EFFECTS OF TEAM TEACHING ON PERFORMANCE AND RETENTION OF PHYSICS CONCEPTS AMONG SENIOR SECONDARY SCHOOL STUDENTS OF DIFFERENT ABILITY LEVELS IN MARADI, REPUBLIC OF NIGER

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DECLARATION

I hereby declare that this thesis entitled **"Effects of Team Teaching on Performance and Retention of Physics Concepts Among Senior Secondary School Students of Different Ability Levels in Maradi, Republic of Niger"** has been written by me. It is a record of my own research work and it has not been presented in any previous application for a higher degree. All quotations and sources of information are fully acknowledged by means of references.

_____ _____

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CERTIFICATION

This thesis entitled **" Effects of Team Teaching on Performance and Retention of Physics Concepts Among Senior Secondary School Students of Different Ability Levels in Maradi, Republic of Niger"** by Omar SAIDOU meets the regulations governing the award of the degree of Master in Science Education of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to the teaching of science in Niger Republic.

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LIST OF ABBREVIATIONS

N.T.E: National Teacher Examination

P.P.T: Physics Performance Test

C.S.S.T: Complex of Secondary Schools Teaching

C.G.T: College of General Teaching

R.D.S.S.T: Regional Direction of Secondary School Teaching

D.EX: Direction of Examination

D.T.EX: Direction of Tests and Examination

N.Y.S.C: National Youth Service Corps

I.N.D.R.A.P: National Institute of Documentation, Research, and Pedagogical Aide

P.W.E: Practical Work- Experiment

A.D.E.I: Activity Student Experiment

P.D.S.I: Practice Do See and Improve

A.S.E.I: Activity Student Experiment Improvisation

P.D.S.I: Plan Do See and Improve

L.O.S.E.N: Loi d'Orientation du Système Educatif Nigérien

S.M.A.S.S: Strengthening of Mathematics And Sciences in Secondary Education (project)

OPERATIONAL DEFINITION OF TERMS

Team Teaching: An instructional strategy in which a group of two or more teachers work together to plan, conduct and evaluate the learning activities for the same group of learners.

Security Measure: Instructions giving assurance, advices that provides a sense of protection against loss, attack, or harm.

Safety Measure: Precaution to maintain safety, precaution taken to keep somebody or something safe from attack or danger.

Missed Students: Students who did not understand, absent-minded, confused by something complicated or poorly explained.

Retained Students: Students who are repeating the year or the classes

Ability Level: A level of academic skill or performance within a grade level of instruction

Ability Grouping: The practice of grouping students according to their level of academic skills or performance, allowing a teacher to provide a uniform level of instruction to an entire group

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ABSTRACT

This study investigated effects of team teaching on the academic performance and retention of SSII students in physic in Maradi, Niger Republic. The study adopted quasi-experimental, pre-test, post-test control group design. The population of the study was made up of 1287 Senior Secondary level two students. The sample for the study consisted of 180 SSII students of different ability levels and different genders, randomly selected from two schools. The instrument used for data collection was the Physics Performance Test (PPT). Reliability coefficient of PPT was 0.79. Four hypotheses were formulated and tested at 0.05 levels of significance. The data were analyzed using one-way analysis of variance and t-test statistical tools at P=0.05. On the basis of the findings, it was concluded that Team Teaching was more effective than the Conventional Teaching Strategy in improving students' performance and retention in physics at Senior Secondary School level. It was found to be better in enhancing retention level of students in high, medium and low ability levels. Also team teaching was found to be gender friendly. On the basis of these findings the study recommended among others the use of Team Teaching to teach secondary school physics in Niger Republic, the organization of seminars, conferences, and workshops to train practicing teachers on the use of the Team Teaching in the teaching of physics.

CHAPTER ONE

THE PROBLEM

1.1 Background to the Study

There has been a great shift in emphasis on science teaching and learning all over the world especially in USA, England, Kenya, Nigeria, and Senegal. The concern in recent times is to have science classroom that is student-centred, activity-oriented, and focused on understanding rather than rote learning and simple recall of knowledge (Owolabi, 2000).

Many studies such as, Owolabi (2000) and Bichi (2002) have shown that the little application of the invention of science and technology to education is a step towards solving educational problems. In fact science and technology are considered by many scientists, scholars and educators as sine qua none for national development and its ramifications, both in the short and long term. Fafunwa in Shaibu (2005) said: "We are living in a world where science and technology have become an integral part of the world's culture, and any country that overlooks this significant truism does so at its own peril". It is also observed that nations that develop their science education also do well in the other parameters of education and vice versa. Therefore science and technology are inevitable requirements for national development, most especially for developing nations like Republic of Niger.

However, research findings (SMASS and National Reports, 2009) still indicate students' failure in physics in Maradi, Niger Republic. For many decades now, the different instructional strategies employed in teaching physics have not improved students' performance in the subject to an appreciable level. Table 1.1 clearly confirm this.

Table 1.1: Annual Percentage of Students' Success in SSIII Physics Examination in Maradi (1999-2009).

Years	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Percentage of success	20.17	17.61	17.02	19.45	23.07	26.82	20.26	17.94	18.67	21.45	22.15

* Statistics Yearbook of Ministry of Education, Maradi (1999-2010)

Many National Reports pointed out that the inadequate exposure of secondary school students to science and physics in particular, is responsible for the qualitative defects in the educational system (Report 2007 and preceding). Also various educators within the country have blamed the methods usually used to teach physics students. Siddikou (2007) observed that teachers mainly adopt instructional strategies that do not encourage deeper students' involvement and collaboration. Very often descriptive method is used instead of hands-on approach. The Ministry of Education called on schools to adopt a right approach to the teaching of physics as money should not be wasted on ineffective and theoretical knowledge (National Report, 2008). The Faculty of Education Board Niamey has claimed that student performance cannot only be realized by providing the necessary infrastructural facilities, but effort should be made on personal resources, that are well trained, who can develop teaching skills and strategies that would bring about proper understanding of scientific knowledge and attitudes that would keep student interested, motivated, and help in living a useful life.

The teaching of physic is confronted with numerous but related problems ranging from lack of qualified and experienced teachers, poor students' performance, large class sizes of students, and low ability of students to retain physics concepts (Report, 2004). Many students turn out to be very disinterested and inattentive in a physics class after being taught a topic

and discover they could not memorize or recall such a concept with ease. The reason for this difficulty may vary but this is generally related to the teaching method being used to explain such topics. Abdallah and Ali (2001) attributed the poor performance of students in physics on poor methods and approaches to teaching which have reduced the level of motivation and interest. Foumakoy (2007) stated that the issue of poor performance in physics examinations was due to the poor teaching methods. Many research efforts have been made to diagnose the problems associated with the teaching and learning of physics in order to give solution that could lead to better Performance and retention.

On the issue of ability level, teachers did not consider various level of students' ability, during the course. Teachers consider students to be at the same ability level which is another factor for student low performance in science. According to Tuckman (1972) ability subjects are categorized based on their scores thus for a test over 100. Subjects who scored below 39 were considered low ability subjects, those who scored between 40 -59 were called medium ability when students who scored 60 and above were graded as high ability students. Similarly Achila and Collia in Anaso (2008) categorized achievers thus: Students who scored 60°/° and above were categorized as high ability students, those who scored between 40°/° to 59°/° were graded as medium ability students. Lastly those students who scored below 40°/° were categorized as low ability students.

Any of the problems stated above which the teaching of physics is facing can lead to failure and is sufficient to call for a review of physics teaching. This need has been there since 2004 when the National Report (2009) pointed out that, the inadequate exposure of secondary school students to physics is responsible for the qualitative defect in Nigerien educational system. The traditional methods of teaching physics, has not been very successful. It has also

been noted that lecture method commonly used for teaching/learning process in Nigerien schools is not so effective because the students are not given the opportunity to interact with the environment and develop their intellectual capabilities. Modi (2009) and Almou (1994) discovered that lecture method had negative effects on students. Such effects include total lack of motivation and interest, negative attitude towards the subject, poor performance on the part of the students and inability to retain physics concepts for a long time. Even if the lecture method allows a great deal of information to be passed to the learner and favors handling of large classes, it does not stimulate students' innovations, inquiry and scientific attitudes. It encourages students to cram facts which are easily forgotten (Abdoullahi, 2000). It involves the talk and chalk with very little concern for practical activities.

