk about how to serve as process recorder and how to provide directions to the group by serving as coordinator, as well as to ensure that everyone in the group understands and can explain by serving as the checker. Educators should take the responsibility of teaching the students social skills with accompanying rewards for employing those skills (Johnson & Johnson, 2008).

2.4.5. Group processing

Here, members decide on effective actions that need to be fine tuned as well as those that must be discarded such that the group will be effective. Teachers must make sure that members of the each group discuss how well they are achieving their goals and maintaining effective working relationships (Johnson & Johnson, 2005).

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Groups need to describe which actions are helpful and unhelpful and make decisions about what to continue or change. The benefits of group processing is that, it enables learning groups to focus on group maintenance, facilitate the learning of cooperative skills, ensure that members receive feedback on their participation, and remind students to practice cooperative skills consistently. The key to successful processing is allowing sufficient time for it to take place. A common procedure for group processing is to ask each group to list at least three things the group did well and at least one thing that could be improved (Johnson & Johnson, 2008).

To design a unit, course, or laboratory session that fully embodies the five essential elements, namely positive goal interdependence, individual accountability, equal participation, team work as well as group processing all at once may seem daunting. It is important to note, however, that the inclusion of all five essential elements is characteristic of extensively structured and developed formal cooperative learning groups, which exist over long periods of time such as a semester, a year, or even multiple years. However, there are many ways in which instructors can take small steps toward incorporating cooperative learning strategies into their teaching in less formal ways (Johnson & Johnson, 2008).

2.5. Cooperative Learning Strategies

There are some important cooperative learning strategies that can be used to maximize cooperative learning (Johnson, Johnson & Smith, 2005). These strategies are described below:

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2. 5.1. Peer interaction during a lecture

Instructors who have always used a lecture-based teaching approach often find it most challenging to take small steps toward cooperative learning. Large, introductory courses that must occur in lecture halls seem mutually exclusive with cooperative learning. This, however, need not be the case. Informal cooperative learning groups of two to four students can be convened for as little as 5 minutes across the auditorium rows to discuss a challenging question, check for understanding of a concept, or construct a list of concepts that students find confusing. These groups can occur before, during, or after a lecture and can provide opportunities both for students to explore their understanding with others and for instructors to listen to students‟ understanding of a concept. These groups have no structured continuity and may or may not share the content of their discussions with the instructor orally or in writing (Putnam, 2006).

2.5.2 Jigsaw groups

A jigsaw group is an informal cooperative learning group structure that can be used in both laboratory investigations and the discussion of scientific papers or readings. The explicit goal of the jigsaw discussion is for the students to share their expertise and to gather information from peers who have completed a different task. In team Jigsaw, students form “temporary mastery teams” or “expert groups” with different learning assignments to master. Students then return to their original or “home” teams and share new knowledge with teammates. Grades are based on individual examination performance. There is no specific reward for achievement or for the use of cooperative skills (Fletcher, 2010). Each student could be assigned readings highlights such as findings in one organism, such as the fruit fly, nematode

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worm, zebra, fish, or mouse. After completing the reading, students would be assigned to jigsaw groups that would bring together four students, each of whom had completed readings on one organism, with the requirement that each student report to the others in an effort to identify common features. This type of jigsaw approach has been successfully used to introduce students to literature research in biology and provide peer support in understanding the complexities of language in written scientific communications. A similar approach can be taken in laboratory courses in which different groups of students have pursued different investigations on a related topic (Fletcher, 2010). In addition, students learning laboratory techniques, jigsaw with two or three students who have developed expertise in other techniques, thus promoting mutual teaching and learning among students (Gagne & Briggs, 2005).

2.5.3. Team project roles

Often Science courses have at least one team or group project during the course of a semester, even in the absence of formal cooperative learning. However, these groups tend to have no structure, and the work and productivity of the group may be dictated by the dominant personalities. To facilitate positive interdependence among group members during a team project, instructors can assign randomly or strategically, specified roles within groups. Assigned roles in cooperative learning are procedural and not roles of intellect or talent; they serve to delegate individual authority to students and engage all students in the work of the group. Scaffolding these procedural roles, the intellectual work of the group is accomplished cooperatively by all team members. Common procedural roles that can be used in informal, as well as formal cooperative learning groups include facilitator, recorder, reporter, and a time keeper. In addition, instructors may choose to design other

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procedural roles depending on the age of the students and the nature of the task (Wright, 2002).

2. 5.4. Student Team Achievement Division

Student Team Achievement Division is one of the simplest and most flexible of the cooperative-learning methods, having been used in grades at different levels in such diverse subject areas as Mathematics, Language arts, Social studies, and Science. As with other cooperative learning methods, students are assigned to four or five-member groups, with each group mirroring the make-up of the class in terms of ability, background, and gender (Slavin, 2001). Once these assignments are made, a four-step cycle is initiated: teaching, team study, test, and recognition. The teaching phase begins with the presentation of material, usually in a lecture-discussion format. Students should be told what it is they are going to learn and why it is important. During team study, group members work cooperatively with teacher-provided worksheets and answer sheets. Next, each student individually takes a quiz (Slavin, 2001). Using a scoring system that ranges from 0 to 30 points to reflect the degree of individual improvement over previous quiz scores, the teacher scores the papers. Each team receives one of three recognition awards, depending on the average number of points earned by the team. For example, teams that average 15 to 19 improvement points receive a „Good team" certificate, teams that average 20 to 24 improvement points receive a „Great team" certificate, and teams that average 25 to 30 improvement points receive a „Super team" certificate (Slavin,2001).

The cooperative methods developed by the Johnsons are similar to those developed by Slavin, but with these two exceptions: the methods by the Johnsons place a greater emphasis on teaching students how to work productively together, and

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they recommend using team grades, rather than certificates or other forms of recognition, as positive reinforcers (Johnson &Johnson, 2008).

