UNIVERSITY OF EDUCATION, WINNEBA

EFFECTS OF USING COOPERATIVE LEARNING APPROACH ON ACHIEVEMENT IN SELECTED TOPICS IN PHYSICS

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2015

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A DISSERTATION IN THE DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF SCIENCE, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF EDUCATION (SCIENCE EDUCATION) DEGREE

NOVEMBER, 2015

DECLARATION

Student's Declaration

I, RICHARD AGBESHIE HAVOR, 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 elsewhere.

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 by the University of Education, Winneba.

SUPERVISOR‟S NAME: ISHMAEL K. ANDERSON (PhD)

SIGNATURE: ……

DATE: ……

ACKNOWLEDGMENTS

I wish to first of all, express my deepest appreciation to the Almighty God, who has been my source of strength and direction in all my endeavours.

My earnest gratitude goes to my supervisor, Dr. Ismeal K. Anderson of the Department of Science Education, University of Education, Winneba, for taking the pains to supervise this work against all odds. I am grateful for your kind and friendly reception every time I called or visited you, not withstanding your enormous suggestions and contribution to this work. God richly bless you.

I also want to express my warmest gratitude to all my brothers and sisters and all friends and contemporaries for their immense contributions in diverse ways without which, this work would not have come into reality. I an eternally grateful.

Another sincere gratitude once again goes to Prof. John Eminah for his useful suggestions which cannot also be overlooked.

DEDICATION

This is dedicated to the Almighty God whose amazing grace and mercy has brought me this far and to my father, Mr. Godfred Havor who has been my mentor and my source of encouragement, I say God bless you.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The study sought to investigate the effect of Cooperative Learning (CL) approach on achievement in some selected topics in physics. It also aimed at finding out their perception about cooperative Learning. Two control groups (class sizes 25 and 35) totaling 55 and two treatment groups (class sizes 25 and 35) totaling 55 were used. The study design was quasi-experimental with, pretest-intervention and post-intervention tests on the two groups (treatment and control). Four instruments which include worksheets and test on some selected topics in physics called Achievement Test on some selected topics, a questionnaire demanding student‟s perceptions about the use of cooperative learning in teaching and learning. The results subjected to T-test showed a significant difference in the mean scores between the groups taught using Cooperative Learning (treatment group) and control group taught with traditional approach at p-value of 0.05 with a medium effect size of 0.36. The results also showed an improvement in attitude of students and were motivated towards the subject. Though, difference in mean scores was registered between pre and post-tests for both groups that of the treatment group taught with Cooperative learning was higher than the group taught with traditional approach of 4.93 as against 1.03. The study therefore recommends that more emphasis should be given to teaching using Cooperative Learning in the Ghanaian Senior High Schools.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This is the introductory chapter of the study. Included in this chapter are the background of the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitation of the study, limitation of the study. Finally, it presents the organization of the chapters in this study.

1.1 Background of the study

Science education plays a vital role in the lives of individuals and the development of a nation scientifically and technologically (Alebiosu, 2008). It is widely acknowledged that, the gateway to the survival of a nation scientifically and technologically is scientific literacy which can only be achieved through the teaching and learning of science. However, science programmes or its teaching and learning in the secondary school, is now characterised by learning modules which makes learning procedure in especially physics to be more complicated and difficult for learners to grasp (Bello,2011). According to the chief examiners reports of 2010, 2011 and 2012, one of the major weaknesses of the physics student is the lack of understanding of physics concepts.

Also, in many countries, there has been report on a decline in the number of students wishing to continue with the study of physics (Woolnough, 1994). A number of factors have been identified and reported in some studies as contributing to this decline. For example Smithers (2006) noted that the study of physics in schools and universities is spiralling into decline as many teenagers believe it is too difficult. Silito and Mackinnon (2000) noted that physics has an image of being both „difficult" and

„boring". Williams (2003) observed that major general reasons for students finding physics uninteresting are that, it is seen as difficult and irrelevant, and that Physics deals with abstract concepts and students find these concepts difficult to grasp.

If before now, poor performance has been recorded in science (physics) subjects in the external examinations, the worst may still be expected with the current learning modules. To avert this, the mode of dissemination of physics to the students needs to be looked into so as to help the learners to understand physics concepts.

More often than not, the role of physics in humans" day to day activities surpasses what can be handled with levity. If the students perception of the science classroom, as a place where authorities delivers facts that are important for examination but irrelevant to life outside school, then the students will learn certain things and reject others.

Students understanding of physics and the learning strategies that are consequently employed evolved throughout their school time. As a result the way physics was presented over the years was likely to affect students" understanding of the subject and consequently how they relate to science. The actual content and the types of competencies sought for within physics as a science subject, contributes to student"s perception of physics as well as their achievement, competence, sense of efficacy and learning strategies towards physics (Stodolsky, Salk & Glessner, 1991). Okebukola (1990) stressed that meaningful learning can take place when a person consciously and explicitly links new knowledge to relevant concepts they already possessed. Thus the physics learning experiences provided by the teachers are very important. The way physics is presented to students will inevitably affect its understanding by students and consequently how they relate to science in general.

In order for physics teachers to provide an environment that facilitates learning in the classroom, an understanding of the factors that are most influential in teaching is required. These factors may include the instructional approach and the experiences of the instructor.

Although there are a lot of teaching methods that are employed in the teaching of science in general and physics in particular but the researcher believes cooperative learning approach appears to stand tall above them all hence the desire by researcher to look at effect of cooperative learning on the understanding and achievements of students in some selected physics topics. The researcher also believes that a better understanding will go a long way to develop the students" interest in the topics and subsequently physics in general.

1.2 Statement of the Problem

Teaching in Ghana today appears to be reduced to giving of lecture notes which is more of traditional approach to students to learn and reproduce during examinations (Adu, Adobor & Molenaar, 2004). Among the reasons some physics teachers give is about class size. Through this approach, students seem to lack the requisite skills for learning of physics. This is seen in the poor performance exhibited by students in physics examinations. A new approach to the teaching of physics must be adopted that is likely to motivate student to learn the subject. Cooperative learning is suggested to be one of such approaches in this study. Therefore, the focus of this study is on the effect of cooperative learning on achievement, aside helping students to share their strengths and also to develop skills in order to appreciate the physics subject.

1.3 Purpose of the Study

The purpose of the study was to investigate the effect of the use of cooperative learning approach on achievement in some selected topics in physics.

1.4 Objectives of the Study

The objectives of the study were:

1. To find out the effects of cooperative leaning approach on students‟ achievement in some selected topics in physics at Nyakrom Senior High School in Agona West Municipality.
2. To find out the effects of traditional leaning approach on students‟ achievement in some selected topics in physics at Nyakrom Senior High School in Agona West Municipality.
3. To determine the difference in achievement between cooperative and traditional learning approaches.
4. Find out the perception of the students exposed to cooperative Learning with regards to traditional approach.

1.5 Research Questions

The following research questions guided this study.

1. What is the achievement of students in the selected topics in physics after using cooperative learning approach to teach in Nyakrom Senior High Technical School?
2. What is the achievement of students in the selected topics in physics after using traditional learning approach to teach at senior high school in Nyakrom?
3. What is the difference in achievement between using cooperative and traditional learning approaches in teaching?

4. What are the perceptions of the students taught using cooperative Learning at Senior High Schools in Nyakrom?

1.6 Hypothesis

The following hypothesis were tested for research question 1 and 2

H_0: There is no difference in achievement between the students taught using cooperative learning approach and those taught using traditional learning approach.

1.7 Significance of the Study

It will add to the existing body of knowledge and research findings as well as the literature on teaching approach. The research may give other physics teachers elsewhere more insight into the effect of cooperative learning approach on achievement of students. The cooperative learning approach is more of student centred and is likely to help students to construct their own knowledge.

1.9 Delimitation of the study

This study sought to concentrate on the effects of cooperative learning approach on performance in physics only, at the senior high school level at Nyakrom Senior High School in the Agona West Municipality.

It is limited only to Nyakrom senior high school and therefore cannot be generalised. Although the selected topics are challenging, the study focused on form two students only. Time constraints within the confines of this study will not allow for the exploration of information that does not fall within the ambit of this study, but such information will form the basis for further study.

The study was limited to Nyakrom Senior High School in Agona West Municipality and as a result, the findings from this study may not be used for general inference and

deductions in the case of using cooperative learning approach on achievement and its effects on academic achievements in some selected topics in physics in Senior High Schools in any other District.