The teaching of physics requires well trained and experienced teachers who would lay solid foundation for physics. But on one hand there were not up to 30% professionally qualified physics teachers teaching in the schools. Table 1.2 clearly confirms this.

Table 1.2: A Comparison of Physics Teachers Training (2003-2010)

Years	2003	2004	2005	2006	2007	2008	2009	2010
Total number of teachers	129	198	234	296	327	362	394	423
Number of trained teachers	25	36	47	65	85	109	126	131
Number of untrained teachers	104	162	187	231	242	253	268	292
Percentage of trained teachers	19.37	18.18	20.08	21.95	25.99	30.11	31.97	30.96
Percentage of untrained teachers	80.62	81.81	79.91	78.04	74.00	69.88	68.01	69.03

* Statistics Yearbook of Ministry of Education, Maradi (1999-2010)

On the other hand an assumption has been made that any science graduate can teach science because he has learned it before graduation. On the contrary there is a scientific way of thinking, a scientific attitude and a scientific way of behavior and action. To teach science it is all these attributes of science that ought to be appropriately packaged and presented to learners using appropriate and most recent and effective pedagogical strategies.

There is therefore, a need to search for alternative strategies more suitable and efficient for promoting the level of performance and retention in teaching secondary schools. This makes it imperative to suggest an approach for teaching physics that aims at understanding rather than memorizing and juggling of facts, encouraging very open-ended activity in a minimum of teacher direction. In this situation a teacher is expected to be a facilitator whose main function is to help learners to become active participants in their learning and thereby making meaningful connection between prior knowledge, new knowledge and the process involved in learning. If the children are given opportunity to be listened to, practised and guided in a non-threatening atmosphere, they would perform well in terms of problem-solving and decision making. An effective way of dealing with this problem could be for teachers to collaborate, to arrange conditions or select strategies which will produce the desired degree of interaction between students, subject matter and the teacher. Team teaching can be one of these strategies.

The Team Teaching Strategy is a form of collaboration between two or more teachers in order to improve classroom teaching or management to enhance learning. Team teaching approach in this study is summarised as follows: two or more teachers attend classes together. While one person teaches and initiates group works, the other assists to ensure that students carry out tasks assigned to them. In this situation each member of the group participates fully.

The other teacher, who for this purpose may be referred to as a teaching assistant, also observes the responses of the students to the session being taught. It is important to note that all physics teachers make conscious effort to be conversant with each unit of the teaching materials. While one person teaches, the other is able to observe students responses in class to know what aspects of the unit the students find interesting or difficult and how long it takes explain the different aspects of the lesson. Moreover, sitting in class affords the opportunity of observing how the teaching process is going on and the opportunity of looking at the teaching materials as a student not as a teacher.

The team teaching strategy is particularly useful to the situation in Niger Republic where a mass failure of students in physics has been observed for several successive years (see Table 1.1, Dexo report, 2003). Failure is related to the lack of qualified and experienced teachers which the teaching of physics is faced with. In fact, a recent research conducted between 2003 and 2006 (see Table 1.2) has shown that the number of untrained teachers who have not any pedagogical qualification to teach in secondary school represent 64% of the total number of physics teachers in secondary schools (Ministry of Education Statistics Report 2007).

In such context, it is imperative to ensure that teachers have continuous training in order to improve the quality of their teaching, the motivation and interest of students to physics through the help or collaboration of qualified and experienced teachers, hence the investigation on the Team Teaching in this study.

1.1.1 Theoretical Framework

According to Witherspoon (1962) the heart of the concept of team teaching lies more on the essential spirit of co-operation planning, constant collaboration, close unity, unrestrained communication, and sincere sharing. Team teaching involves students and teachers with a wide diversity of training and backgrounds, acting to create a program of study better than the traditional ones (Mellisa, 2007). Team Teaching allows more extensive cooperation between groups of teachers, which provide opportunity to expand the talents of one teacher to help others. If teachers want to experience the full benefits of team teaching, they must adjust their course planning and classroom management strategies to accommodate a collaborative activity able to create a dynamic interactive learning environment (Kenwright, 1996)

Team Teaching works on the principle that the knowledge and ideas of several people are likely to find solutions or answers to specified problems or topics. This is in line with the proverb "Two good heads are better than one". Information does not become knowledge automatically until learners have been actively involved in its processing (Akinleye, 2010). The individual member can hear his colleagues perform and receive from them feedback on his own work. The younger, less experienced teacher can gain a lot from this process and feel less isolated in coping with this work (Grandall, 1988). Wherever there are beginners and experts, old and young, there is some kind of learning going on, and some sort of teaching. We are all teachers and at the same time we are all learners (Gilbert, 1950). Working as part of a team gives the participating team member a supportive environment, allows development of new teaching approaches, aids in overcoming academic isolation, increases the likelihood of good solutions regarding the discipline.

Team members are exposed to different styles of planning, organization, and class presentation. This can give the team members an opportunity to develop or improve their own teaching approaches and discuss issues such as student motivation and teaching policies, and end up with improved solutions (Robinson and Schaible, 1995). When team teaching involves interdisciplinary subjects, each member can gain clarification about less known fields, and therefore grow intellectually. The stimulation and challenge of team teaching prevent and remedy monotony and mental fatigue when one teacher's views are followed by another's.

1.2 Statement of the Problem

Effective teaching and learning of physics in Nigerien Secondary schools has become an important issue that needs urgent attention. It has been observed that the teaching is affecting the performance of students in both internal and external examinations negatively (National Statistics of Education Report, 2009). Many research studies and National Reports (eg SMASS 2010 and DRESS, 2010) have been revealing and publicizing physics students' failure which is attributed to the poor quality of teaching. It has also been reported by the Regional Inspectorate of Education (2010) that poor academic performance of students is related to the method (lecture generally) used to teach them. Students express severe difficulty in understanding and retaining physics concepts being taught to them by their teachers. The pedagogical approach of imparting knowledge to learners is inadequate to students' learning abilities and ability to retain. Ali (1998) feels that the major difficulty in learning physics is the method by which the subject is being taught without regard to instructional materials, student ability level to understand and to retain.

Physics is a practical subject in nature; its progress depends on practical activities and experiments. Without instructional materials or experiments, it will not be easy for students to understand the concepts being taught. Too often the instructional approaches do not enhance practical learning of the subject. Physics is not taught in a way it should be taught (Siddikou, 2008). Some of the applicable empirical findings of developmental and educational psychology are not taken into account during lessons because many teachers ignore their effect on the learning process.

For many decades now, the different instructional strategies employed in teaching physics have not improved students' performance in the subject to an appreciable level. It is therefore, imperative to look for alternative teaching strategy, to find out whether it can enhance students' performance or not. Specifically, this study is to find out the effectiveness of team teaching strategy on students' performance in physics and how this strategy can be used to enhance students' ability in retaining physics concepts. The study would also fill the gap on gender related issues that would be investigated.

1.3 Objectives of the Study

The study is designed to achieve the following objectives:

- To compare the relative effectiveness of Team Teaching and the Conventional Teaching Strategy on the performances of students of different ability levels.
- To compare the relative effectiveness of Team Teaching and the Conventional Teaching Strategy on students' ability to retain physics concepts being taught to senior secondary students of different ability levels.

- To investigate the effectiveness of Team Teaching Strategy on the academic performances of physics students of different ability levels (high, medium, low).
- To investigate the effectiveness of Team Teaching Strategy on students' ability to retain physics concepts being taught to senior secondary students of different ability levels (high, medium, low).
- To compare the performance of male and female physics students taught using team teaching.
- To compare the retention of learned concepts in physics of male and female students taught using Team Teaching.

1.4 Research Questions

The study attempts to answer the following questions:

1. What is the effect of Team Teaching and Conventional Teaching Strategies on the performance of students of high, medium and low ability levels taught physics concepts?
2. What is the effect of Team Teaching and Conventional Teaching Strategies on the retention of learned physics concepts among students with high, medium and low ability level?
3. What is the effect of gender on the performance of students taught physics concepts using Team Teaching Strategy?
4. What is the effect of gender on the retention ability of physics students taught using Team Teaching Strategy?