2.5.5. Team accelerated instruction

In team accelerated instruction, students encourage one another to work hard because they want their teams to succeed. Individual accountability is assured because the only score that counts is the final test score and students take the final test without the help of their teammate. Students have equal opportunities for success because all have been placed according to their prior knowledge (Slavin, 2001).

2.5.6. Cooperative integrated reading and composition

In this, teachers use novels and basal readers. They may or may not use reading groups, as in traditional reading classes. Students are assigned to teams composed of pairs of students from different reading levels. Students work in pairs in their groups. They help each other to do activities including reading. In the end, a quiz is given to students to assess their performance (Putnam, 2006).

2.5.7. Structured dyadic method

This is a highly structured method in which pairs of students teach each other. Tutoring is paired and it follows a simple study procedure. Tutors present problems to their tutees. If they respond correctly, the tutees earn points. If they are not able to do so, tutors provide answers and tutee must write the answers three times. Every ten minutes tutors and tutees switch their role (Putnam, 2006).

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2.6. Learning Theories that Support Cooperative Learning

A lot of learning theories support cooperative learning. These include:

2.6.1. Constructivist learning theory

Constructivist learning is an active constructive process. Learners are not passive to accept the external information, but active to choose the external information according to the former cognitive structure in order to construct the meaning of the present situation. The process of the construction is two ways. On one hand, learners construct the meaning of present things to trace the given information. On the other hand, the original knowledge is not taken out unchangeably, but it will be constructed according to the variation of the concrete situation. Learners‟ constructions are pluralistic, that is, each learner‟s constructions are different from each other‟s (Gay, 2010). It is not only a revolution of learning psychology, but also a leap of epistemology from behaviorism to constructivism. Behaviorists think that human understanding is determined totally by the property of stimulus. The subject of understanding is passive, just as a mirror reflects an object, while constructivists think that man, as the subject of understanding, does not simply reflect reality. In the process of understanding, the individuals make choices and choose methods, and they also give reality special meaning. So understanding does not come from reality itself, but comes from the interaction between subjects and objects (Woolfolk, 2001).

Constructivism stresses the subject‟s conscious activity, and does not take learners as passive recipients. It considers teaching a process in which students construct their knowledge actively. This construction takes place through interaction with others. In teaching, the teacher becomes a co-operator who constructs knowledge with the students. Based on the constructivist theory, cooperative learning assumes

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students are the main body of teaching and the active constructors of knowledge. The students are no longer the passive receivers of outside stimulus or the objects of knowledge inculcation (Gay, 2010).

2.6.2. Developmental theory

The basic supposition of the developmental theory is that the interaction for the proper task can promote their mastery of important concepts. Children‟s cognitive and social development has grown through companions‟ interaction and association.

A famous psychologist of Russia, Vygotsky in 1978 presented "Zone of Proximal Development (ZPD)", in which he stressed the difference between the actual developmental level that enables children to solve the problem alone and the latent developmental level with the guidance of adults or cooperation of a better companion (Vygotsky, 1978). He stated that it was not only necessary in the teacher‟s teaching, but also necessary in the cooperation with better companions. Vygotsky believed that what the learner is able to do in collaboration today; he or she will be able to do independently tomorrow. Enlightened by Vygotsky‟s ZPD, latter scholars discussed the cognitive function of the companions‟ association from two aspects. One is that the companions teach each other. That is, students with better abilities work as teachers. The other is that the companions cooperate with each other. That is, the students communicate with each other equally and cooperate with each other (Mabrouk, 2007).

Similarly, a Swiss developmental psychologist, thought that social experience and know1edge; language, value, rules, morality and sign system can be acquired through interaction with others (Piaget, 1970). Many supporters of Piaget appeal for schools to use more cooperative activities. They think that students‟ interaction for the

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learning task can improve their achievements. And they can learn from each other through interactions (Mabrouk, 2007).

Bruner, one of the supporters of Piaget, created the discovery learning and one of its pedagogical aims is to help students to learn how to learn. Teachers should present the best optimum conditions for learning, which is one of the aims of the cooperative learning. Cooperative learning can provide the students with more opportunities for interactions. It can also improve the students‟ understanding and facilitate their development (Mabrouk, 2007).

2.6.3. Group dynamics theory

A group is a dynamic whole in the sense that the interdependence between the members can change. As has been said, the nature of a cooperative group is the interdependence of the members that leads to the group becoming “a dynamic whole”, in which any member‟s change will lead to the other members‟ change (Johnson, Johnson & Smith, 2005). Another experimental research on group aims and individual aims shows that in cooperative groups, individuals have strong motives. They can encourage each other and make allowance for each other. The information communication between the individuals can go on fluently. The work efficiency of cooperative groups is obviously higher than that of non-cooperative groups (Johnson, Johnson & Smith, 2005). In America, Johnson and Johnson developed the theory into social interdependence theory. They researched and concluded that only a cooperative structure can work towards the efficiency that promote students‟ interaction and improve the teaching efficiency of the whole class (Johnson & Johnson, 2005). From the viewpoint of group interaction, the core theory of cooperative learning can be expressed simply in the following way. When all the people get together to work for

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the same purpose, they must depend on each other. The interdependence on each other provides interaction for individuals and causes them to encourage each other; willing to do whatever promotes the group success, helping each other, trying to make the group successful and loving each other (Johnson, Johnson & Smith, 2005).

2.7 Disadvantages with Cooperative Learning Instructional Method

Slavin(2001), explains that, if activities are not properly coordinated, cooperative learning methods can result in some group members doing all or most of the work while others go along without contributing when assigned just a single task. Some of such tasks is when a group is asked to hand over a single report, complete a single worksheet, or produce one project. Diffusion of responsibility is another problem. It is a situation in which other group members ignore students, who are perceived to be less skillful. When each group member is made responsible for a unique part of the group"s task, as in Jigsaw, group investigation and related methods, there is the danger that students may learn a great deal about the portion of the task they worked on themselves but not about the rest of the content (Slavin, 2001).