1.8 Limitation of the Study

Issues‟ concerning the teaching and achievement of students in selected topics in physics is broad and varied that, it is not possible for any single study to capture all issues. The scope of this study was therefore limited to identifying the cause‟s poor performance of students in some selected topics in physics and the effects of using cooperative learning in remedying the situation in Nyakrom in the Central Region of Ghana. Again time constraint, lack of funds and other resources among others limited the researcher from carrying out the study on a large scale. Fund available for the study were woefully inadequate to enable the researcher conduct the study in all the Senior High schools in the Central Region of Ghana.

1.9 Organization of the Report

The study is organized into five chapters. Chapter one discusses the introduction of the study by looking at the background to the study, statement of the problem, purpose of the study, research questions, and significance of the study, delimitation of the study, limitations of the study and organization of the rest of the study. Chapter two deals with, the review of related literature. Chapter three concentrates on the methodology for the study. The next chapter which is chapter four is on results and discussions. Finally, chapter five is on the summary, conclusions, and recommendations of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter primarily focused on varied views on what others have written concerning the topic under study. It takes into consideration views from authorities in the field of cooperative learning approach in education and other theoretical concepts on the subject. The first part of this chapter examines the literature on the issues related to the role of cooperative learning approach to solving students learning approach and various researches that support cooperative learning.

The second part of the chapter discusses students' difficulties and strategies employed in solving selected topics in physics. The third part of the chapter discusses the general philosophy.

2.2 Cooperative Learning Approach

The physics approach curriculum for the Senior High School Level has been designed purposely to provide students with physics knowledge and skills and develop thinking skills strategies to enable them to move higher on the educational ladder, solve problems and make decisions in everyday life. The attainment of these goals among others is based on a set of general objectives which should guide instruction in basic school work; including working cooperatively with other students and develop interest in physics, manipulating learning materials to enhance understanding of concepts and skills among others (Ministry of Education Youth and Sports, 2007).

Educators' instructional decisions stems from complex foundational beliefs about teaching, learning, the nature of human interaction, and the fundamental purposes of schooling (Fang, 1996). Understanding these beliefs is central to the implementation

of educational innovations and instructional improvement efforts (Abrani, Poulserire Chambers, 2004). One such innovation is cooperative learning, which research "consistently supports as effective in raising student achievement and increase motivation to learn (Gillies, 2002; Johnson and Johnson; Kagan, 1997).

2.3 Definition of Cooperative Learning

Cooperative Learning, according to Springer, Stanne and Donovan (2006) is a general term that is used to describe an instructional arrangement for teaching academic collaborative skills to small heterogeneous groups of students. The authors explained that the term *cooperative learning* refers to students working in teams or an assignment or project under conditions in which certain criteria are satisfied, including team members being held individually accountable for the content of the complex assignment or project. Therefore, it can be said that cooperative learning is an instructional strategy used for small groups so that students work together to maximize their effort and each other's learning activities.

Cooperative efforts results in participants striving for mutual benefits so that all group members gain from each other's efforts *(your success benefits me and my success:: benefits you),* recognizing that all group members share a common fate *(we all sink or swim together here),* knowing that one's performance is mutually caused by oneself arc one's colleagues *(we cannot do it without you),* and feeling proudly jointly celebrate when a group member is recognized for achievement *(we all congratulate you or your accomplishment).* The challenge in education today is to effectively teach students of diverse ability and differing rates of learning.

In Ghana teachers are expected to teach in a way that enables students to learn mathematics concepts while acquiring process skills, positive attitudes and values and

problem solving skills. A variety of teaching strategies had been advocated for use in mathematics lessons, ranging from teacher-centered approach to more students-centered ones. In the last decade, there is vast amount of research (Redish, 2000; Barkley, Cross and Major, Johnson, Johnson and Stanne, 2006) done on cooperative learning in science and mathematics. However, cooperative learning is grounded in the belief that learning is most effective when students are actively involved in sharing ideas and working cooperatively to complete academic tasks.

2.4 Elements of Cooperative Learning

Several definitions and elements of cooperative learning have been formulated. But it appears the one mostly used in higher education is probably that of David and Roger Johnson of the University of Minnesota. According to Johnson and Johnson (2005) model, cooperative learning is instruction that involves students working in teams to accomplish a common goal, under conditions that include the following elements:

- Positive interdependence.
- Promotive interaction.
- Individual accountability.
- Appropriate use of collaborative skills.
- Group processing.

The first and most important element in structuring cooperative learning as outlined earlier is positive interdependence. Positive interdependence is successfully structured when group members perceive that they are linked with each other in a way that one cannot succeed unless everyone succeeds. Group goals and tasks must therefore be designed and communicated to students in ways that make them believe they sink or

they swim together. When positive interdependence is solidly structured, it highlights that:

- Each group member's efforts are required and indispensable for group success and
- Each group member has a unique contribution to make the joint effort because of his or her resources and/or role and task responsibilities.

The second basic element of cooperative learning is promotive interaction that is face-to- face. Students need to do real work together in which they promote each other's success by sharing resources and helping, supporting, encouraging, and applauding each other's efforts to achieve. There are important cognitive activities and interpersonal dynamics that can only occur when students promote each other's learning. This, according to Johnson and Johnson (2005) includes orally explaining how to solve problems, explaining one's idea to others, checking for understanding, discussing concept being learned, and connecting present with past learning. By so doing helps ensure that cooperative learning groups are both an academic support system. *(Every student has someone who is committed to him or her as a person).*

The third basic element of cooperative learning is individual and group accountability. Two levels of accountability according to Johnson and Johnson (2005) must be structured into cooperative lessons. The group must be accountable for achieving its goals and each member must be accountable for contributing his or her share of the work. Individual accountability exists when the performance of each individual is assessed and the results are given back to the group and the individual in other to ascertain who needs more assistance, support, and encouragement in learning. The authors added that the purpose of cooperative learning groups is to make each

member a stronger individual in his or her right. It follows that students learn together so that they subsequently can gain greater individual competency.

The fourth basic element of cooperative learning is teaching students the required interpersonal and small group skills. However, it appears cooperative learning is inherently more complex than competitive or individualistic learning because students have to engage simultaneously in task *(learning academic subject matter)* and teamwork *(functioning effectively as a group).*

The fifth element cooperative learning is group processing. Group processing exits when members discuss how well they are achieving their goals and maintaining effective working relationships. Groups need to describe what member actions are helpful and unhelpful and make decisions about what behaviours to continue or change. Continuous improvement of the processes of learning results from the careful 'analysis of how members are working together and determining how group effectiveness can be enhanced. Johnson, Johnson and Holubec (2002) conclude by arguing that:

Cooperative learning is not simply a synonym for students working together to accomplish shared goals. A learning exercise only qualifies as cooperative learning to the extent that the five listed elements is present (p. 23).

2.5 The use of Cooperative Learning

Teaching involves more than covering the material for the students, but rather uncovering the material with the students (Redish, 2000). An extensive body research emphasizes two forms of interaction most important for enhancing student academic development, personal development and satisfaction. These are: • student-student

interactions, student-faculty interactions. Pascarella and Terenzini's (1991) summary of twenty years of research on the impact; college has on student development supports the importance of this engagement. The authors added that cooperative learning is a way to facilitate student-student, student- faculty interactions effectively and systematically. No matter what the setting is, proper planning designing and implementing cooperative learning involves five key steps. Following these steps is critical to ensuring that the five key elements that differentiate cooperative learning from simply putting students into groups are met (Johnson and Johnson, 2002: 30-31). The steps are:

- Pre-Instructional Planning: Prior planning helps to establish the specific cooperative learning technique to be used and lays the foundation for effective group work. It follows that, planning out how groups will be formed and structuring how the members will interact with each other is very crucial.
- Introducing the Activity to the Students: Students need to get their "marching orders". Hence the academic task should be explained to students and what the criteria are for success. Then structure the cooperative aspects of students work with special attention to the components of positive interdependence and individual accountability. Set up time limits and allow for clarifying questions.
- Monitoring and Interviewing: This is where instructors should allow the groups run while the instructor circulates through the room to collect observation data, see whether the students understand the assignment, give immediate feedback and praise for working together. It follows that, if a group is having difficulties, the instructor can intervene to help them get on the right track.

- Assignment: Some informal assignment is already done while monitoring the groups during the exercise. However, once the group finishes their project, work should be assessed by both the instructor and the group.
- Process: Group processing involves asking the groups to rate their own performance and set goals for themselves to improve their cooperative work.

Systematically structuring the basic five key steps into group learning situations helps ensure cooperative efforts and enables the disciplined implementation of cooperative learning for long-term success.