1.5 Null Hypotheses

In order to guide the study, the following null hypotheses are formulated for testing, at 0.05 level of significance.

H_{O1}: There is no significant difference between the mean performance scores of students with low, medium and high ability levels taught physics using Team Teaching Strategy.

H_{O2}: There is no significant difference in the retention of learned concepts of students with low, medium and high ability levels taught physics using Team Teaching Strategy

H_{O3}: There is no significant difference between the mean performance scores of male and female students taught physics concepts using Team Teaching Strategy.

H_{O4}: There is no significant difference between the retention ability of male and female students taught physics concepts using Team Teaching Strategy.

1.6 Significance of the Study

This study is expected to throw more light in the following issues. The country faces growing challenges of hiring highly trained teachers. The number of graduates from teacher training programs has been steadily declining over the last couple of years. As a result, schools in many parts of the country have no choice but to hire untrained teachers. This study will be one the attempts to provide useful solution to face this challenges. This research will be one of the few reported attempts to provide useful method of teaching of physics based on understanding rather than rote learning. Teachers training institutions could find the results of this study a useful resource for training teachers as well as handling students of different

abilities. Teachers will find valuable information on handling class with students of different ability levels. The interactions that teachers and students have in Team Teaching session will help them learn to work in groups and increase their capacity of working cooperatively together, respecting the view and dignity of one another. In Team Teaching process, teachers are engaged in professional tasks such as curriculum evaluation, curriculum revision, production of text books and the like. Curriculum planners will, hopefully, find the results of this study quite valuable for curriculum formulation and development based on students' actual needs. Policy makers and school administrators would find the findings of this study relevant to the use of collaborative teaching, thereby creating an avenue for better performance and retention.

1.7 Scope and Delimitation of the Study

The study was delimited to senior secondary schools in Maradi metropolis of Niger Republic. There are 27 schools 9 of which are government owned 18 are privately owned. Although ownership differs the schools are relatively homogenous with regard to staffing curriculum in use, academic calendar and examination procedures. SS2 students are used in the study because they are relatively stable, with adequate exposure to the learning of physics. SS1 and SS3 are avoided because the former have not yet stabilized in the school system while the latter are busy preparing for their final examinations. SS2 Physics curriculum was used which focused on:

1. Enhancing science education and technology.
2. Developing in students the abilities of observation and reasoning; experimentation and research; analysis and synthesis; and judgment.

3. Combining theory with practice.
4. Creating and stimulating the spirit of creativity, initiative and enterprise to bring to the student new knowledge, in the scientific areas.
5. To strengthen the interest and the provisions of student activities

Specifically in physics, the curriculum used focused on some basic concepts such as: Archimedes principle**:** identifying Archimedes pressure as resultant of many forces exerted by the liquid with Application to an aerostat. Atmospheric pressure: its measurement, its variation and the factors influencing the pressure with application on water distribution in towns. Hydrostatic: Fundamental relation of hydrostatic with application to flying objects. Electricity and magnetisms**:** -electric current- voltage- resistance - Conductivity- Electromotive force- resistance to current flow - Electrical Power - Resistance and resistors circuits - Ohms' law. - Electric and magnetic fields.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature relevant to the topic being investigated. The review is organized under the following sub-headings:

- Nature And Scope of Team Teaching
- Conventional Teaching Strategy
- Science Teaching Methods
- Physics Curriculum in Niger Republic
- Ability Levels and Academic Performance in Science
- Retention of Learned Concepts in Science / Physics
- Gender and Academic Performance in Physics
- Overview of Similar Studies
- Implications of Literature Reviewed on Present Study

2.2 Nature and Scope of Team Teaching

Team teaching has been defined in many different ways. Much has been written about it in terms of classroom organization, teacher deployment and curriculum innovation. Leslie (1969) defines team teaching as a method of organizing teachers, children, space and curriculum which requires several teachers as a group to plan conduct and evaluate the educational program for all children assigned to them.

Basically team teaching is a teaching strategy in which a group of two or more teachers cooperate in the teaching of the same set of students. Implicit within this cooperation are both the sharing of plans and objectives for the students and pooling of knowledge of all sorts about the students (Buckley 2000). Davis (1995) considers team teaching as a form of organization in which teachers decide to pool resources, interest and expertise in order to devise and implement a scheme of work suitable to the needs of their pupils and the facilities of their school. Bess (2000) defines team teaching as a process in which all team members are equally involved and responsible for student instruction, assessment and the setting and meeting of learning objectives.

Other authors suggest that team teaching is a model that involves two or more instructors collaborating in the planning and delivery of a course (Zhang and Keim, 1993). Davis (1995) contributes further that team teaching involves a variety of models and practices distinguishable from one another principally on the basis of the level of collaboration within the teaching team. Mc Daniel and Guy (1997) expatiated on this notion by suggesting that, models of team teaching can be described along four dimensions, namely, the degree of interaction between team teaching members and students during the teaching process, the degree of student engagement in the learning process, the degree of interdependence in the teaching and learning process, and lastly, the degree of integration in the content and the perspective of the discipline based knowledge.

Team teaching models can be described as weak or strong depending on the degree of collaboration and integration between team members and level of their engagement in the teaching and learning process (George and Davis-Wiley, 2000). In the weak forms; there is little evidence of collaboration and or involvement between team members in the planning,

management and delivery of a course. While in the other strong end of the team teaching, the team members are both intimately and equally involved in all aspects of the planning management and delivery of a subject. At this end of the variety, collaboration between team members is at its greatest (George and Davis-Wiley, 2000). The success of a team teaching is not only dependent on the degree of involvement and collaboration between team members; rather it is dependent on who is in the team as well as the teaching skills of the individual teachers in it. This study will judge the success on the basis of teachers' collaboration as well as their ability to teach, not on whether they are experts in a specific area of subject.

There are several approaches to organising team teaching. It can be explained as a group of two or more teachers working together to plan conduct and evaluate the learning activities for the same group of learners. Quinn and Kanter (1984) define team teaching as "simply team work between two qualified instructors who, together, make presentations to an audience." According to Goetz (2000) there appear to be two broad categories of team teaching: Given the two or more instructor model, two versions of team teaching in the strict sense can be identified:

Category A: Two or more instructors are teaching the same students at the same time within the same classroom; all instructors are jointly responsible for course content, presentations, and grading. They interact in front of the class, discussing specific topics from divergent perspectives. Category B: The instructors work together but do not necessarily teach the same groups of students nor necessarily teach at the same time. All instructors are jointly responsible for course content and grading. However, they take turns presenting material appropriate to their individual areas of specialization. At times when they are not called upon to lecture, other participants remain in an essentially subordinate role, contributing no more

than occasional comments and questions. In category A: team teaching usually involves a combination of the following models according to the personalities, philosophies or strengths of the team teachers as well as the personalities and strengths of the learners.

Traditional Team Teaching: In this case, the teachers actively share the instruction of content and skills to all students. For example, one teacher may present the new material to the students while the other teacher constructs a concept map on the overhead projector as the students listen to the presenting teacher.

Collaborative Teaching: This academic experience describes a traditional team teaching situation in which the team teachers work together in designing the course and teach the material not by the usual monologue, but rather by exchanging and discussing ideas and theories in front of the learners. Not only do the team teachers work together, but the course itself uses group learning techniques for the learners, such as small-group work, student-led discussion and joint test-taking.

Complimentary / Supportive Team Teaching: This situation occurs when one teacher is responsible for teaching the content to the students, while the other teacher takes charge of providing follow-up activities on related topics or on study skills. Parallel Instruction: In this setting, the class is divided into two groups and each teacher is responsible for teaching the same material to her/his smaller group. This model is usually used in conjunction with other forms of team teaching, and is ideally suited to the situation where students are involved in projects or problem-solving activities, as the instructor can roam and give students individualized support.