These dangers must be considered in selecting the cooperative learning method to be used, since these shortfalls are automatically controlled in some methods of cooperative learning(Slavin, 2001).

2.8. The Traditional Learning Instructional Method

The traditinal learning instuctional method also known as the lecture method is the usual classroom „chalk-talk" method. Here, the teacher talks actively as the students listen passively (Gregory, 2005). This is a teacher-centred instructional approach that places the teacher at the centre stage of the learning process, presenting

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information to be learnt. The traditional learning method involves the use of less interactive techniques (Griffin, 2007). With this method, the teacher is the main source of knowledge as well as the focal point of all activity. Here, the goal of the teaching process is merely to transmit information, help students master facts for examination purposes, through lectures, explanations and demonstrations (Gregory, 2005). This method allows for minimal teacher-student interaction. The main advantages of this approach is that, it promotes transmission or absorption mode of learning; communicating much information quickly to students in the shortest possible time (Griffin, 2007).

2.8.1 Disadvantages with the traditional method of instruction

The traditional method of instruction is not considered scientific at all; it rarely creates interest or draws the attention of the student to the lesson being taught (Griffin, 2007). This method mars the liveliness of the students when the lecture is long. A dull lesson is more harmful: it kills the student‟s interest towards the subject (Brown, 2001). The greatest disadvantage is that, the traditional method of instruction ignores experimentation, which is the basis of scientific knowledge (Griffin, 2007). Students‟ participation is minimal, such that very little knowledge is retained by the student. This method is a spoon-feeding method where students‟ faculties are never developed (Brown, 2001). When the traditional method of instruction is used, the essential qualities of learning Science such as independent thinking, power of observation and reasoning are never developed (Brown, 2001).

When the traditional method of instruction is combined with well-planned classroom demonstrations, audio-visual aids as well as classroom discussions the lesson makes a greater impact on the student (Chaffee, 2010). Such demonstrations

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together with students‟ interactions jeer the traditional learning method towards the cooperative learning approach which tends to be more effective (Chaffee, 2010).

2.9 Differences between Cooperative Learning Instuctional Approach and the Traditional Method of Instruction

In cooperative learning, students work or act together for a common purpose. This is an approach to teaching and learning in which classrooms are organized so that students work together in small groups to achieve a common goal under the guidance of a teacher (Lin, 2006). However, in the traditional learning methods, the teacher talks actively as the students listen passively (Gregory, 2005). This is a teacher-centred instructional approach that places the teacher at the centre stage of the learning process, presenting information to be learnt by students as individuals (Chaffee,2010).

Cooperative learning involves the formation of structured small group work based on interdependence, social skills, accountability and group processing where students work together to achieve a common goal or master a concept (Lin, 2006). The traditional learning method involves the use of less interactive techniques (Griffin, 2007). This method allows for minimal teacher-student interaction. The traditional method of instruction ignores experimentation, which is the basis of scientific knowledge. When the traditional method of instruction is used, the essential qualities of learning Science such as independent thinking, power of observation and reasoning are never developed (Brown, 2001). The traditional learning method is a spoon-feeding method where students‟ scientific explorative faculties are never developed (Brown, 2001). Cooperative learning method improves students thinking in a scientific contest since they learn to share ideas, explore and question new ideas

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(Chin & Brown, 2000). This method also enhances students‟ involvement and engagement (Powell, 2009). Students tend to learn more by doing something actively than by simply watching and listening. This has long been known to both cognitive psychologists and effective teachers (Mabrouk, 2007). Weak students who work independently are likely to give up easily when they get stuck. However, when students work cooperatively, they keep going. Strong students tend to get a firmer grasp as they teach the weak ones. Cooperative learning provides the social setting that helps improve communication skills as well as scientific thinking process. (Chin & Brown, 2000). In th traditinal method of instruction, the teaching process is merely to transmit information, help students master facts for examination purposes, through lectures, explanations and demonstrations, communicating much information quickly to students in the shortest possible time (Gregory, 2005) . This method may prove helpful for higher achievers in memorising facts, but is of little benefit to average students and lower than average students (Gregory, 2005).

Cooperative learning situations are unique, in that, all the students are involved, experiencing learning as a collaborative process such that all the students are partners in learning , thus making all the students beneficiaries (Lin, 2006).

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CHAPTER THREE

RESEARCH METHOD

This chapter describes the research methodology applied to this study. This study examined the effect of cooperative learning on Obrachire Senior High School Students" achievement and interest in Integrated Science.

The chapter is divided into the following topics:

1. Design of the Study
2. Population
3. Sample
4. Research Instrument
5. Sessions for Experimental group during Cooperative interaction
6. Sessions of Traditional learning in Control Group
7. Variables
8. Analysis of Data

3.1. Design of the Study

The study applied pre-test post-test equivalent groups design (Gay, 2010). In this design, Pre-test was first administered before the class was divided into groups and assigned experimental and control for treatment. Post-test was given at the end of the treatment period (See Appendix-v). The control group was taught using the traditional learning instructional method, while the experimental group used the cooperative learning instruction; Student Team Achievement Division, developed by Slavin (2001). This technique of cooperative learning was selected as a teaching method and as a form of intervention. This study was employed because it encompasses all the five cooperative learning elements of heterogeneous grouping,

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positive interdependence, individual accountability, social and collaborative skills, and group processing.

3.2. Population

The population for the study was all students studying Integrated Science in form two at the Senior High School level at Obrachire, Central Region of Ghana. Most students in this school appear to perceive Integrated Science as abstract in nature, hence face challenges in relation to the study of this subject. The cooperative learning instructional method was used as an intervention to help students understand some basic concepts in Integrated Science. This population was selected based on convenience and accessibility to researcher.