2.6 Expected Educational Outcomes of Cooperative Learning

Research has shown that students who work in cooperative groups do better on tests, especially with regards to reasoning and critical thinking skills than those that do not work in groups (Johnson and Johnson, and Stanne, 2006). In extensive meta-analysis across hundreds of studies according to Barkley (2005), cooperative arrangements were found superior to either competitive or individualistic structures on a variety of outcome measures, generally showing higher achievement, higher-level reasoning, more frequent generation of new ideas and solutions, and greater transfer of what is learned from one situation to another. Slavin (1996) review 67 studies, reported that 61% of the cooperative learning Classes in mathematics, achieved significantly higher test scores than the traditional classes. The author noticed that the difference between the more and less effective cooperative learning classes was that the effective ones stressed group goals and individual accountability.

2.7 Challenges with Cooperative Learning

Although cooperative learning can be highly effective, there are also some possible challenges in this approach of teaching. One of the major criticisms of cooperative

learning is that it tends to hold back the learning potential of students who are naturally gifted. Often times, students who are prone to social anxiety and prefer to work alone may suffer a negative effect of cooperative learning. Instructors must therefore understand that cooperative learning is not for everyone and must compliment or support some material to students who thrive in a class socially active environment.

Gergits and Schramer (1994) report that most students have trained to see learning as an uncompromisingly individual process in which independence is demanded and rewarded. Introducing cooperative learning into a classroom where individuality is highly regarded creates confusion. Cooperative learning earning is based on several basic principles that all must be considered during assessment: positive interdependence, individual -accountability, face-face positive interaction, appropriate use of collaborative skills. Positive interdependence for example, occurs when the success of the individual and the success of the team are positively correlated.

Another concern about cooperative learning is that advanced students will be hampered by the pace and competence of their team members. Vocal opponents of cooperative learning take issue with the concept of group rewards in which each member of learning team receives the same grade although the contributions to the task may be disparate. Leading researchers on cooperative learning assert that the challenges of cooperative learning are surmountable when it is understood and implemented fully by teachers (Walters; 2000; Rottier and Ogan, 1991). Research on group process behaviours identified two primary areas of process loss related to cooperative learning; these include *accountability* and *task-hindering group dynamics* (Harhey and Allen, 2007).

Another important difficulty of cooperative learning, which must be avoided if the methods are to be effective, is the freeloader effect (Slavin, 1999). When cooperative learning is not properly planned and executed, especially when students lack clearly defined goals, some group members may do most of the work while others passively observe or minimally participate. This diffusion of responsibility is detrimental to the achievement outcomes of cooperative learning because it may promote ignoring and off-task behaviours among the members of the group.

However, recalling and active listening roles can mitigate this problem. The careful formation of cooperative learning teams, widely regarded as a teacher responsibility rather than a student, one can offset some of the drawbacks of cooperative learning (Kagan, 1997; Slavin, 1999). For example, structuring teams of three or four students is optimal; pairs limit, the diversity of ideas that are generated by groups of four or five and teams of six or more freeloading and off-task behaviors (Felder and Brent, 2007). For most projects, teams should be constructed to include heterogeneous ability levels, although forming teams based on interest can be an effective approach. Teachers should take care not to isolate at-risk students to avoid their marginalization in a group. The research support for the efficacy of cooperative learning is substantial, but it is important to recognize and address its limitations and challenges to maximize the benefits for student achievement and social development.

2.8 The Need for Cooperative Learning

In the United States and Canada there has been extensive research into cooperative learning, that has attempted to establish how effective it is in promoting achievement, improving exam results, establishing positive relationships between different groups of young people including different cultural groups, levels of ability and indeed in

integrating sections of society who have previously been challenged in mainstream education.

Yager (1986) looks at the benefits and limitations of different theoretical perspectives of cooperative learning. A great deal of this research is relevant to this particular study as it addresses some of the central themes that are a features of this study which aims to produce students who are successful learners, effective contributors, responsible citizens and confident individuals.

The question this literature review hopes to establish is in what ways the current available research can show whether cooperative learning can assist in the understanding of physics. For example successful learners should be able to „learn independently and as part of a group", confident individuals should be able to „live as independently as they can" and effective contributors should be able to „work in partnership and in teams". All of these are essential life skills and the hope is that this study will assist in the development of these. The aim is further to give a broad overview of the findings of cooperative learning research and to establish what further research, if any, it is necessary to undertake in this area. To clarify whether the cooperative learning literature is able to identify areas where students have been shown to be successful learners, one would expect to find evidence of achievement and enthusiasm for learning.

In general terms there has been a significant amount of research conducted into cooperative learning. There is research that focuses on the different methods used in cooperative learning (Gillies, 2007; Hauserman, 1991; Jolliffe, 2007; Manning, 1991) and some that will directly support a particular approach to cooperative learning (Johnson 1990; Kagan, 1994; Slavin, 1995).

Indeed there is a degree of controversy in the different philosophies of David Johnson & Robert Slavin. Slavin (1984) insists the inclusion of incentives is essential for cooperative learning to be effective and ensure achievement whereas Johnson (1990) would disagree. Competition and rewards is not a predominant feature of other theoretical approaches to cooperative learning (Johnson, 1994) where competition is at times regarded as divisive and unhelpful to progress and achievement, indeed they argue "When students are required to compete with each other for grades, they work against each other to achieve a goal that only one or a few students can attain" (Johnson, 1990).

Slavin (1999) would argue for the use of average scores for group tasks therefore making all pupils in the group dependant on one another, whereas Johnson (1990) identify five essential components of cooperative learning which are: Positive interdependence, face to face interaction, individual accountability, social skills , Group processing. It is argued that when each of these is in place pupils will work together towards a shared goal and increase achievement, whereas Slavin would argue that achievement is only improved if there is a reward motivating the group to do so (Johnson & Johnson, 1990).

The debate regarding whether it is beneficial to use competition in a classroom is an important one as so many of our classrooms today are driven by exam results, statistics and league tables. At all times pupils and teachers are aware that there is a hierarchy in education and that only a few will be noted as „top" of the class; we celebrate this but at the expense of so many others.

The key concept of cooperative learning is that, in a classroom, young people will work together. This sends a cautionary note, to many involved in education as traditional „working together" or „group work" has been viewed as chaotic and ineffective. Cooperative learning is not a return to the older style of group work when there could be situations where one pupil would complete a task and the rest of the group are carried along with it, claiming credit for work they did not produce, nor is it an opportunity to divide and conquer a task where every pupil will complete some small section of the work.

Johnson (1990) discusses the issues around traditional groups and the many hazards and limitations found within them. In cooperative learning the aim is to allow all pupils to enhance their learning through working together and to assist one another in their personal learning.

The idea that „we" becomes important in the classroom rather than „me" is an important feature of cooperative learning classrooms. Learners focus on a joint target rather than competing to be number one. As a team they will sink or swim together (Johnson & Johnson, 1994) and thus a greater regard is given to peers. Johnson (1990) stress that the difference between the activities in traditional style classrooms and the world young people will encounter beyond school is very significant. Others would agree that learning to work together is a very important element of managing a career and life after school (Johnson 1990; Gillies, 2007; Kagan, 1994; Kohn, 1992; Slavin, 1995).

Indeed Johnson (1990) state: "Much of what students learn in school is worthless in the real world. Schools teach that performing tasks means largely working by oneself, helping and assisting others is cheating, technical competencies are the other

thing that matters, attendance and punctuality are secondary to test scores, motivation is up to the teacher, success depends on performance on individual tests, and promotions are received no matter how little one works. In the real world of work, things are altogether different.

It is evident from this, and the various authors noted above who make similar points, that young people are given the opportunity to be better prepared for our rapidly changing world and the challenges and complexities that this will bring to them McAlister (2009). The idea that competition can have a negative effect on many individuals is growing and this raises the case for challenging the competitive nature of our post-industrial societies.

Kohn (1992) discusses these issues at length and stresses that competition requires that some people fail in order that others can succeed. Johnson (1990) argued that the whole process of competition puts learners in negative relationships where pupils recognise their negatively linked fate (the more you gain, the less for me; the more I gain, the less for you).

This does not breed a healthy learning environment but one, in which, each student is pitted against the other. The aim of cooperative learning is that all pupils should gain in their learning rather than only the ones who have a chance of achieving a positive outcome at the start. Kohn (1992) identifies only those who have a chance of winning in any area as being willing to take part.

In school situations only those in the class with a chance of „winning" will take part and „the rest" (basically the majority) may sit back and put in limited effort. Competition therefore does not motivate all pupils and people to achieve and succeed

to their full potential. Cooperative learning aims to address this by ensuring that all learners are included and able to progress and achieve. The theoretical argument as to whether there should be any competition or external reward system is ongoing.