Differentiated Split Class: This type of teaching involves dividing the class into smaller groups according to learning needs. Each educator provides the respective group with the instruction required to meet their learning needs. For example, a class may be divided into those learners who grasp adding fractions and those who need more practice with the addition of fractions. One teacher would challenge the learners who grasped the concept more quickly, while the second teacher would likely review or re-teach those students who require further instruction. Monitoring Team Teaching: This situation occurs when one teacher assumes the responsibility for teaching the entire class while the other teacher circulates in the room helping student understand.

In category B: the instructors work together but do not necessarily teach the same groups of students, or if they do, they do not teach these students at the same time. This category can take many forms. Team members meet to share ideas and resources but work independently. A recent article in Mathematics Teacher Rumsey (1999) describes cooperative teaching in which instructors share teaching ideas and resources but otherwise teach independently. This version of cooperative teaching entails weekly meetings and a teaching-resource notebook. The goals of the weekly meetings are to discuss the concepts to be covered during the following week of classes, to present ways of teaching and assessing these concepts, and to share new ideas among teachers. The resource notebook is a comprehensive collection of teachers' best ideas that are ready to implement and use.

Teams of teachers sharing a common resource centre**.** In this form, teachers instruct classes independently, but share resource materials such as lesson plans, supplementary textbooks and exercise problems. Teams of teachers share a common group of students, share the planning for instruction but teach different sub-groups within the whole group. This appears similar to the way in which the Master of Teaching program is operated. The various professors share a common group, or cadre, but teach separate sub-groups of this cadre.

One individual plans the instructional activities for the entire team. This model does not take full advantage of the team concept as only one individual's ideas are incorporated. Sometimes, due to time or financial constraints, there may be no alternative to one person designing the entire program. The team members share planning, but each instructor teaches his own specialized skill area to the whole group of students. An example would be seven instructors teaching the seven different topics in Mathematics 30 to seven different classes and rotating throughout the duration of the course. No single model of teaching will automatically result in success for a given teaching situation. Each team's experience will be unique regardless of the variables because of the talents, abilities and goals of the teachers and students involved.

Team Teaching Strategy allows more extensive cooperation between groups of teachers, which provide opportunity to expand the talents of one teacher to help others. Team Teaching encourages innovations and experiments. It can encourage the integration of scientific concepts, thinking and working styles or techniques. Through team teaching students can demonstrate what they do know and can do, in contrast with what they don't know. This influence is positively on students' self-esteem, motivation and interest.

Team teaching should not be left up to chance. Careful planning is essential, even more so than in a classroom left to one individual. A good planning keeps the syllabus current, clarifies the goals of each lesson, ensures better use of class time, and improves the quality of teaching. Moreover the planning enable, teachers animated by new approaches, to share ideas and polish materials before the class presentation. They can also plan time to discuss educational psychology, teaching techniques, and stimulating activities, which can make them to teach more effectively. In team teaching environment, you have everyone pulling in different directions, and you need to keep coherence in the course" Anderson and Landy (2000).

Teaching the same class at the same time imply that teachers should meet daily or weekly to make important decisions about: (1) what will be presented (e.g., the units, lesson objectives) and in what order, (2) how the material is to be presented (e.g., to a large or small group presentation), (3) who is to present the information, (4) how the students will be assessed, and (5) how small groups will be organized and which team teacher will be assigned to each small group. Three time meetings are necessary:

- The pre-observation meetings when the teachers can agree upon issues such as the observer presentation or intervention during the proper lesson or discuss exactly the kind of lessons, methods, techniques, styles, strategies, classes etc they would like to teach or present.
- Then the observation and presentation of lessons, when teachers present, observe and collect relevant data for the teacher's attention.
- And the post-observation meeting at which the teachers will look back at the lesson and the data gathered.

The team teaching approach is perceived as less impersonal and more supportive, breaking down barriers of alienation. Team teaching can open a student's eyes to accepting more than one opinion and to acting more cooperatively with others (Wentworth and Davis, 2002).Team teaching can promote a teacher's professional development (McKee and Day, 1922); overcome isolation that is inherent in more traditional forms of teaching (Goetz, 2000), It can aid in improving morale within a school and deepens friendship between school members. It encourages innovations, experiments, integration of scientific concepts, thinking and working styles or techniques (Bucley, 2000).

Team Teaching offers increased student-teacher interaction which enables students to benefit through the opportunity to receive instruction from experts in specific areas and in the amount of feedback (Wadkins and Miller, 2006). It is beneficial for students to see models of different teaching styles (Anderson and Landy, 2000). The cooperation that the students observe between team teachers serves as a model of positive teamwork (Robinson and Schaible, 1995). Students have good models of collaborative learning when they see teachers working together in and out of the classroom. Students can discover interdependence and correlations between subject areas (Miller, 2006). Students learn new material by approaching it from many different perspectives (Melissa, 2007). Students are exposed to a variety of teaching style and approaches, which increases the potential for the team to meet the various learning styles of students (Brandenburg, 1997).

Teachers also benefit through the opportunity "to teach in a different way and to learn in a different way" (Anderson and Landy, 2000). Teachers generally agree that being prompted to look at a topic from different angles can be more of the most experience of participating in a teaching (Grandall, 1998), Corcos, Durshlag and Morris, 1997). This

environment encourages instructors to horn their pedagogical skills (Kenwright; 1997), (Wentworth and Davis, 2002). Co-teaching within the same classroom, can offer an ongoing means of developing both knowledge and skills (Gee, 1984). Even when the collaboration is limited to two teachers, the opportunities for introspection, reflection, and impact on ones practice can be profound (Grandall, 1998). The teachers' discussion leads to a number of very productive collaborative strategies benefiting both the students and the teacher. This includes analysis of texts, development of integrated or complementary lesson materials and curriculum.

There are potential problems arising through the lack of collaboration and cohesiveness within a team. The primary disadvantage to team teaching appears to be the element of time required prior to the implementation of the team teaching partnership, the many meetings needed during the running of the program as well as the numerous spontaneous problems that are bound to arise from such an endeavour. The time required to function effectively as a team may increase the probability of personality conflicts arising between team members. An irreparable rift between the colleagues may result. It would be disastrous if the teachers weren't compatible.

Some students may experience feeling of frustration and confusion when exposed to a variety of teaching styles and viewpoints within the same subject (Goetz, 2000). Some students feel that there are too many variations in teaching style and this is detrimental to the learning environment. The lack of continuity in teaching styles and not knowing what to expect at each course discourages students (Yanamandram and Noble, 2005).

The lack of cohesion in instruction is also a significant issue for students, as stated by Angelo (1993) "to be remembered, new information must be meaningfully connected to prior knowledge". In the weak forms of team teaching, there's little opportunity to facilitate all those connections. Consequently, the linkage of the individual courses into a cohesive body of knowledge can be poor and this can affect students' ability to connect one topic to another, and the necessary integration will not take place. The lack of cooperation and involvement by all team members in the planning and administration aspects of the subject detracts the learning experience.

The advantages outweigh the disadvantages. And despite the considerable resources and efforts required to do team teaching effectively, it has many worthwhile benefits for students of all kinds and school. According to Davis (2002) the heart of the concept of team teaching does not lie in details of structure and organisation but more on the essential spirit of co-operation planning, constant collaboration, close unity, unrestrained communication, and sincere sharing. If teachers want to experience the full benefits of team teaching, they must adjust their course planning and classroom management strategies to accommodate a collaborative activity able to create a dynamic interactive environment.

2.3 Conventional Teaching Strategy

Teachers are so familiar with the traditional organization of teaching by single teacher that this is taken for granted and it is assumed that it is the only viable way of operating. But the practice of one man one class inevitably leads to departments (Bess, 2000). Teachers Work in isolation in their classroom, in the departments, in their preparation. Very few people

in an average school have complete picture of the work going on within any one year. But as soon as teachers think and act cooperatively, changes become possible.

The conventional method of science teaching has been described as "transmission approach" in which the teacher sees knowledge as existing in form of content and criteria performance and himself as an only authority in a subject. The teacher's task is to evaluate and correct learner's performance according to criteria which the teacher is the guardian watts (1989). McDaniel and Guy (1997) are of the opinion that teachers who depend solely on the Conventional Teaching Method are inexperienced. The careful and extensive planning can help instructors prevent disagreements along the line regarding teaching strategies, approaches, teaching styles, assignment, grading procedures, etc (Biggs,1999).