3.3. Sample

In this study, the sample consisted of 64 students, being the total number of students in the second year General Arts class. These participants selected were accessibility to the researcher and represented a population of a typical government Senior High School in Ghana. The experimental group included 32 participants divided into eight groups consisting of four members in each group according to the dynamics of cooperative learning. Meanwhile, 32 participants in the control group studied the same material using the traditional learning method. The pre-test scores were used to equate the groups. Each student of experimental group was equated with corresponding student in the control group.

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3.3.1. Sample equating test

All the participants were from the form two General Arts class of the school. Students were ranked into high achievers, average achievers and low achievers based on the pre-test scores. Then two students from each rank were assigned randomly to control and experimental groups by balloting (with folded papers with the number 1 or 2 concealed in them) until the total sample of 64 was distributed into two groups (i.e. experimental and control) with 32 students in each group. In this experimental group of 32 students, eight students were high achievers, eight were low achievers, and sixteen students were average achievers. The same criteria of selection of students were adopted to form control group. Thus two equivalent groups were formed in such a way that average scores of the students of the two groups were almost equal. Then, a high achiever, two average achievers and one low achiever in the experimental group were assigned to each of the eight working groups.

3.3.2. Teaching conditions

In order to establish equal conditions for both groups, the same teacher taught both groups. Both groups were taught the same material. The study lasted for three weeks with a daily average period of 35 minutes. Experimental group was taught using cooperative learning as an instructional technique and control group was taught by using traditional learning method of instruction . Researcher applied the elements of cooperative learning i.e. social skills, heterogeneous grouping, positive interdependence and group processing in the teaching of Integrated Science in the experimental group. Researcher taught both experimental and control groups.

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3.4. Research Instrument

A pre-test (Appendix-I) was administered before the allocation of students to experimental and control groups. Immediately after the treatment was over, a post-test (Appendix-II) was administered to subjects of both the experimental and the control groups. The purpose of these tests was to measure the achievement of the students constituting the sample. The researcher constructed pre-test and post-test after a thorough review of the techniques of test construction. The pre-test and post-tests were different. Two class teachers first constructed the tests. These tests were assessed and finalized by lecturers in the Science Education Department of the University of Education, Winneba. Then the test was administered to ten students in a form two class different from the class of students constituting the experimental and control groups. After this stage the tests were edited and finalized.

3.5. Sessions for Experimental Group during Cooperative Interaction

The lesson plans for the experimental group were based on lesson templates of Student Team Achievement Division designed by Slavin (Appendix-III). Specifically, the lesson plans included instructional objectives, and a list of materials needed as well as specifications of time required, group size, assignment to groups and arrangement of the room. The lesson plans also included an explanation of procedures to form the teams/groups, structure positive interdependence, individual accountability and criteria of team recognition.

The results of the pre-test was used as base scores to divide whole class into two groups (experimental and control groups). As well as divide the experimental group into smaller groups consisting of four members made up of one high achiever, two average achievers and one low achiever after ranking students from highest to

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lowest on a sheet of paper. Materials used in the presentation included direct instruction, work sheets and text books as well as charts. After the teacher‟s instruction, the students met to study the worksheets. They then discussed the problems in their respective teams. They assisted each other to correct misconceptions and then completed the worksheets after agreeing and finalizing their answers. After each section, the students took individual quizzes. The average score of the group members represented the score for each team. The teacher announced excellent teams and good teams and discussed improvement scores before the next section (sample lesson in appendix- III).

3.6 Sessions of Traditional Learning in Control Group

The same lessons and recommended text books used for the experimental group were used in the traditional learning method (see sample in appendix IV). This employed explanation of objectives and lessons using instructional procedures suggested in the text books. In this, the teacher was in full command. She performed demonstrations for students to observe, gave notes, highlighted points written on the board and explained them as the students listened. Concerns of students concerning the lesson were then addressed by the teacher.

3.7. Variables

Independent variable**:** Cooperative-learning method.

Dependent variable: Scores in the achievement test (post-test) in the subject of Integrated Science.

Variables controlled: Teacher, Time and Classroom conditions.

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Variables uncontrolled: I.Q. of the students, their previous achievement, socioeconomic status, anxieties, self-concept, interests and attitude.

3.8. Data Analysis

Statistical Package for Social Sciences provides a variety of ways to summarise data and accurately describe variables of interest (Easterby-Smith, Thorphe & Lowe, 2009). Data were analysed using Statistical Package for Social Sciences (SPSS) Software package version 16. A paired sample t-test was used to compare the means of pre-test and post-test scores of the subjects (find details in appendix-VI). The levels of significances at 95% confidence interval (t-value) between the mean of the two groups were determined. On the basis of the analytical findings, conclusions and recommendations were made.

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CHAPTER FOUR

RESULTS

This chapter presents the results as obtained from the data analysis made on the test scores. These scores were obtained from the control and experimental groups that represented the sample chosen on the study that examines the effect of cooperative learning on Obrachire Senior High School students‟ achievement in Integrated Science. The difference between Mean scores of Experimental and Control groups on Pre-test are presented in tables below:

Table I. Difference between Mean scores of Experimental and Control groups on Pre-test

Groups	Number	Mean	Standard Deviation	Level of significance at 95% confidence interval t-value
Experimental	32	66.3	10.5	0.89
Control	32	66.4	10.3	

Table I indicates that the mean score of experimental group was 66.3 and that of the control group was 66.4. From these scores, the mean score of the control group was higher than the experimental group. However, a t-value of 0.89 is higher than the p-value of 0.05, indicating that there is no significant difference between the mean values of experimental scores and control scores.