External competition provides an extrinsic reward that only some can achieve whereas a greater sense of participation, awareness, building of knowledge and the freedom to interact has the potential to enhance a young person"s learning experience. Indeed, Johnson (1990) would argue, cooperative learning should be used when we want students to learn more, like school better, like each other better, like themselves better and learn more effective social skills."

With a view to further exploring the impact that cooperative learning activities can have this literature review will now assess whether using cooperative learning methodologies can improve understanding based on existing published research.

2.7 Successful Learners

Successful learners are classified above as individuals who, among other things, have shown achievement, motivation and enthusiasm for learning. In completing this literature review, there is a wealth of evidence that supports this point; the challenge was to locate literature that did not support the notion that cooperative learning could produce successful learners. There is, however, some research that suggests all students do not benefit to the same degree and this includes the work of Hannah Shacker. Shacker (2003) reviews a number of studies into cooperative learning and reports on the evidence of achievement between low, middle and high achieving students following cooperative learning lessons.

Shacker (2003) is able to show an increase in achievement at all levels; the biggest increases, however, were found with low and middle achieving pupils. Shacker suggests that the reason for the more able not achieving an increase comparable with lower and middle ability groups could be due to their previous success with traditional systems, preference for this, and wish to maintain the status quo.

Wiegmann (1992) looked at the ways that may be more successful for learners of different abilities in raising attainment and concluded that the lower achievers were successful when in the role of the teacher – one they traditionally would not be given whereas the high achievers learned more in the role of a learner – again not the positional norm for them. The evidence here, however, did show improvements for all pupils included.

There are concerns among some researchers that cooperative learning strategies do not fully address the needs of high achievers and the more able. Logan‟s (1986) research used an ethnographic approach and he said that pupils themselves decided on a hierarchy of what individuals could and could not do and even used terms such as „slow‟ when describing one another.

Logan stressed that all pupils did not participate to the same degree but arguably this could be altered by effective management of lessons and appropriate group organising and role allocation. Logan does state that the situation could be assisted by clear instruction by teachers themselves, which in some ways suggests the issue is not so much with cooperative learning but with how it is implemented and that the teaching of social skills would be advantageous. Slavin and Hill (1986), say the more able do not benefit unless appropriately challenged, again arguing for the use of incentives to promote achievement.

There is anecdotal evidence from one high achiever that they had been „held back" by cooperative activities (Panitz, 2000). This self-starter and independent learner believed their progress was slowed and stifled by the ability of others. There is evidence in this research of pupils perceiving the behaviour of others as limiting their progress, not ability. Independent learning is a valuable skill that we should all be able to embrace and, indeed, even prefer; but this does not imply that learning together is second to this.

Seagreaves (2007) on evaluating the implementation of cooperative learning strategies in a Local Authority in Scotland have a fairly modest assessment of improvements in academic achievement. The Local Authority in question, however, views its strategy as a long term solution and not an overnight response to raising standards and achievement.

Although some research highlights different degrees of improvement through cooperative learning I could find no indication that any pupil lost through this. This may be an area that will benefit from further detailed and large scale study in Ghana as greater use of cooperative learning is made in our schools. For the purposes of this review, however, there is overwhelming evidence from positivist and interpretive paradigms that cooperative learning methodologies have shown benefits to pupils of all abilities.

Rigorous studies by Johnson (1993), Slavin (1984) and Yager (1986) all focussed on the impact that cooperative learning could have in raising achievement. Slavin (1984) focussed on the impact of achievement with and without rewards and concludes that cooperative learning does improve achievement but only with awards tied in. This is

still controversial and many would argue with this stating that group processing is much more important for higher achievement (Yager, 1986).

Yager would also argue from this research that the use of heterogeneous groups, as suggested through the Johnson and Johnson model (1994), is the most effective way to raise attainment for all. In Ghana schools setting takes place and this prohibits a heterogeneous population in a classroom. The process of setting does not go unnoticed by pupils however and although teachers may perceive this as an „easier" option to manage, and would argue its benefits to pupils, it may not be the best for all. Johnson and Johnson (1994) have shown that lower and middle ability students benefit more from being in mixed groupings.

Johnson and Johnson (1993) advocate the use of heterogeneous groups reflecting the different abilities, gender and ethnic mix if appropriate. This study reviewed the impact on 60 pupils, some of whom were exposed to cooperative learning and some to traditional teaching methods. The results showed that the high achievers who had been exposed to cooperative learning achieved higher results with recall and a higher level overall. Some of the additional benefits included improved self esteem with this group. This could also be linked to their higher achievement but also through the improved interaction they had with their peers.

Clark"s (1998) study compares the results of pupils participating in cooperative learning with those in traditional settings and shows academic achievement is improved. Donnell (1993) shows how listening skills and uptake of information from lectures can be enhanced through discussion in cooperative groups through cooperative review where students were seen to show greater understanding of the lecture content. Again, this highlights the fact that students can become switched off

during some activities and this forces attention and engagement. Gabbert (1986) investigated the notion that groups can limit creativity and challenged the evidence from Slavin and Hill (1984) that higher ability students do not benefit. Indeed they found that overall high achievers were not hurt by cooperative learning activities but that their responses may have been improved by it. Gillies (2000) support the notion that pupils‟ responses can be enhanced by cooperative learning through research results. The results showed cooperative learning in pupils provided more cooperative behaviour, more explanations, used higher cognitive strategies such as providing specific concrete facts and reasons and also obtained higher scores than their untrained peers (Gillies, 2000).

Hauserman (1992) was able to show that students involved in cooperative learning were able to achieve superior achievement in higher order thinking which is backed up by the work of Gillies (2000). Neber (2001) confirms this with an analysis of 12 studies, and although they say some of the studies were not as rigorous as possible, there was evidence that cooperative learning could enhance the instruction given to gifted and high achieving students.

Kagan (1994) has offered an excellent resource for teachers to assist in the implementation of some cooperative learning strategies and his evidence for raising achievement is prevalent throughout it. Each of the studies noted, although some employing alternative theoretical approaches, provides evidence that cooperative learning helps to produce successful learners through raised achievement. In relation to enthusiasm for learning achievement is a reflection of this: as pupils engage more actively in their learning and support one another, the potential to increase their own personal success grows.

2.8 Group Work

The inclusion of small group skills helps to ensure young people are aware of the importance of taking turns, listening to and supporting one another (Gillies, 2007). Among the research into cooperative learning, there has been explicit research that has looked at the relationships between different groups of young people.

Johnson (1982) conducted a study looking at the impact on cross ethnic interaction and friendship following the implementation of cooperative learning and found that greater ethnic interaction took place during instruction time and, importantly, more spontaneous interaction in the students" free time. This is a positive outcome that can support the changing citizenship across Ghana where social and cultural diversity increases. The opportunity to have ethnic groups interacting breeds tolerance and understanding.

Johnson (1985) built on the previous study by looking at the impact socially over time on different groups and found the more cooperative learning activities that were perceived by pupils the greater the social support. The longer cooperative learning took place the greater the social support among students.

Gillies (2000) looked at the long term impact of cooperative learning activities on social support and found that young people trained in cooperative learning activities showed more supportive behaviour over a period of time to those not trained in the strategies. It was also found that young children who have been trained to cooperate and help each other are able to demonstrate these behaviours in reconstituted groups without additional training a year later (Gillies,1997). This shows the skills developed through cooperative learning can be maintained over a period of time, leading to greater respect for other individuals.

Martin (2007) advocates the use of cooperative learning to build a learning community in the classroom and this supports citizenship among young learners. Clark (1988) indicates the importance of schools in helping to develop children"s ability to cooperate with one another, as this may not be a feature of their family life. Gabbert (1986) identify the ability of cooperative learning methods in ensuring social support among groups and in allowing for social and personal development over time.

It is hard to find opposing views here and this may be due to a lack of focus on this area. The process of teaching young people how to interact with one another is an area that many are unskilled in, may be having a positive effect. In cooperative learning situations any behaviours that are deemed to be unacceptable to the group and the class, are dealt with directly and moved through. Kagan (1994) offers guidance on how to manage any difficult situations or bedding them down. There may still be issues at times where students do not want to take part, contribute or take a turn. As individual teachers skills evolve they will develop strategies for this or find ways to manage the situations.

Johnson (1985) does state that the more cooperative learning activities that are included and used over a period of time, the more positive the climate of the classroom is and the conditions are for social support. Pell (2007) recently completed research looking at the attitudes of pupils in Key Stage 3 in England and focussed on pupils with a very negative attitude to school. In both studies, they found teachers unhappy to complete group work of any kind due to the behavioural issues and attitudes of some young people. Following the input of cooperative learning activities at this stage the researchers found that the actual curriculum, and the way it was being taught, was possibly part of the problem with irresponsible behaviour. They reported

the comments of one participating practitioner, "I used to think that group work was the problem in dealing with these difficult pupils, now I think it"s the solution" Pell (2007).