No teacher is excellent in all phases of teaching. Some teachers could be excellent in selecting learning experiences, others in lecturing, others in leading class discussions, still others in designing tests. By working together, all can help each other by doing or coping with what one does best and learning from mistakes, to improve the quality of the educational experience. Teachers discover and develop new talents within themselves by trying out different methods, class sizes, and groupings. Working together improves the quality of teaching as various experts approach the same topic from different angles and areas of expertise. Teachers' strengths are combined, and weaknesses are remedied. Teachers complement each other's expertise. Teachers can help students to learn more effectively by providing a carefully structured approach to the gradual development of learning skills, and the various materials are well integrated with each other (Abdullahi, 1997).

The individual teacher is out of danger giving the same lecture to different classes, where one teacher's views are followed by another's. The instructor who is not presenting still has an opportunity to help students, identify, and analyze the variables needed for every student to succeed" (Brandenburg, 1997). Team teachers can discuss issues relating to students, such as behavioural expectations, student motivation and teaching policies, and end up with improved solutions. Teachers working in team can orient students more quickly and effectively. The teacher who is not presenting; observes students' responses and activities to identify who are not working/doing well; then guide them to observe or do what is relevant by indicating what to do, how to operate, what to avoid, explaining again or explaining in another form using various examples.

2.4 Science Teaching Methods

The chief goal of teaching is to improve the quality of education, by helping the teachers teach better and helping the students learn better. For learning to be more efficient there is need for teaching to take place. The concept of teaching is viewed by Smith in Bichi (2002) as cycle of observing, diagnosing and acting by the teachers, with teacher's subsequent actions being based on his interpretation or diagnosis of student's responses. Teaching is the dynamic process of bringing a learner into active and productive contact with the stimuli of transmitting knowledge (Jones, 1988). So to be effective, and to achieve its purpose, teaching should be a planned, methodological, activity based, and related to learners' experience in life (Sckunk, 2000).

Teaching is making the students want to learn and learn more than what you are teaching. In order to capture students' attention and activate their motivation to learn, teachers must consider the relevance of each topic. Then connect science concepts with students' interests, personal lives, societal issues, cultural backgrounds, and other school subjects. Ausubel's (1963) cognitive learning theory emphasizes the importance of learning something new by relating it to things that are already meaningful and familiar. Students' motivation is more activated by connecting science to things that are already familiar and important to them.

There are many types of teaching methods; the choice of a teaching method may depend on the nature of the subject and the experience of the teacher. Some of the teaching methods are discussed below.

- Lecture method

This method involves verbal presentation of ideas, concepts and facts. It is often the method of choice when introducing and explaining new concepts. The main objective of lecture method is to impact large amount of scientific information to students. Eight percent of the scientific information or principles that students receive from their teachers come through this method (Anaso, 2008). With lecture method, the instructor can present many ideas facts in a relatively short time.

Lecture method is the most frequently encountered science teaching in the schools. It is commonly referred to as the conventional method. Science teachers embrace this method as it leads to easy coverage of the school syllabus, time saving and more so, it does not require the use or organization of laboratory materials. Bichi (2002) attributed the indiscriminate use

of lecture method by science teachers to the academic level of teachers, little teaching experience of science teachers, non-availability of teaching equipment in schools and the pressure to cover prescribed examination syllabus in too short a time. But it does not stimulate students' innovations, inquiry and scientific attitudes. It encourages students to cram facts which are easily forgotten (Okwilagwe, 2000). Adeyemi (2003) stated that lecture method is inappropriate and ineffective for achieving the high objectives of sciences. Researches had shown that lecture method had negative effects on students outcomes (Iroegbu, 1988). Such effects include total lack of motivation, negative attitude towards the subject. That method most used by physics teachers does not easily allow the teacher to estimate the students' understanding and provides no accurate means of checking student progress. Within a single period, the instructor present more information than students can absorb.

Learning is an active process, and the lecture method tends to foster passiveness and teacher-dependence on the part of the students. As a teaching method, the lecture does not bring about maximum attainment of certain types of learning outcomes. The learners have little opportunity to express their ideas and to engage in the tentative explanatory talk, which some scholars now believed to be of crucial importance in learning physics. The only effective way students can perfect such skills is through hands-on practice.

- Discussion Method

In this method, knowledge is supposed to arise within the individual rather than from any external source. The teacher's questions motivate students to reason rather than recall and more so, students are free to express their view points. The teacher acts as a moderator for the discussion. Having students work in groups is another way a teacher can direct a lesson.

Discussion allows students to talk with each other and listen to all points of view in the discussion. It helps students think in a less personally biased way. Discussion method allows students to actively participate in the learning process. But Abdullahi (1982) noted that there are short-comings of this method of imparting knowledge to students which are given below: a lot of time is spent on such a topic, a lot of speculation is made during the discussion, the method does not allow easy coverage of the syllabus, students get bored and uninterested when they lack background knowledge on the topic under discussion.

- Demonstration method

This method is a process of presenting, establishing principles or simply display of something (Abdullahi, 1982). Demonstrations are done to provide an opportunity to learn new exploration and visual learning tasks from a different perspective. A teacher may use experimentation to demonstrate ideas in a science class. A demonstration may be used in the circumstance of proving conclusively a fact, as by reasoning or showing evidence. The use of examples allows better understanding and also greater individual ability to relate to the information presented. Therefore, it is important to provide supplementary examples in all forms of information presentation because this practice likely allows for greater interest in the subject matter and better information-retention rates. If the student can not only hear but see what is being taught, it is more likely they will believe and fully grasp what is being taught. Students are not usually given the opportunity to develop manipulative skills. Most students are unable to follow the demonstrations and might have difficulties of seeing laboratory equipment as theses demonstrations are often carried out by the science teacher.

- Student-centered teaching methods shift the focus of activity from the teacher to the learners. These methods include:

Active learning, in which students solve problems, answer questions, formulate questions of their own, discuss, explain, debate, or brainstorm during class. Cooperative or group learning is an instructional strategy which organizes students into small groups, so that they can work together to maximize their own and each other's learning. The most significant characteristic of group learning is that it continually requires active participation of the student in the learning process. Inductive teaching and learning, in which students are first presented with challenges questions or problems and learn the course material in the context of addressing the challenges. Inductive methods include inquiry-based learning, problem-based learning and discovery learning.

For effective teaching to take place, the skilful physics teacher needs to use many different methods and techniques at his disposal. A carefully designed teaching method can make teaching and learning effective (Chang and Mao, 2008). It has been noticed that the methods that result in positive effect on students' learning are those based on collaboration (between teachers and/or students). Also the most effective strategies for teachers to help each other in their teaching experiences, styles and techniques are for them to collaborate, to organized Team Teaching.

Many researches on methods and procedures indicate that teaching method is not a minor variable and the better the teaching method is, the more likely quality learning will occur (Marzo and Pollock, 2001, Walberg, and Welch 1986,). Gibbs (1996) assimilates the fact of improving teaching method as the getting better learning by students. For that reason teachers must constantly assess how well their methods are working to meet student needs. Teachers should also use their experience, knowledge, and skills to adapt the curriculum to instructional methods.

The success of teaching depends on strong well trained teachers able to use suitable teaching strategies or methods. The use of a particular method of teaching depends on the teacher, the situation, the nature of the topic or concept being taught. It depends on factors such as knowledge of the subject matter, instructional materials his experience, the student's ability and interest, the nature of the topics and his philosophy (Dale, 1969).

Teachers can help students to learn more effectively providing a carefully structured approach to the gradual development of learning skills, and the various materials are well integrated with each other (Abdullahi, 1997). This indicates that teachers should possess and be able to apply special knowledge and skills with respect to the selecting, using, and producing of many different kinds of instructional materials. Davis (1995) held that the teaching of science calls for the provision of qualified teachers and effective utilisation of the resources of the school.