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Table II. Difference between Mean scores of Experimental group and Control group on Post-test

Groups	Number	Mean	Standard deviation	Level of significance at 95% confidence interval t-value
Experimental	32	69.4	8.3	0.02
Control	32	66.7	10.4	

Table II indicates that the mean score of experimental group was 69.4 and that of the control group was 66.7. From these scores, the mean score of the experimental group was higher than the control group. A t-value of 0.02 is lower than a p-value of 0.05, indicating that there is a significant difference between the mean values of experimental scores and control scores on post-test.

Table III. Difference between Mean scores of Control group with regards to Achievement Scores on Pre-test and Post-test.

Control Groups	Number	Mean	Standard deviation	Level of significance at 95% confidence interval t-value
Pre-test	32	66.4	10.3	0.62
post-test	32	66.7	10.4	

Table III indicates that the mean score of pre-test in control group was 66.4 and that of the post-test in control group was 66.7. From these scores, the mean score of the post-test in control group was higher than pre-test in the control group.

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A t-value of 0.62 is higher than a p-value of 0.05, indicating that there is no significant difference between the pre-test and post-test scores in control group.

Table IV. Difference between mean scores of experimental group with regards to achievement scores on pre-test and post-test.

Experimental Group	Number	Mean	Standard deviation	Level of significance at 95% confidence interval t-value
Pre-test	32	66.3	10.4	0.00
Post-test	32	69.4	8.3	

Table IV shows that the mean score of pre-test in experimental group was 66.3 and that of the post-test in experimental group was 69.4. From these scores, the mean score of the post-test in experimental group was higher than the mean of the pre-test scores. A t-value of 0.00 is smaller than a p-value of 0.05, indicating that there is significant difference between the mean of the pre-test scores and post-test scores in experimental group.

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CHAPTER FIVE

DISCUSSION OF RESULTS

The purpose of this study was to assess the effects of cooperative learning method and traditional learning method on the achievement of students in Integrated Science.

Table I compares pre-test scores of the experimental group to the control group. Statistical analysis shows that there existed no significant difference between the two groups, although the average score of the control group was higher. It means that the level of achievement in both the groups before starting the experiment was similar.

At the beginning of the treatment, it was important to establish equal conditions for both groups. This result on the pre-test clearly demonstrates that the difference between the mean scores of the two groups was not statistically significant. This shows that conditions established for both groups were the same before treatment (Slavin, 2001).

Analysis of result in Table II indicates that the mean score of the experimental group (69.4) was higher than the control group (66.7) after the post-test. A t-value of 0.02 indicates that there is significant difference between the experimental scores and control scores on post-test. This is an indication of the benefits that cooperative learning offers compared to the traditional lecture method. In the traditional learning method, there is little student interaction (Johnson & Johnson, 2005). Students do not discuss points raised and tend to reproduce answers. This encourages rote learning and memorization. In this situation, comprehension is minimal. With positive interdependence and face-to-face interaction in the cooperative learning situation, students tend to grasp concepts well, thus performing better. Cooperative learning

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enhances individual accountability such that each student masters the material. Teachers tend to monitor students' behaviour in cooperative learning situation, so students discipline is ensured. This enhances performance (Johnson & Johnson, 2005). Also unlike the traditional learning method, where there is no discussion of how students behaved, feedback and discussion of students behaviour is an integral part of ending a session in cooperative learning before moving on. This enhances students' performance. No wonder the experimental group who used the cooperative learning approach did far better compared to the control group who used the traditional learning method.

From Table III it is clear that the mean score for the post-test obtained by the control group was higher than that of the pre-test score obtained by the control group. This may be an indication that teaching using the traditional learning method might have improved during the treatment period compared to the normal class sessions students had before the treatment began. However, the difference between the pre-test and post-test scores in control group was not of any statistical significance.

Although the traditional teaching method of instruction has been the trend in most Senior High Schools in Ghana for such a long time, it is not likely to bring about a significant improvement in the performance of students. The teacher-fronted approach often ends up preventing students from having genuine interactions with the teacher and fellow students because the teacher initiates and controls all interactions (Siddiqui, 2003). Students work independently and each student is personally accountable for his or her performance. Therefore there must be an intrinsic motivation for a student to continue learning when the traditional teaching method is the mode of instruction. External motivation is minimal and this does not boost student's performance (Wright, 2002). Also, teachers are less likely to notice

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students' behaviour for feedback. Thus, the use of the usual traditional teaching method is less likely to bring about significant improvement in performance of students no matter how concise the teacher may be.

It is clear from Table IV that the mean score of the post-test in experimental group was higher than the mean of the pre-test scores. A t-value of 0.00 is smaller than a p-value of 0.05, indicating that there is significant difference between the pre-test and post-test scores in experimental group. This is consistent with Slavin's report that in cooperative learning, students tend to focus on the tasks given to them. This alleviates stress on the teacher in maintaining order and keeping students on the task, resulting in positive outcomes (Slavin, 2001). Also, group work gives students more chance to interact with each other and express themselves. Shy students are able to avoid the anxiety when they are "on show" in front of the whole class. This leads to better understanding of concepts as well as better retention of knowledge (Gronlund, 2006). It has been noted that in cooperative learning, students are more engaged on tasks, have better peer collaboration, flexible thinking, multiple solutions and a clearer understanding of steps and concepts leading to higher scores on post-tests (Johnson & Johnson, 2008). Learners could communicate their ideas freely, were more active in the learning process and more tasks oriented. The better results obtained by the experimental group is of a significant difference and this may be attributed to the fact that cooperative learning approaches might have encouraged mutual interaction between students.

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CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In the light of the results and the discussions, the following conclusions are made:

Generally, students' performance improved on post-tests. However, the average performance of control group was less than that of the experimental group. This implies that students in the experimental groups showed better performance in the Integrated Science lesson taught in cooperative learning approach than when the traditional learning method was used.