2.9 Effective Contributors

Effective contributors should be able to communicate in various ways and have resilience to stick with a project and see it through to the end. Contributors may be skilled in some areas and have developing skills in others. This is not isolated to this capacity but there are elements here that some may not want to contribute to, for example, leading a team or contributing some specific idea; this would not preclude an individual from being an effective contributor in other areas. In the research there has been no specific study looking at how effectively different individuals may contribute through cooperative learning activities, but there will be evidence of this, through outcomes and different means of presenting and organising learning and participation that has taken place.

In the same way that current research may highlight issues with different strategies, or the manner in which some young people may respond, this is an area for investigation. In this research there will be an analysis of how participants may or may not have shown themselves to be effective contributors. In the literature there is a lot of evidence of cooperation and support which is linked to being responsible citizens. Part of the mechanism within cooperative learning is to ensure that all learners take part and it is hoped that this research will be able to shed light on how effective that is. Of the published research there is evidence of very positive attitudes from students to cooperative learning.

Hauserman (1992), with his notes on the positive attitudes in the classroom, supports the notion that pupils are contributing to their groups and that students, in receiving academic help and encouragement from their peers, contribute to their mutual learning. Johnson (1985) noted in his study that students engaged with cooperative learning more effectively over time and were less motivated by extrinsic factors and were happy to engage more.

2.10 Conclusion

The research that has been completed on cooperative learning has aimed to show the contribution it can make to raising achievement and in the development of positive social interactions. The nature of cooperative learning requires that learners work together and engage with one another. The evidence from the studies noted here is very positive and will be further supported in the next Chapter; it will then clarify where cooperative learning can be regarded as good practice in relation to the current study.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter discusses the research design, population, the sample and sampling procedures, research instrument, validity and reliability of the instrument, data collection and data analysis procedure.

3.1 Research Design

The quality of a research is determined by how the gathered information is used to solve the stated problem of the study (Anderson 2006). The above stated objective could be achieved by systematic methods and effective information collecting instruments.

According to Leady (1980), the aim of experimental research design is to investigate the possible cause and effect relationship by manipulating one independent variable to influence the other variable in the experimental group, and by controlling the other relevant variables and measuring the effects of the manipulation by some statistical method. By manipulating the independent variable, the researchers can see if the treatments make a difference on the subjects.

Quasi-experimental Pretest-intervention-postest, control group design was used for this study. According to Vanderstoep and Jonhston (2009), quasi-experiment involves conducting an experiment, usually in a real life setting, without the benefit of random assignment of participants to conditions on other controls. The great strength of quasi-experiments lies in their practicality, feasibility and to a certain extent, their generability. The choice of quasi-experiment design was also informed by the fact that SHS level students are put into specific groups or classes to do specific

programmes. The use of control group pretest–postest design has the advantage of reducing the reactive effects of the experimental procedure and therefore ,improves the external validity of the design and pretest-post-test design are widely used in behavioural research, primarily for the purpose of comparing groups and/or measuring change resulting from experimental treatments (Dimitrov & Rumrill, 3003). This design was adopted so that the researcher can control subject characteristics threat to internal validity; observe possible changes on dependent variable. This enables the degree of change that might occur to be measured. The design of the research was based on the effect of using cooperative learning method in Physics teaching as independent variable against students" performance in class test as the dependent variable. The outcome provided the bases for comparison of the degree to which students" have mastered the skills that has been taught in class using cooperative learning and traditional learning methods.

3.2 Population

A population is a group of individuals that have one or more characteristics in common and of an interest to the researcher (Best & Kahn 2006).

The target population of the study comprised of all the public SHS Physics teachers and students in the Central Region of Ghana. The accessible population were One Hundred (110) physics students and four physics teachers including the researcher selected from four school in the central Region. However two control groups (class sizes 25 and 35) totaling 55and two treatment groups (class sizes 25 and 35) totaling 55 were used. The researcher taught at the two treatment schools while one teacher each taught at the control schools.

The population for the study was all elective science students of Agona Nyakrom Senior High Tec School. The students consisted of 10 females and the rest were males. They were of different socio-economic backgrounds and their ages ranged from sixteen (16) to twenty-three (23) years.

3.3 Sampling Procedure

The sampling procedure that was employed in this study was random sampling technique to select five (55) form two elective science students from each schools. These students were randomly selected into two groups of experimental and control groups. In each group there were twenty females and thirty five males. This was done so that changes in the experimental group could easily be compared to those in the control group.

3.4 Research Instrument

The research instruments used in this study were Students Achievement Test in the form of multiple choice tests for both the pre-test and post-test to collect data on performance, and an attitude questionnaire was used to collect data on their perception of the use of cooperative learning approach from the experimental group.

Standard questions were carefully designed by the researcher after reviewing related literature and were validated by some senior colleague‟s physics teachers at the SHS as well as my supervisors. It contained items, which tested knowledge of simple concepts, applications and reasoning skills. A sixty (60) minutes test consisted of thirty (20) multiple choice questions on knowledge and application and two easy type questions.

The attitude questionnaire consisted of thirteen (13) items, which dealt with student‟s perception of the effect of cooperative learning method.

3.5 Content Validity

The quality of a research instrument or a scientific measurement is determined by both its validity and reliability (Aikenhead, 2005). The procedure by which the content of the test is judged to be representative of some appropriate domain of content is the validity of the content. The design instruments were developed in consultation with my supervisor and other expert who also provided excellent advice for correction and amendment.

3.6 Reliability of Instrument

Reliability refers to the consistency of data when multiple instruments are used to gather (Aczel, 1996). In order to ensure the reliability and effectiveness of the test items, a pilot test of the study was conducted on 10 students selected from form three elective science classes after they were exposed to cooperative learning approach for two weeks. The pilot testing identified questions that respondents had difficulty understanding and those they interpreted differently than the Researcher intended. Thus once a test is developed, it is either pilot-tested or pre-tested with a small sample of potential respondents prior to the real respondents (Amedahe, 2002). Improving on research instruments through piloting is likely to improve on the quality of data, the result and interpretations. After the baseline survey test, the researcher had discussion with the class on test time, clarity and understandings of the test items. These led to modification of some of the test items.

3.7 Data Collection Procedure

Permission was sought from the Head of schools and class teachers for the study .Both staff and students were previewed on the cooperative teaching and learning strategy, benefits the social skills and principles guiding intra-team cooperation..

The following procedures were followed in collecting the data:

1. Pre-test (AT 1) was administered to the students to find out their understanding of some concepts in selected topics in physics.
2. Pre –treatment questionnaire on students perception on peer cooperation (administered to only treatment groups) and
3. Questionnaire on their attitudes and motivation (administered to both control and treatment groups) then followed. This strategy was to test the effects of cooperative learning strategy on their study.
4. Worksheets and test-on assessments were used to monitor students‟ progress on comprehension of the concepts during lessons
5. Post treatment (AT 2) was then administered.
6. Post-treatment questionnaire on students perception of cooperative learning strategy (administered to only treatment groups) as well as
7. Questionnaire on their attitude and motivation was then administered to both control and treatment groups again to measure outcome of the cooperative learning strategy in teaching selected topics in physics.

The treatment lasted for three (3) weeks. During the same period, the control group received only conventional learning activities such as lectures and discussions. In addition to these, the experimental group used the cooperative learning approach. Both groups were pretested and post tested using the same test items on both

occasions. The attitude questionnaire was administered to the students in the experimental group at the end of the treatment. The questionnaire on attitude was on five (5) points-Likert scale indicating strongly disagree coded 1, disagreed coded 2, not certain coded 3, agreed coded 4 and strongly agreed coded 5.

3.8 Data Analysis

The data obtained from the questionnaire were quantitative in nature that is, it was in numerical form. The data was checked for consistency and organized in tables according to research questions. Descriptive Statistics was used to analyze quantitative data which were presented as mean value, mean difference and standard deviation value.

CHAPTER FOUR

RESULTS AND FINDINGS

4.0 Overview

This chapter presents the statistical analysis of the research result and inferential statistical evidences needed to draw conclusions. Also, tested hypotheses, interpreted results, as well as evidence-based answers to the research questions have been adequately provided.

4.1 Research Question One

What is the performance of students in the selected topics in physics after using cooperative learning approach to teach at senior high school in Nyakrom in Ghana*?* .

The analysis of the data

The Table 1 presents the raw unadjusted means on the post-test. The post-test mean for CL is 51.36 while that for TA is 24.76.