The students' success is largely based on effective teaching methods. For effective teaching to take place, a good method must be adopted by a teacher. When a teacher is deciding on what teaching method to use, he needs to be flexible and ready to adjust his style according to his students. Students learn in different ways. That means they have different ways of absorbing information and of demonstrating their knowledge. Teachers should use techniques which provide multiple learning styles to help students retain information and understand. They should use variety of strategies to ensure that all students have equal opportunities to learn, because if a student only profit from one form of teaching, all students profit from the different types of learning.

The method used for effective teaching and learning was a matter of grave concern to teachers and educators in Maradi. It has also been noted that the Conventional Teaching strategy commonly used for teaching process in Nigerien schools is not so effective because the students are not given the opportunity to interact with the environment and maximally develop their intellectual capabilities.

The ideal teacher should have the ability to plan and execute lessons on the basis of appropriate methods, to use a material selectively, and to produce valid materials and tests. A competent teacher should have the ability to provide a simple more adequate method of communicating in the class depending upon the topic to be taught. But in Niger Republic, this criterion of competence is not taken in to consideration. Untrained teachers are working in a system in which a single teacher is entirely responsible for planning, management and delivery of the lesson. Teachers tend to be good or bad indifferent to the method they are using. The calls for closer cooperation between teachers to save Nigerien education formulated by specialized bodies like INDRAP found here all their significance.

2 .5 Physics Curriculum in Niger Republic

The national policy, the orientation law (LOSEN) of the education system in Niger in its articles 15 and 24 said that the educational system is designed:

- In terms of content: to provide training focused on the objective realities of the program and to enhance science education and technology…
- In terms of methods: to focus on the spirit of observation, analysis and synthesis; to combine theory with practice; create and to stimulate the spirit of creativity, initiative and enterprise to bring to the student new knowledge, in the scientific areas... develop in students the abilities of observation and reasoning, experimentation and research, analysis and synthesis, judgment; to strengthen the interest and the provisions of student activities …

An overview of SSII physics program is given in the following:

— Archimedes principle**:** Practical experiment on Archimedes principle, Characteristics of Archimedes principle-Identify Archimedes pressure as resultant of many forces exerted by the liquid, formula expression, Archimedes principle in air, aerostats.

— Atmospheric pressure: Existence and measure of atmospheric pressure, reading barometer, variation of atmospheric pressure, Pressure calculation unit SI, List two factors influencing the pressure in a liquid, Explain the principle of water distribution in towns and siphon- Draw a diagram a hydraulic press-Explain the functioning of a motor brake system -Measure of pressure with a manometer.

— Fluids statics, hydrostatic: Fundamental relation of hydrostatic-Archimedes principle: application to flying objects-Justify the existence of atmospheric pressure-Explain the variation that variation -Explain the functioning of an aerostat- Enounce the fundamental relation of hydrostatic.

— Electricity and magnetism basics: Introduction to many of the basic concepts involved with electricity and magnetism: structure of atoms, electrons moving around atoms, electrons and static charge, moving charges, voltage, resistance, and electrical current. Electric charges associated with electric and magnetic fields. Properties of magnets and how magnets are used to produce electric current and vice versa. Conductive metals, non-conductive insulators, and semi-conductor materials like silicon and germanium.

— Electrical charge: Electromotive force and it is measured by a unit called a volt (V). The unit of measurement of the current (I) the resistance, or opposition, to current flow.

— Electrical fields: - Around a charge is an electric field. -Electric field there is a magnetic field. Examples of electric motors, computers, radios, televisions, stereos, and many other electrical and electronic devices depend upon knowledge of these basic principles of electricity magnetism.

— Electrical Power $P = I \times V$

— Resistance and resistors circuits: The relationship between current (I), resistance (R), and voltage (V)-Resistors connected in series (end to end), or in parallel (across one another), or in a combination of series and parallel.

— Ohms' law: Relationship between resistance, current and voltage in an electrical circuit The formula is R (resistance in ohms) = (equals) V (voltage in volts) divided by I (current). That is: R = V ÷ I...and algebraic rules tells us that I - V ÷ R and V = I x R. I = V ÷ R, V = I x R, R = V ÷ I, and P (power in watts) = I x V. where V is the circuit voltage in volts, I is the circuits amperage in amps, and R is the resistance in ohms.

The Physics programs and official instructions constitute the reference and specify the learning objectives. It include objectives of knowledge, the objectives of theoretical how to do and the objectives of experimental knowledge. Practical activities should be the point of attention and the lesson should be prepared in the spirit of ASEI/PDSI lesson plan. A research conducted by the SMASSE-NIGER project in 2006 revealed that a large part of science teachers with those of Physics ignore the different techniques and methods of teaching. The majority of teachers have no introduction for their lessons. Where it exists, this introduction is not challenging and there is no interest or curiosity on the part of learners. To the question, do you like math, physics-chemistry, and the SVT (biology)? Asked students; 60% of them respond yes for math, 57.3% Yes for the SVT 42.2% Yes for the Physics-Chemistry. Physics appears therefore as the less loved among science subjects discipline. For all these factors, it is necessary to think again how to approach the teaching of physics.

2.6 Ability Levels and Academic Performance in Science

Ability grouping is defined as the practice of dividing students into separate classes or groups for high, average and low achievers Oakes (1992). Grouping is separate into within – class grouping and between class grouping patterns (Lynch, 1994). Within-class grouping were found to have substantial positive academic effects Kulik (1998).karen (1993) expressed fears on the grouping of high ability student together and felt this type of grouping might create differences in instructional quality and also create differences in students' motivation to learn. One of the most common arguments against ability grouping in any form is that high ability students are needed in all classrooms to stimulate, motivate and inspire other students. On the contrary Chunk (1997) reported that students of lower and medium ability level often perform or become better students when high ability students were not present. Feldhusen and moon (1992) agreed that grouping students with similar performance and talent is essential if the desire is to help students achieve at level commensurate with their abilities and increase their motivation to learn.

Although the school system groups students by age, not all of the children in one class are at the same academic level. Even so, teachers are expected to teach them all. In a typical classroom, there is a range of learning abilities. There are those students who struggle to keep up, those who are right on grade level and those who are so advanced, and they are uninterested. How could teachers manage their class or their teaching to meet the needs and learning abilities of every student in their classroom regardless of ability?

Setting groups in the classroom with activities for the students enables every student to learn at an appropriate rate. Grouping can be an effective use of instructional time while enabling a teacher to work with a small group of students. Teachers should use creativity in coming up with appropriate tasks for each student, keeping in mind each student's ability level. The level tasks at each group will help prevent higher level students from finishing tasks that are too simple, while allowing the lower level students to not become frustrated with more difficult tasks. Using Student Grouping or Pairing students together for work will enable students with a higher ability assist those with a lower ability. Assigning roles for individuals working in a group will give ownership to every student, and ensure participation.

Teaching students who are at multiple ability levels presents serious difficulties. Teachers are expected to not only teach students but to see each of these students succeed at grade level. The use of teaching strategies that work with various ability levels will help teachers in this effort. They should adopt a strategy which focuses on more than one learning style to meet students' needs or different levels of understanding.

According to Piaget (1970) students' learning capability at any age depends a lot on a complex synthesis of biological maturation, reasoning ability, and instruction. Ausubel (1963) feels they depend on their prior knowledge and experiences, which can helps them to learn something new. Different learners require different kinds of instructional support and guidance to understand the body of scientific knowledge and do scientific inquiry. The ownership of relevant psychological knowledge of learning with that of the teaching process provides the teacher a high capacity to teach well. Merely transmitting meaningful information does not constitute teaching. It should involves systematically planned sequences of communicative events often involving students responses intended to result in a specific

learning outcome (Gibbs and Simonite, 1996). Teachers can help students to learn more effectively providing a carefully structured approach to the gradual development of learning skills, and the various materials integrated with each other (Abdullahi, 1997).

The outcome resulting from a piece of teaching depends on the method adopted in presenting a learning situation. Teachers often have the challenge of accommodating students of different ability levels as well as dealing with the needs of students with varying backgrounds. While dealing with the differences among students can seem overpowering to some, the task can be made much simpler through the integration of several teaching techniques which aim at helping teachers accommodate learning differences among students. These techniques allow teachers to present information that is accessible to all students, regardless of their personal background and academic needs.