Cooperative learning has shown to be a more effective teaching and learning technique for teaching Form Two Integrated Science Students in Obrachire Senior High School. The result of this study leads to conclusion that cooperative learning method appears to be more useful for improving the performance of Form Two Integrated Science Students in Obrachire Senior High School. Cooperative learning encourages mutual interaction by increasing the number of opportunities available for more communication than those found in the traditional classroom learning situation.

Pedagogically, the dynamics of the Student Team Achievement Division of cooperative learning model are conducive for teaching and learning Integrated Science because it engages learners in meaningful interaction in a supportive classroom environment.

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6.2 Recommendations

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

1. For classroom instruction, teachers must be encouraged to use cooperative learning to improve students‟ academic achievement in Integrated Science. In the light of the above recommendation, teachers of Integrated Science in Senior High Schools must be trained to use the basic elements of cooperative learning in lesson delivery.
2. Generally, desks that can easily be moved or rotated be provided in all Senior High Schools for effective group processing during cooperative learning.

6.3 Contributions of Study to Science Education

1. The results of the study may be disseminated to teachers who are teaching Integrated Science in Senior High Schools to convince them to use cooperative learning method for the academic achievements of their students.
2. These results may serve as guidelines for Ministry of Education to revise and Improve the Integrated Science curriculum for Senior High Schools.
3. The results of this study may be disseminated to planners, to encourage policy makers to allocate the proper financial resources for training of the teachers in cooperative learning techniques during teacher training programmes.

6.4. Suggestions for Further Studies

Further studies can be conducted to investigate the effectiveness of cooperative learning for other variables such as attitude towards subjects, self-esteem, peer relation, social skills and academic motivation for different subjects.

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APPENDIX I

Pre-test

Time 1hour

NAME: ----------

DATE: ----------

CLASS: ----------

GROUP: ----------

General Instructions:

i. Write your name, group/class on the answer sheet.

ii. Please read the questions carefully before answering.

iii. Attempt all questions.

iv. Use blue pen for filling the correct option.

v. Answer all questions in spaces provided

1. Explain briefly the following terms

A**.** Akaryotic ……

……

……

……(2 marks)

B. Prokaryotic ……

……

……

……(2 marks)

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C .Eukaryotic ……....

……

……

……(2 marks)

2. An object of mass 500g occupies a volume of 40 m3. Calculate the density of the object in kg/m3 (3marks)

3. Write down the correct order for classifying living things starting from the highest rank to the lowest.----------

---

---(3 marks)

4a. Give three characteristics of viruses.

i.----------

----------ii.----------

----------iii.----------

----------(3 marks)

4b.List all the characteristics of living things

--- (3 marks)

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5. Write down the quantities of measurement for these fundamental units.

Kilogram----------

Candela----------

Kelvin----------

Mole----------

(4 marks)

6. Define the following terms.

Density----------

----------(2 marks)

Relative density----------

----------(2 marks)

7. What will you use for the following measurements?

Measuring a fixed volume of water----------

Measuring the diameter of a thin copper wire----------

Measuring the internal diameter of a cylinder----------

Measuring the relative density of kerosene ----------

----------(4 marks)

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APPENDIX-II

Post-test

Time 1hour

NAME: ----------

DATE: ----------

CLASS: ----------

GROUP: ----------

General Instructions:

vi. Write your name, group and class on the answer sheet.

vii. Please read the questions carefully before answering.

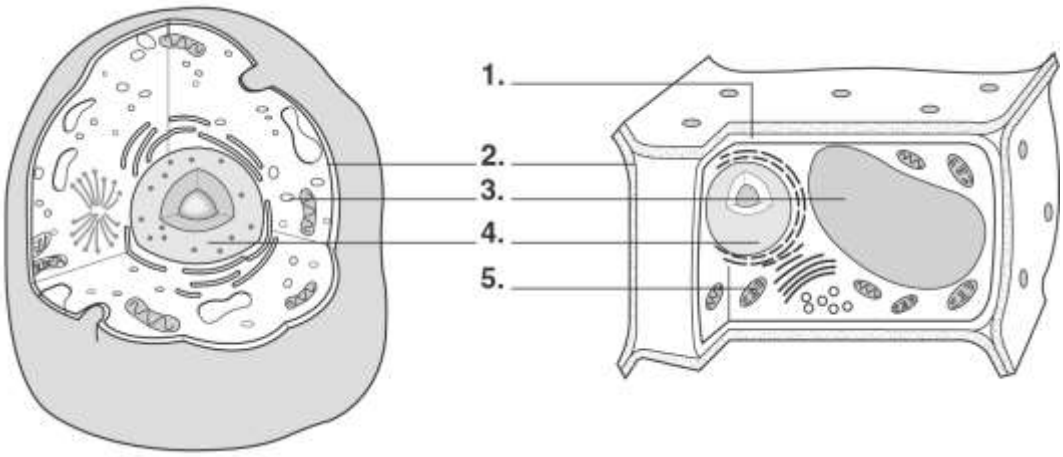
viii. Attempt all questions.

ix. Use blue pen for filling the correct option.

x. Answer all questions in spaces provided

Cell Structure and Function

Interpreting Diagrams - Write your answers in the spaces provided.



A **B**

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1. ----------

----------2. ----------

----------3. ----------

----------4. ----------

----------5. ----------

----------(5 marks)

6. What kind of cell is shown in Part A of the diagram? ----------

----------(1 mark)

7. What kind of cell is shown in Part B of the diagram? ----------

---------- (1 mark)

8. Give one function of the cell membrane----------

---------- (1 mark)

9. What part of the cell is made up of cellulose? ----------

---------- (1 mark)

10. What part of the cell is needed to make food? ----------

---------- (1 mark)

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11. Give 3(three) **differences** between mitosis and meiosis

MITOSIS	MEIOSIS
1.	1.
2.	2.
3.	3.