Table 1: CL and ITA Groups' Post-test Raw Mean Scores and Standard Deviations

Mode of Instruction	Mean Score	Std. Deviation	N
CL	51.36	7.981	45
TA	24.76	8.623	37
Total	**39.35**	**15.652**	**82**

CL treatment group scored higher marks on the post-achievement (AT 2) than the control TA group as indicated in the table 1. After controlling group difference with

the covariate (pre-test or AT 1), the adjust; mean for the CL group was 52.325 and that for ITA group was 23.57' can be found on the Table 2.

Table 2: CL and TA Groups' Post-test Adjusted Mean Scores and Standard Deviations

			95% Confidence Interval	
Mode of Instruction	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
CL	52.325[a]	1.203	49.930	54.720
TA	23.577[a]	1.336	20.919	26.236

Covariates appearing in the model are evaluated at the following values: pre-test = 7.68. Again, after adjusting for pre-test scores, a significant difference was found between group taught with cooperative learning and the group taught with TA f (l, 79 78.722, p < 0.000, if = 0.499) (f = 78.722, p < 0.05) as illustrated in the ANCCT Table 3 (against the labels "error" and "method").

Table 3: Mean Scores in the Baseline Survey and Post-Test for Experimental Groups within CL and TA

Schools	Mean Scores	Mean	p-value
	Baseline Survey Post-Test	Difference	
CL	25.84 58.33	32.49	0.000
TA	23.14 46.82	23.68	0.000

In comparing the base line survey test scores across the CL and TA experimental groups, the CL experimental group scored 2.7 more than the TA experimental group. On the variable post-test, the CL experimental group with a mean score of 58.33 had

11.51 more than the TA experimental group which had a mean score of 46.82. The P-values of 0.000 in both CL and TA situations indicates that the differences between their mean scores of the post-test and the baseline survey test are highly significant since they are less than 0.05. The implication is that, the intervention had a positive effect on both CL and TA experimental groups but a greater effect on the CL experimental group as they scored a mean difference of 8.81 higher than the TA experimental group.

Table 4: Mean Scores in the Baseline Survey and Post-Test for Control Groups within CL and TA schools

Group	Mean Scores		Mean	p-value
	Baseline Survey	Post-Test	Difference	
CL	8.12	9.40	1.28	0.350
TA	28.49	33.98	5.49	0.085

Table 5: Mean scores in the Baseline Survey test and Post-Test for Experimental and Control groups within both CL and TA schools

Achievement Test	Mean Scores		Standard Deviation	
	Experimental	Control	Experimental	Control
CL Students:				
Baseline survey test	25.84	8.12	10.99	5.53
Post-test	58.33	9.40	11.92	8.06
TA students:				
Baseline survey test	23.14	28.49	10.93	12.82
Post-test	46.82	33.98	14.69	14.04

It can be seen from Table 5, the experimental group from the CL group had a mean score of 25.84 in the base line survey test whiles the control group had a mean score of 8.12. On the average, the experimental group had excess score of 17.72 over that of the control group for the baseline survey test. This could be just a coincidence that students from the school used as the experimental group were brighter than the students of the school used as control group.

In the TA group, the experimental group had a mean score of 23.14 whiles their counterpart in the control group scored 28.49. Results from Table 4 shows that the CL control group had a mean difference score of 1.28 whiles the TA control group had 5.49 as the difference between the baseline survey test scores and post test scores. This indicates a slight improvement in the post-test scores. However, the differences are not significant since all the p-values are greater than 0.05. The slight improvement in the post-test scores could be attributed to the fact that, pupils answered the post-test items immediately after they had been taught the respective topics unlike the Base Line Survey where there was a time lapse between when the topics were taught and when the test was taken.

Research Question 2: What is the performance of students in the selected topics in physics after using traditional learning approach at senior high school in Nyakrom in Ghana?

4.2 Research Question Two

Results of the means and standard deviations of the control and treatment groups on the attitude and motivation scale is summarised in the Table 6

Table 6: Mean Score Values for Pre and Post Test for both groups

Group	**Intervention**	**Mean**	**Variance**	**SD**	**N of items**	**Mean Difference**
Control	Pre	77.97	87.471	9.353	20	1.03
Group	Post	79.00	104.222	10.209	20	
Treatment	Pre	75.31	75.856	8.710	20	4.93
Group	post	80.24	57.189	7.562	20	

From the Table 6, it can be seen that the treatment group had a larger effect size or mean difference (4.93) than the control group which had smaller mean difference 1.03. This though marginal, suggests that CL improves students' attitude more towards studying physics

Science Teachers from both control and treatment groups were also trained to observed the changes in attitudes of students before and after the treatment of using the cooperative and the traditional method of teaching physics in the classroom. The observations were made twice a week for a total number of six weeks and the average calculated. This was to ensure that all the experimental groups from both CL and TA received equal treatment based on cooperative learning approach. The students' observational guide (Appendix D) was used to determine the changes in attitude that were likely to occur as a result of the use of collaborative learning approach on the students from both CL and TA areas in their science classes. Some of the indicators used are; perseverance, ability to ask and answer questions, ability to interpret graphs, collaborating with one another to solve problem and respect for evidence

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4.3 Effect Size (ES) of the Treatment

The term 'Effect Size' describes indices that measure the magnitude of treatment effects (Kotrlik, Williams, & Jabor, 2011). Cohen (1962), sees it as a measure of the degree of difference or association deemed large enough to be of practical significance. Effect size provides a rigorous method for building on the findings of previous studies and aggregating the results to advance scientific knowledge and to guide policy development during educational reform (McNamara, Morales. Kim, & McNamara,1998). Whereas statistical tests of significance tell us the likelihood that experimental results differ from chance expectations, effect size measurements tell us the relative magnitude of the experimental treatment (Thalheimer & Cook. 2002). Using standardized mean differences, the effect size of the control group ITA) is compared against the treatment group CL) in this study. This involves comparing the mean scores of the two variables and dividing them by the standard deviation. Researchers adopt different methods to calculate effect size among which is Cohen‟s „d‟ or „g‟. Cohen's g ES is the difference between two means (treatment minus control) divided by the standard deviation of the two conditions. Table 5 presents Cohen‟s suggested ES and its interpretation.

Table 7: Cohen's Interpretation of Effect sizes

Effect Size	Interpretation
≤ 0.2	Small
≤ 0.5	Medium
≥ 0.8	Large

Depending on the statistical figurers available, a researcher could choose form a number of several formulae for determining ES. Appropriate for this study is the one indicated below:

ES = $\frac{\bar{x}_1\bar{x}_2}{S_{within}}$ **But** $S_{within} = \sqrt{\frac{s_1^2(n_1-1)s_2^2(n_2-1)}{n_1+n_2-2}}$

Therefore

ES = $\dfrac{\bar{x}_1\bar{x}_2}{\sqrt{\dfrac{s_1^2(n_1-1)s_2^2(n_2-1)}{n_1+n_2-2}}}$

Where;

$\bar{X}_1$ = mean score of treatment group: $\bar{X}_2$ = mean score of control group

S_1 Standard deviation of treatment group; S_2 = Statement deviation of control group

n_1 = sample size of treatment group n_2 = sample size of control group

Some met-analysts argue that Cohen's g is a compromised form of ES since it has an inherent tendency to inflate the ES with small sample size. In other words, g is intuitively a biased estimator of the population effect size (DeCoster, 2004).

The corrected ES, also called Hedges' d is thus obtained using the following formula;

Hedge's d = **g** $(1-\frac{3}{4(n_t+n_c)-2})$

Where;

n_t = sample size of treatment group

n_c = sample size of control group

Using the above formulae, both 'd' and 'g' values were found to be approximately 0.36 for the use of CL in teaching some concept in physics. This ES according to Cohen's suggested interpretation is medium.

Research Question Three

What is the difference in performance between using cooperative and traditional learning approaches in teaching?

The third objective of this study sought to determine whether or not there is any difference in performance between student learning cooperative and traditional learning approach. Comparing the two experimental groups the CL experimental group performed better than the traditional experimental group in the post test scores. However the difference in the improvement was not statistically significant.

The finding might suggest that collaborative learning helped greatly and therefore should be recommended for use by all schools. In general the findings of the study seems to indicate that small groups using collaborative learning approach supported with the appropriate and adequate materials ensured active participation of students in the lessons. This is supported by Narrow (1998) who contended that ,team work and collaboration is beneficial to students .Similarly Rennie (1990) found that small learning group were beneficial in motivating students to participate in science class

4.4 Research Question Four:

What are the perceptions of students taught using cooperative learning approach at Senior High Schools in Nyakrom?