One of the easiest ways for teachers to accommodate multiple ability levels within their class is to differentiate instruction. When teachers differentiate their instruction, they provide individual students or groups of students with work adapted to their ability level. To differentiate effectively, teachers require higher level responses for more capable students and allow struggling students to produce more rudimentary work. The practice of differentiation is possible in all classes. A teacher must first assign an ability level to each of his students. This can be done by consulting students' previous test results or looking at their general work habits. The teacher would then create three separate activities: one high, one on grade level and one below grade level. The students would then receive the assignment that falls within their ability level.

Many researchers have identified, different ability levels of students as one of the majors factors affecting the performance of students in physics. Alant, (2004) discovered that students' of varying ability levels performed differently depending on the type of method of instruction. Adesoji (2002) opined that students are not the same, especially when it is found that the rate at which facts and principles in sciences are been assimilated at different levels. This implies that the rate of which an individual performs his specific task differs. The ability level of student is a construct of his academic performance (Aremu, 2001). Salami (2000) discovered that students' performance depends on their cognitive ability. Studies have shown that learners are qualitatively different in their ability levels and in learning problems (Adesoji, 1997; Chang & Mao, 1998; Iroegbu, 1998).

Iroegbu (1998) ascertained that the proper method of instruction can improve the performance of students with low ability level. Adesoji (1995, 1997) discovered that strategies were effective in teaching students of different ability levels. Okebukola (1992) confirmed that the use of appropriate instructional strategies can influence the performances of low achieving students. However, Divers, Asoko, and Mortimer (1994) discovered that learning can be made successful in science classrooms when more emphasis is given to prior knowledge rather than the students' cognitive level. Problem based learning has been found to be effective and enhances retention. Studies have also shown that problem based learning leads to an understanding of physics (Maloney, 1994; Julie, 2004). Teachers' expectations of how much and how well their students learn influence directly that learning. Students who are supposed to be high-ability learners receive more positive feedback from teachers. Those who are supposed to be low ability learners get less feedback, less time to respond, and less praise. Higher performance is expected through more work and effort by students of all abilities.

An interesting outcome from White's (1959) study was the finding that classroom and environment were important influences on student outcomes. It also supports the notion that well motivated students learn more content. Students retain more if they can see, hear or feel what is being taught, discuss, and apply it. The more a child sees the more he wants to see and hear. Tomlinson (1981) considers that school brings little influence on students' outcome that is independent of his background and general social context.

It was successful tested that student performance and attitude were influenced jointly by students ability, maturity, motivation, the quality and the quantity of instruction, the pedagogical environment at home, the school / classroom size and the peer group outside the classroom (Walberg, Fraser, and Welch, 1986). Prescoot and Anger (1972) listed four perspectives: the degree to which environment are learner- centred, knowledge- centred, assessment- centred, Community- centred, while Taylor (2004) tend to focus on issues of teaching and learning methodology and the curriculum.

Greater attention has been given to the role that teacher quality plays on student performance. Many studies have found positive correlations between teaching performance and teachers' general academic ability (Bruner, 1965). One considers verbal ability as a more sensitive measure of teachers' abilities to convey ideas in clear and convincing ways (Thomas, 2003). Gee (1984) asserts that well-prepared teachers enhanced learning through the use of technology; the closer the technology is to learning, the greater the impact it will have on learning.

Teamwork encourage active student engagement, learning the unfamiliar by association with the familiar, frequent repetition, movement from the simple to the complex, immediate reinforcement or correction, variable rates adapted to the learners' acceptance of personal responsibility, and the desire to achieve better performance. Students who learn in smaller groups retain and achieve more than those in a large class or single individual. Differences in teacher effectiveness were found to be the dominant factors affecting student academic gain. The effects of class size and classroom heterogeneity appear to be minor.

Student academic level was found to be significantly related to academic progress. High scoring students were found to make somewhat lower gains than average and lower scoring students. Possible explanations include lack of opportunity for high-scoring students to proceed at their own pace, lack of challenging materials, lack of accelerated course offerings, and concentration of instruction on the average or below-average student. Learners who have relevant skills in self regulation are more strategic in pursuing learning and achieve better in their academic endeavor (Kuiper, 2002: Rivers 2001).

2.7 Retention of Learned Concepts in Science

Retention is the ability to retain and consequently remember thing experienced or learned by an individual at a later time. It takes place when learning is coded into memory. Thus, appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane (Oyedokum in Bichi, 2002). The nature of the materials to be coded contributed to the level of retention in terms of their meaningfulness, familiarity, concrete and image evolving characteristics Adeniyi (1997).

Retention is defined by Kolb (1984) as a preservative factor of the mind. The mind acquires the materials of knowledge through sensation and perception. These acquired materials in the mind need to be preserved in form of images for knowledge to develop. Whenever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible.

In general, factors affecting retention and performance are likely to be complex, multi-faceted and require a joined-up approach in terms of institutional strategy (Martinez and Munday, 1998). In a review of the literature on student retention (Modi, 2009) concluded that the student experience is a significant factor in retention and that teachers can adopt strategies which will improve retention rates. Kenwright (1996) found that, even where there was considerable individual difficulty, students persisted if they appreciated the course enough; if students felt they were having a useful learning experience, they would battle through family problems, health or money difficulties and remain on the course.

In a research on retention (Kenwright,1996) suggests that the following are key factors in causing students to drop out: poor quality of student experience, inability to cope with the demands of the course, unhappiness with the social environment, wrong choice of the program, matters related to financial need, dissatisfaction with aspects of the course and student support structures.

Anything that aids learning improves retention while things that lead to confusion or interference among learned materials decrease the speed and efficiency of learning and accelerates forgotten. Likewise practice affects or influence retention of learned concepts among students. Motivating conditions at the time of learning can either facilitate or interfere

with its success, which means it can enhance or facilitate forgetfulness. In a similar way, emotion can interfere with retention that is difficult experiences are intentionally forgotten or repressed. Anxiety at the time an individual attempts to recall something he has learned blocks recall.

The knowledge of how students learn constitutes a very vital component of teaching. Understanding and retaining concepts are products of meaningful learning when teaching is effective and meaningful to the students (Bichi, 2002). Instruction should be done in a way which is adapted to students' ability to understand, to do, and to act. According to Piaget (1964) the instruction should be adapted to the learners' intellectual development level. Learning; thus extended to children, should be redefined to be consistent with the child's abilities and limitations. The discovery learning of Bruner (1966) insists on the opportunities for learners to explore and experiment, thus encouraging new understanding and development of skills. This is outlined in the Chinese proverb «I see I remember, I hear I forget, I do I understand" and another emphasizing on the motivation and interest. This implies that the teacher's role is to facilitate learning by providing a variety of experiences already familiar and important to the students.

For Ausubel (1963) knowledge should be approached structurally. That is, general ideas of subject should be presented first and then progressively differentiated in terms of details and specifics. This implies that:

- Learning of science should involve learners in the construction of knowledge and the development of new ideas from what they already know. Consequently Science

teachers should select organizers that must contain ideas which the students are familiar with.

- The students should have information readily available in their memory at the time he undertakes the learning of new knowledge or new intellectual skills.
- Instructional sequence should start with organized statements which should be broad, general and inclusive to bridge the gap between prior knowledge and new learning material.

Therefore learning is taking place when there is interaction between the student and the new material. This will likely occur in a laboratory where students are asked to manipulate materials themselves. If we want children to learn skills, they must practice the skills, they must have the tools required for learning them and the teacher must find and use these materials whenever available. The development and use of process skills would enable students to bring logic and available evidence to bear on their ideas, attitudes and actions so that they can pursue better, whatever objectives and aspirations they may have (Grandall, 1987). Abdullahi (1997) feels that the main purpose of using instructional materials in the classroom is to provide a simpler more easily adequate method of communicating in the class depending upon the topic to be taught.