(6 marks)

Multiple Choices

Instructions: circle the letter of the term or phrase that best completes each statement in the spaces provided. Each correct answer earns you one mark.

12. The basic unit of structure and function in living things is the

a. nucleus **b**. membrane **c**. cell **d**. chloroplast

13. The thin structure that surrounds a cell is known as

a nucleus **b.** a cell membrane **c.** cytoplasm **d.** a vacuole

14. All the living material inside a cell, except the nucleus, makes up the

a. cytoplasm **b.** membranes **c.** vacuole **d.** mitochondria

15. Small, round structures in a cell that make proteins are known as

a. cellulose **b.** ribosome **c.** vacuoles **d.** mitochondria

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16. The cell structures that break down food to produce energy are the

a. ribosome **b.** mitochondria **c.** vacuoles **d.** chloroplasts

17. The cell structures that break down nutrient molecules and old cell parts are known as

a. ribosome **b.** lysosomes **c.** vacuoles **d.** chloroplasts

18. The small network of tubes that transports proteins in the cell is known as the

a. lysosomes **b.** mitochondria **c.** vacuoles **d.** endoplasmic reticulum

19. Animal cells have all of the following *except*

a. ribosome **b.** mitochondria **c.** vacuoles **d.** a cell wall

20. The specialized cells that carry information throughout the body are known as

a. white blood cells **b.** red blood cells **c.** nerve cells **d.** guard cells

21. All of the following are types of organelles *except*

a. ribosome **b.** cell walls **c.** mitochondria **d.** vacuoles

22. All of the following are found only in plant cells *except*

a. vacuoles **b.** cell walls **c.** chlorophyll **d.** chloroplasts

23. Which of the following eukaryotic organelles is primarily responsible for cellular digestion?

a. Nucleus **b**. Lysosomes **c**. Mitochondria **d**. Golgi apparatus

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24. Which of the following is not a normal function of plant cell vacuoles?

a. Cellular digestion **b**. space filling **c.** energy production **d.** storage

25. The endoplasmic reticulum with ribosome are known as

a. Smooth endoplasmic reticulum

b. spiked endoplasmic reticulum

c. rough endoplasmic reticulum

d. cytoskeleton endoplasmic reticulum

(14 marks)

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APPENDIX-III

SAMPLE LESSON PLAN (EXPERIMENTAL GROUP)

Teacher _____ Subject: Integrated Science

Class: Form 2

Date: _____ Time: 70 Minutes

Lesson: Cell structure

Topic : The cell

Subtopic/Contents: 1. Definition of cell

2. Parts and structure of a cell

3. Differences between plants and Animal cells

Lesson objectives:

Student must be able to:

1. Define cell
2. Describe the structure and functions of basic components of the cell.
3. Draw and label plant and animal cells as seen under a light microscope
4. List the differences between plants and animal cells

Materials

1. Textbook
2. Workbook
3. Quiz sheet

Teaching methods

Cooperative learning- Student team achievement division (STAD)

Group size : Four students per group

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Classroom arrangement/students assignments to groups

Teacher assigns a high achiever, two average achievers and one low achieving student to each group. Teacher produces a numbered list of students from highest to lowest achiever based on pre-test base average scores. He chooses the top, bottom and two middle achievers. He assigns them to one team.

The teacher assists students to arrange heavy desks in classroom. Two desks are arranged to face each other. A team will sit around the two desks. Two students would be sitting on one desk. In this way whole class will be divided and arranged in groups of four for a practice session.

Introductory activity/previous relevant knowledge

What is the basic unit of a building? Living things are also made up of basic units called cells.

Announcement of the topic

By receiving the reply the teacher will announce the topic for discussion and the topic "structure and function of the cell" will be written on the board.

Presentation stage

The diagram showing the structures in the plant and animal cells will be displayed on the board. The teacher will tell the class to look at the diagram and will discuss briefly the basic components of a cell. He will explain the lesson.

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Practice stage

The worksheet will be distributed within the groups. Students will do silent and loud reading in their groups as they fill out the worksheet. Teacher will visit every group and guide the students where they find difficulty. Teacher will ask the students to brainstorm and discuss the ideas they have presented on the worksheet, review ideas and complete the worksheet together.

He will allow students to discuss the answers on their worksheets together and share what they have studied within their group. He will ask students to read together the selected text and agree on group answers to the following questions:

i. What is a cell?

ii. What is an organelle?

iii. What are the differences between plant and animal cells?

He will delegate a group member to share his answers with the class. Finally, he will delegate a group member to provide an oral summary of selected sections to the class.

Positive interdependence

Students will earn points for their teams based on the degree to which their quiz scores (percentage) exceed their base score. Base scores points are common rewards given to each group member as they meet a particular criterion. As each member of a group is able to explain a groups‟ answer, the group earns a base score. When each member fulfils his assigned role responsibility, the group earns extra base core points. To figure a team score, each team member‟s improvement points will be collated and divided among team members to give one response from the group.

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Individual accountability

To ensure individual accountability, individual improvement scores are given. In this scoring system, each student is given a base score, derived from the students‟ average past performance on last test. Students then earn points for their teams based on the degree to which their quiz scores exceed their base score. Thus, they are individually accountable. Also, Students are responsible for helping their group members to come to one conclusion.

Team recognitions

Teacher figured individual scores and team scores and will announce the excelling teams and will award certificates. Improvement points: students earn points for their team based on the degree to which their quiz score (percentage correct) exceed their base score.

These levels of awards are given based on average team scores, as follows:

Criterion (team average)	**Award**
15-19 improvement scores	Good team
20-24 improvement scores	Great team
25-30 improvement scores	Super team

Homework: Describe any four organelles found in animal or plant cells in your exercise books.