The QSP was used to collect data which was analyzed to answer the research question. The mean and standard deviation produced by the scale on the perception of students regarding TA, CL and benefits of CL before and after treatment are presented in the Tables 8 and 9.

Table 8: Mean and Standard Deviation for Pre-treatment

Item	Mean	Variance	SD	N of items
Treatment (TA)	11.24	3.689	1.921	3
Control (CL)	9.02	4.022	2.006	0

As can be seen in the Table 7, the pre-treatment QSP scale produced a mean of 11.24 (SD = 1.921) for "Perception of TA". "Perception of CL" had a mean of 9.02 (SD = 2.006) and "Perception of Benefits of CL" yielded a mean of 17.22 (SD = 2.540).

In the Table 8, it can be observed that for the post-treatment response to the QSP, the mean for "Perception of TA" is 8.62 (SD = 1.435), that for "Perception of CL" is 12.09 (SD = 2.032) and for "Perception of Benefits of CL" it is 20.51 (SD = 2.967). A glance at these means generally reveals that after exposing students to CL, their "Perception of TA" dropped (from 11.24 to 8.62) whiles it increased for "Perception of CL" (9.02 to 12.09) and that for "Perception of benefits of CL" (17.22 to 20.51).

Table 9: Mean and Standard Deviation for Post-treatment Control

Item	Mean	Variance	SD	N of items
Control Group	8.62	2.059	1.435	3
Treatment Group	12.09	4.128	2.032	3

The extent of effect of treatment by way of mean difference between the pre and post treatment response is presented in the Table 9.

Table 10: Comparison between the pre and post Mean scores

Mean		Mean	Inference	
Post	Pre	Difference		
Treatment (TA)	8.62	11.24	-2.62	Drop in perception for TA
Control CL	12.09	9.02	.307	

It can be observed from the Table 9 (summarized for Tables 7 and 8) that after exposing students to CL, they perceived cooperative learning and its benefits as more viable instructional method than TA. Perception for TA saw a drop in mean by 2.62 (-2.62 in the Table 9) between the post-treatment and pre-treatment QSP scale whiles perception for both CL and its benefits saw an increase in mean difference of 3.07 and 3.29 respectively on the QSP scale. To answer the research question directly, students who have undergone CL did not perceive TA as more beneficial in the teaching and learning process but rather they perceived CL and its benefits brings more meaningful teaching and learning to them.

In order to understand the student preference for both cooperative learning and the traditional learning approaches after going through the various treatment groups the following responses was illicieted which gave credence to the preference for cooperative learning as a preferred approach. Frequency count was conducted on selected items (6, 7, 10 and 11) on the QSP which supported the outcome. Thus table 10 presents the frequency and percentages of students who responded to selected items relating to preference of TA and CL as a viable instructional method at the SHS.

From the table 10, item 1 “I prefer to work on my own”, supports TA. To this, 22 students representing 48. 9% were resolute in agreeing to the statement in both pre and post treatment response to the QSP. A drop from 14 to 10 students (31.1% to

22.2%) respectively were undecided in responding to the item on the QSP in the pre and post treatment. An increase from 9 to 13 students (20% to 28.9%) respectively disagreed with the statement in the pre and post treatment on the QSP.

The item 2, "I learn more from direct teacher instruction" which also supported TA on the QSP, produced the following responses in the pre and post treatment respectively:

A drop in number of students from 7 to 3 and in percentages, from 15.6% to 6.7%, disagreed to learning more from direct teacher instruction. A fairly constant number for student (4 to 5) representing 8.9% and 11.1% were undecided. Last but not least for item 2, a slight increase in number from 34 to 37 for student which represents 75.6% and 82.2% respectively, agreed to learning more form direct teacher instruction.

The third item "it is fair to use group efforts at the SHS", supports CL. 14 to 6 students (31.1% to 13.3%) agreed that it is fair to use group effort at the SHS.

To item 4 " All teachers should sue cooperative group work in teaching at the SHS", a significant drop in number for students from 11 to 6 (24.4% to 13.3%) disagreed just as number of students who were undecided dropped from 14 to 6 (31.1% to 13.3%) respectively in responding to the item in the pre and post treatment QSP. 14 students (31.1%) agreed to the statement in the pre –treatment with more than double this number (33) representing 73.3% agreeing to the item in the post treatment item on the QSP.

To further define the percentage of students who prefer CL to TA, items 1 and 2 in table 10 have been averaged and termed „preference of TA" and items 3 and 4 into 'preference of CL' and summarized in the Table 11.

Table 11: Students' Preference of TA and CL

Item 1: Preference of TA

	Pre-Treatment		Post-Treatment	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Disagree	8	17.8	$	17.8
Undecided	9	20.0	7*	15.5
Agree	28	62.2	30*	66.7
Total	**45**	**100.0**	**45**	**100.0**

Item 2: Preference of CL

	Pre-Treatment		Post-Treatment	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Disagree	12	26.6	6	13.3
Undecided	16	35.6	6	13.3
Agree	17	37.8	33	HI 173.3
Total	**45**	**100.0**	**45**	**100.0**

NB: * = fractions have been rationalised.

A glance at the Table 10 indicates that for perception of TA, a fairly constant response pattern to the QSP was recorded. 8 students, representing 17.8% disagreed in pre and post treatment response to the QSP, 8 and 7 students representing 20% and 15.5% respectively were undecided and 28 and 30 students representing 62.2% and 66.7% respectively agreed on the QSP.

Response to the second item labelled “Preference of CL” indicates a more favorable preference of CL to preference of TA by majority of students. The pre and post

treatment responses to the QSP recorded 12 and 6 students representing 26.6% and 13.3% respectively registering their displeasure (disagreeing to) about using CL as a major instructional method at the SHS, 16 and 6 students representing 35.6% and 13.3% respectively were undecided and finally, 17 and 33 representing 37.8% and 73.3% respectively agreed to using CL by teachers at the SHS.

Also worth noting is the fact that for preference of TA, number of students who were undecided dropped from 9 to 7 at the end of treatment period with those disagreeing remaining constant at 8 students whiles number of students who agreed, slightly increased from 28 to 30 students. On the item of preference of CL, number of students who disagreed dropped significantly from 12 to 6 and the undecided number of students sharply dropped from 16 to 6 at the end of treatment. These culminated into an increase from 17 to 33 students who agreed to the use of CL as a major instructional method at the SHS.

The reports gathered from the interviews and the questionnaire indicates that, most of the responses from the cooperative learning group show that, when they were involved in the cooperative learning approach, their level of understanding improved and were able to understand the concept of the topics treated better. It is therefore not surprising that they performed better in their test conducted after the intervention.

They also claim that topics that, when they are learning alone wouldn‟t have paid much attention to or comprehend easily, when they came in a group their attention was drawn to them and this really helped them to have a full view of what the teacher was trying to communicate.

The results clearly show that there is a significantly positive impact of cooperative learning approach based on the performance of students that were used for this study. This is based on the higher scores from the cooperative learning approach group in table 4.3 and consequently confirmed by the independent t-test on the mean. The findings based on the performance of students as a result of the cooperative learning approach is in line with findings of Slavin 1990 and Cohen 1994 who concluded their various studies that the use of cooperative learning approach helps students to attain higher performances academically.

This study also agrees with Nattiv (1994) and Dansereau (1987) who also in their studies reported that cooperative learning approach augments students‟ performances and in still cooperative attitudes which overall improves learning. The findings obtained from the study may be link to several factors including mutual dependent.

When students are working cooperatively, „„all work for one‟‟ and „„one works for all‟‟, this help individual team members in the team to receive emotional and academic support that helps and also encourages them persist against the obstacles that they confront in school (Johnson and John 1994)

Another attributed factor in the study might be the interactions among the students in the various groups of the cooperative learning group which agrees with the findings of Mcgroarty (1993), who opined that interaction naturally, create surroundings that helps students in listening to each other, asking questions. It also improves cognitive abilities.

The discussion, observation and the administration of questionnaire among the students suggested that, most of the cooperative group students showed a very

positive response. They expressed their happiness and their like for the cooperative learning method as compared to the traditional way of learning and even went on to express their profound gratitude to the teacher and pray that he continues with this method. It was also observed that the cooperative learning group performed better in the post-test scores than their pre-test their scores.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter summarizes the study and its main findings, makes conclusions from the study and outlines appropriate recommendations based on the findings of this study.

5.1 Summary of Study

Methodologically, quasi experimental and cross-sectional case survey that involved the use of multiple choice tests used both in the pre-test and post-test, and an attitude questionnaire to collect data from selected form two pure science students of Agona Nyakrom Senior High Technical School. Out of the sixty-four (64) questionnaires which were administered, 60 were returned representing 93.75%. The data was analysed using descriptive statistics such as mean score and standard deviation

5.2 Summary of Findings

The main findings were summarized below:

1. The result of the main hypothesis postulated for the study revealed that co-operative method improves the performance of the students as compared to the traditional approach.
2. The Leven‟s test showed there was significant difference between the co-operative approach and the traditional method.
3. The study revealed that an appreciable number of the respondents were of the opinion that the amount and quality of cooperation in the programme were just about right compared with what would normally be covered in the traditional classroom.

4. The study showed that the use of co-operative approach has increased the degree of interest in physics, improved enthusiasm, and reduced anxiety, provided more time on task, and provided instant feedback for the student.
5. Findings also indicated that majority of the students expressed an opinion that traditional method of teaching be replaced completely with the co-operative method rather than only supplementary. They therefore recommended that the use of the co-operative method be maintained in teaching and learning other subjects as well.

5.3 Conclusions

There were statistical differences between the two groups after the intervention on the experimental group in their post-test scores. The results of the study imply that students exposed to cooperative learning performed significantly better than the traditional approach group. Co-operative Instructional Approach provides opportunities for learner control, improves enthusiasm, associations to the real world, and enhances student‟s achievement as measured in variety of ways.

Co-operative instructional approach provides a self-directed learning to students, and allows learners to become empowered to take increasingly more responsibility to choose, control, and evaluate their own learning activities which can be pursued at any time, in any place, through any means, at any age. Simply put, learners can decide what they want to learn and in what order.

5.4 Recommendations

In view of the result obtained in this study, the following suggestions are presented:

1. Curriculum developers should take advantage of any future review of educational reforms at the SHS level to bring on board innovative teaching strategies such as the cooperative learning in teaching physics at the SHS.
2. Teachers teach the way they were taught (Degbor, 2014). If cooperative learning is given serious attention in our schools, then student teachers at the training colleges and educational faculties of the universities should be taught how to incorporate cooperative learning strategies in their lessons.
3. The Ghana Education Service should hold workshops to educate teachers on the use and practice of cooperative learning in physics classrooms.
4. Cooperative learning method should be introduced at the SHS for the education of students offering Physics and other subjects.
5. Teachers in particular should be encouraged to adopt the use of cooperative learning to improve performance of students in physics.
6. Teachers should be supported by school administrators with teaching and learning materials and equipments.
7. A more comprehensive research with long period should be done with respect to cooperative learning to determine the effects of the method on science teaching and in all subject and levels of education.

5.5 Suggestions for Further Studies

In light of the findings of the study and their educational implications, the following suggestions are made for further research with respect to the use of cooperative learning on physics at the Senior High School level:

1. It is suggested that the study be replicated using Cooperative Learning on difficult Physics concepts, such as, electronics and electromagnetism.
2. Additionally, it is suggested that the study be replicated using larger samples to provide a basis for more generalisation of conclusions drawn from the findings of the study about the effectiveness of Cooperative Learning in the teaching and learning of some concepts in physics
3. Also, it is recommended that the period for the intervention may be extended to cover a whole term. This may ensure the coverage of more topics (about four or five) to be used for further studies.
4. Finally, similar empirical studies should be carried out on the use of Cooperative Learning on other science subjects and at different levels of science education.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

SCIENCE EDUCATION DEPARTMENT

PRE-TEST DATA COLLECTION INSTRUMENT ON STUDENTS'

ACHIEVEMENT TEST

Name of participant.....

Gender of participant.....Group of participant.....

School of participant.....

GENERAL INSTRUCTIONS:

This test contains twelve (12) questions grouped in two sections, namely Section A and B. Please answer all the questions. Answer all questions on the question paper.

SECTION A

MULTIPLE CHOICE QUESTIONS

INSTRUCTIONS: The following questions are followed by four 4 options lettered A to D.

Choose the correct option and circle A, B, C, or D to indicate your answer. Answer all questions on the question paper.

1. The rate at which a body changes velocity with time is called

   (a) Velocity (b) Inertia (C) Momentum (d) Acceleration

2. A change in the position or direction of a body is termed as

   (a) Motive (b) Motion (C) Movement (d) diffusion

3. The SI Unit of distance is (a) CM (b) M (C) MM (d) Km

4. In elastic collision, momentum is conserved (a) True (b) False

5. An athlete covers 40m at an average speed of 29.6kmh$^{-1.}$ Calculate the duration of race. (a) 74.00s (b) 48.65s (c) 48.40s (d) 13.51s
6. A particle accelerates uniformly from rest at 6.0ms-2. Calculate the distance covered in 4s of its motion. (a) 75.0m (b) 48.0m (c) 27.0m (d) 21.0m
7. The unit of energy is (a) the Joule (b) the Watt (C) the Newton (d) the Newton per metre
8. A force on a 120kg mass accelerates the body at 8ms-$^{2.}$ What is the magnitude of the force? (a) 140N (b) 520N (C) 640N (d) 960N
9. The unit of momentum is (a) Kgms^{-1} (b) kgms^{-2} (C) kgs^{-1} (d) Nm
10. A body of mass 4kg is acted upon by a force of 12N. Calculate the kinetic energy gained by in 2s. (a) 24.0J (b) 36.0J (C) 48.0J (d) 72.0J

SECTION B

11. A car travels a distance of S in time (t) seconds. If the car starts from rest and moves with a constant acceleration. Show that S=1/2 at^2
12. Calculate the distance travel if the car travels with acceleration of 20ms^{-2} for 5 minutes.

APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA

SCIENCE EDUCATION DEPARTMENT

POST-TEST DATA COLLECTION INSTRUMENT ON STUDENTS'

ACHIEVEMENT TEST

Name of participant.....

Gender of participant.....Group of participant.....

School of participant.....

GENERAL INSTRUCTIONS:

This test contains twelve (12) questions grouped in two sections, namely Section A and B. Please answer all the questions. Answer all questions on the question paper.

SECTION A

MULTIPLE CHOICE QUESTIONS

INSTRUCTIONS: The following questions are followed by four 4 options lettered A to D.

Choose the correct option and circle A, B, C, or D to indicate your answer.

1. Which of the following indicates a change of state of matter

   A. cooling B. warming C. drying D. melting

2. Which of the following is correct about a ray from air entering a triangular glass prism A. the ray is internally reflected B. the angle of incident is greater than the angle of reflection C. the ray is refracted away from the normal D. the angle of reflection is greater than the angle of incidence

3. A man 1.8m tall stands in front of a plane mirror. Calculate the shortest length of mirror that will enable him to see his total height

A. 0.3m B. 0.6m C. 0.9m D. 1.8m

4. Which feature of the eye performs the same functions as the diaphragm in the camera?

   A. choroid B. iris C. cornea D. pupil

5. What energy transformation occurs in a hydroelectric plant?

   A. mechanical energy to electrical energy B. electrical energy changes to electric energy

   C. mechanical energy changes to chemical energy D. chemical energy changes to electrical energy

6. Which of the following instruments would a man in a submerged submarine use to view a boat on a sea? A. binoculars B. telescope C. Echo sounder D. periscope

7. Which of the following is the reason for using plane mirrors inclined to each other on theatre stage?

   A. to enlarge the actors B. to increase the distance from spectators

   C. to produce multiple images D. to produce lateral inversion

8. An illuminated body is one which can be seen as a result of the light it;

   A. reflects B. diffracts C. refracts D. Diffuse

9. The following are all luminous bodies except

   A. the sun B. A candle C. the moon D. a fluorescent body

10. In a pinhole camera when the hole is large the image formed is

    A. bright and blurred B. small and bright C. dark and sharp D. bright and sharp

SECTION B

11. The critical angle of flint glass is 42^0. Calculate the refractive index for a ray passing from this material into air.

12. Explain what is meant by the refractive index of water is 1.33.

APPENDIX C

Levene's Test for Equality of Variances with Respect to Research Question One. (Before intervention)

Independent Samples Test before Equal Variance Assumed

Type of Group	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Experimental Group	.654	.422	1.305	58	.197	3.73333	2.86062	-1.99282	9.4595
Control Group			1.305	57.784	.197	3.73333	2.86062	-1.99327	9.4599

APPENDIX D

Levene's Test for Equality of Variances with Respect to Research Question Two. (After intervention)

Independent Samples Test After Equal Variance Assumed

Type of Group	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Experimental Group	2.398	.127	5.866	58	.000	19.16667	3.26714	12.62677	25.7066
Control Group			5.866	55.054	.000	19.16667	3.26714	12.61931	25.7140