Lesson ending: The teacher will announce when the class will meet again and will leave the class.

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APPENDIX-IV
SAMPLE LESSON PLAN (CONTROL GROUP)

Tutor; Ruth Abban (6100130002)
School/Class; Obrachire Senior High School. Form 2. No on roll; 34
Subject ; Integrated Science Topic ;Cell structure
Reference; Integrated science for senior high school- GAST (Fourth edition)

Days/Duration	**Topic/Subtopic**	**Lesson Objectives /RPK**	**Teacher/Learner activities**	**Teaching /Learning materials.**	**Core points**	**Evaluation/Remarks**
	The cell 1. Definition of cell 2.Parts and structure of a cell 3.Differences between plants and Animal cells	At the end of the period student must be able to: 1. Define cell 2. Describe the structure and functions of basic components of the cell. 3. draw and label plant and animal cells as seen under a light microscope / list the differences between plants and animal cells	Introductory activity; blocks are the basic unit of a building. Living things are also made up of basic units.	A white board marker Diagrams of plants and animal cells.	1. the cell is the basic unit of life. 2.structures present in the cell includes: nucleus, cytoplasm, cell membrane, vacuoles, golgi body, endoplasmic reticulum, lysosome, ribosomes, mitochondria. 3. Only plant cells have the cell wall and chloroplasts. Only animal cells have centrioles.	Evaluation; Define the following terms; 1. The cell. 2. Tabulate four differences between plants and animal cells. 3. Draw and label the plant cell as seen under the light microscope. Remarks; As home work ,students were asked to describe four organelles found in cells and present this during the next lesson

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APPENDIX V
STUDENTS RAW SCORES AND GROUPS

	EXPERIMENTAL					CONTROL GROUP			
No.	Group	Students	Pre-test scores	Post-test scores	No.	Group	Students	Pre-test scores	Post-test scores
1	1	Isaac	86	90	33	1	Zinnatu	90	92
2	1	Emmanuel	73	80	34	1	Richard	70	65
3	1	Harriet	65	67	35	1	Jonah	45	52
4	1	Nathaniel	49	60	36	1	Mawutor	65	68
5	2	Eric	85	83	37	2	Peter	80	79
6	2	Salomme	72	71	38	2	Alberta	74	73
7	2	Christiana	65	70	39	2	Herbet	62	69
8	2	Portia	47	57	40	2	Isaac	53	50
9	3	Simon	82	80	41	3	Kwao	80	75
10	3	John	70	73	42	3	Margaret	73	75
11	3	Noah	64	68	43	3	Efia	60	63
12	3	Vida	53	64	44	3	Moses	57	55
13	4	Francis	82	84	45	4	Lydia	77	74
14	4	Isaac	70	66	46	4	Patience	73	71
15	4	Grace	63	66	47	4	Priscilla	62	68
16	4	Alex	54	60	48	4	Vera	55	58
17	5	Jackline	80	77	49	5	Kow	77	84
18	5	Richard	69	65	50	5	Mohamed	67	70
19	5	Vincent	55	60	51	5	Alice	62	65
20	5	Micheal	63	68	52	5	Felix	54	50
21	6	Abigail	77	75	53	6	Yaaya	77	80
22	6	Richmond	67	72	54	6	Prince	75	70
23	6	Hannah	62	65	55	6	Ruth	62	63
24	6	Mathew	55	63	56	6	Tawiah	52	50
25	7	Gladys	77	77	57	7	Naa	77	78
26	7	Ebenezer	66	70	58	7	Francis	66	63
27	7	Favour	59	62	59	7	Mark	60	55
28	7	Daniel	57	62	60	7	Rahim	65	69
29	8	Emmanuel	73	75	61	8	Mark	75	72
30	8	Gloria	66	67	62	8	Ismeal	65	60
31	8	Sophia	58	70	63	8	Samuel	62	65
32	8	Micheal	58	55	64	8	Shika	53	55
	MEAN VALUES		**66.31**	**69.44**				**66.41**	**66.75**

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APPENDIX-VI

DATA OUTPUT FROM SPSS

T-Test: Experimental group: Comparison of Pre-test and Post-test:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-testExpt	66.3125	32	10.45247	1,84775
	Post-testExpt	69.4375	32	8.29278	1.46597

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre-testExpt & Post-testExpt	32	0.914	0.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre-testExpt - Post-testExpt	-3.12500	4.42682	0.78256	-4.72104	-1.52896	-3.993	31	0.000

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APPENDIX-VI CONTINUED

T-Test: Control group, Comparison of Pre-test and post-test results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-testCntrl	66.4062	32	10.26067	1,81385
	Post-testcntrl	66.7500	32	10.38299	1,83547

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre-testCntrl & Post-testcntrl	32	0.930	0.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-test Cntrl - Post-testcntrl	-0.34375	3.86556	O.68334	-1.73743	1.04993	-0.503	31	0.618

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APPENDIX-VI CONTINUED

T-Test: Experimental and Control group; Comparison of Post-test results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post-testExpt	69.4375	32	8.29278	1.46597
	Post-testcntrl	66.7500	32	10.38299	1.83547

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Post-testExpt & Post-testcntrl	32	0.816	0.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Post-testExpt - Post-testcntrl	2.68750	6.00235	1.06108	0.52342	4.85158	2.533	31	0.017

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APPENDIX-VI CONTINUED

T-Test: Comparison of results on Pre-test for both Experimental and control groups

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-testExpt	66.3125	32	10.45247	1.84775
	Pre-testCntrl	66.4062	32	10.26067	1.81385

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre-testExpt & Pre-testCntrl	32	0.932	0.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pre-testExpt - Pre-testCntrl	-0.09375	3.81305	0.67406	-1.46850	1.28100	-0.1139	31	0.890