Modern learning theories describe learning as an active, internal process of constructing new understandings. In some instances, a newly constructed idea fits easily into the structure of existing understanding. In other cases, the construction of new understanding catalyzes substantial revision of existing knowledge into a new, more coherent framework. In still other instances, new and old ideas conflict but are retained and used separately (Ausubel, 1963). The construction of deep scientific knowledge results from actively practicing science

in structured learning environments. Learning environments should support students' active construction of knowledge. Teachers should employ teaching strategies that help learners recognize conflicts and inconsistencies in their thinking, as these experiences catalyze the construction of new, more coherent knowledge.

Kolb (1984) was interested with extracting principles and underlying meanings, to make sense of facts and feelings and to integrate them with previously acquired knowledge, in contrast with rote learning. Kolb's model or learning by doing takes the form of a cycle. For deep learning to occur a series of activities need to be set. According to this model, the learning may start at any point in the cycle but all four stages are necessary for the completion of meaningful learning. Active teaching strategies will provide opportunities for relating learning to previous experiences.

Teachers can monitor learning by observing and gathering data on changes in students' actual potential performance. Motivation drives the process of starting and continuing learning. Relevance refers to activities that give students satisfaction and meet their needs, including the chance to achieve learning goals. In the psychology of learning, interest and learning are intimately related.

There is an old concept in science education which supports the idea that most students need hand on laboratory experiences to learn concepts. It is based on the cognitive levels of development originally put forward by Piaget and implied in the Chinese proverb "I hear and forget, I see and remember, I do and I understand"(Woerner, Rivers & Nochell, 1991). Study on how individual learner's retention of information shows that a person remembers 10% of what he reads, 20% of what he hears, 30% of what he saw and 50% of

what he saw and read. The percentage increases for those fortunate enough to read, see and do things in actual practical experiences. This implies that appropriate pedagogical strategies must be used so that students can read, hear, see, and do things in actual and practical experiences in order to perform well in physics.

Exposure to the views of more than one teacher permits students to gain a mature level of understanding knowledge; rather than considering only one view on each issue or new topic brought up in the classroom (International centre for student retention, 1995). It also provides educational benefits such as increasing the student's level of understanding and retention, in addition to enabling the student to obtain higher performance (Schunk, 1996a). The variety of teaching approaches can reach a greater variety of learning styles which can push students to achieve higher level of synthesis and integration in their study of new materials (Minnis and John, 2005). Physics concepts need to be presented to the learners in a way that touches their sub consciousness which can activate quick recalling of the concept being taught or learned.

2.8 Gender and Academic Performance in Physics

The concept of “gender” has attracted the attention of many psychologist, educators and researchers as the result of which a lot of literature exists on different aspects of the concept. For instance, numerous studies have carried out on gender and social role, gender and work role, gender and technology, gender and students academic performance Bichi (2002).

Schools are categorized into three namely the single schools made up of boys only or girls only and the mixed schools made up of boys and girls. The rational for this categorization according to Shaba (1995) and Benjamin (2006) cannot be unconnected with the issue of moral decadence, enrolment explosion and proximity to the learner's community. Gender issues have taken important dimensions in recent times as result of increasing awareness of the moral implications of the dangers inherent in the marginalization of women who form more than half of the world's population.

Research on gender and gender related issues are inconclusive. Onyewadun (1998) found gender related difference in academic performance. Alfa (2007) reported that most researchers found boys performing better than girls especially in order knowledge; a few others found girls out performing while others established no significant differences especially during early education. Also Benson (1997) reported that the largest differences between boys and girls performance lies on the affective domain that is attitude. Mari (1994) and Bichi (2008) support that boys perform well in any rigorous work while girls settle for less rigorous work. Girls perform better than boys in problem solving type activities.

Boys dominate classrooms and take the lion share of teacher attention; this had a very negative effect on girls' performance and success at school (Kajuru and Popoola, 2010). Teachers concentrate on boys and the way teachers treat girls in comparison with the boys lower their self esteem. Gender difference has a very formidable role to play in learning. Therefore teachers should employ appropriate strategies that engage students in meaningful learning without gender biases.

Studies on gender differences have continued to yield inconsistent results (Usman and Memeh. 2007). The results of some studies indicate that male students achieve significantly better than girls (Kador, 2001, Shaaba, 1995) whereas some other studies reveal no significant difference in the performance of the two genders (Loofa, 2001). Where these differences exist between boys and girls, it has usually been attributed to unequal exposure of males and females to relevant learning experiences. This is occasioned by the traditional cultural attitude towards the female gender which restricts them from activities considered masculine (Okeke, 1990). This difference in cultural attitude towards males and females in access to environmental stimulations has been reported to influence their self- efficacy in favour of the boys (Eze and Agboma, 2008).

Numerous research findings have shown that female students exhibit less deviant behaviour and are more organized learners. A research review by Jack and Peter (1998) observed that girls are more attentive in class and more willing to learn than the boys, making them achieve higher than the boys. The causes of underperformance of boys were attributed to the boys' disregard for authority, academic work and formal performance, and the identification with concepts of masculinity frequently seen to be in direct conflict with the ethos of the school.

2.9 Overview of Similar Studies

A number of studies have been carried out that are relevant to this study. Vendy and Marilyn (2004) in a study titled Team Teaching in Higher Education: A Review of the impact of Team Teaching on students and Staff Learning adopted a qualitative approach to the research which included student feedback via formal structured questionnaires and focus group. It was concluded that team teaching allowed more information and examples to be passed onto students and offered different perspectives to the topics and provoked discussion. There was common agreement from students that team teaching helped to maintain concentration levels and interest. Team teaching resulted in more creativity concerning approaches to delivery and deepened understanding of the individual delivery style and allowed closer connection with learning styles and student progress.

Prescott and Anger (1972) have been utilizing team teaching as a method of handling large university freshman classes. They found the strategy has several advantages, provided the two professors have a compatible outlook on physics.

In a study titled: The Impact of Co teaching on Regular Education Eighth Grade Student Achievement on a Basic Skills Algebra Assessment. The research question was designed to investigate, determine, and examine if co-teaching has an impact on regular education students' achievement on an algebra assessment in the eighth grade. A sample of 70 eighth grade students and 6 math co-teachers were used. A two-way analysis of variance (ANOVA) was conducted to assess if differences exist on algebra achievement scores by group (control vs. treatment) and time (pre-test vs. post test). The results of the post hoc analysis, consisting of two independent sample t tests and two dependent sample t tests,

revealed that significant mean differences did in fact exist on algebra achievement scores for only the experimental group suggesting that scores increased from pre to post test. The interview data indicated that the teachers' perception of student learning was greater in the co taught classroom

Chianson, Kurumeh, and Obida (2010) investigated the effect of Co-Teaching method compared with the conventional learning method in order to find out the retention level of students' in circle geometry. The ability of students to grasp and memorize a mathematical concept or topic that was taught has become a basic problem in secondary schools. These problems may arise due to inappropriate teaching methods being used to explain these topics. Hence, this study adopted the co-teaching strategy to teach 358 senior secondary two (SSII) students circle geometry, and see how well the learning method may effectively improve on students' ability to retain concepts in mathematics in comparison to the conventional learning method of teaching. An independent T-test analysis was used to determine whether a statistical significant difference existed between the co-teaching approach and the conventional approach in terms of students' retention of the taught concept. The findings of the study confirmed that students who were subjected to the co-teaching strategy were able to retain the concepts of circle geometry more than those students who were taught using the conventional learning approach. Hence the recommendations were that, students would be able to retain taught and learnt concepts in mathematics for a longer period of time if mathematics teachers applied the co-teaching strategy.

Team teaching gives students the chance to develop their powers of critical reasoning, as they learn to choose from among alternatives. The benefits of collaborative learning include higher performance, greater retention, improved skills and attitudes for both students and teachers. The exposure to the views of more than one teacher permits students to gain a mature level of understanding and greater retention (Wadkins, Miller and Wozmak, 2006). Team teaching pushes students to achieve higher level of synthesis and integration in their study of new materials (Minnis and John Steiner, 2005).

Studies have shown that team teaching approach is highly related to quality of learning and performance, and has been successfully utilized in a wide range of subject areas, including psychology (Heath, Carlson & Kurtze, 1987; Flanagan & Falston, 1983; Lindauer, 1990; Plotnicov, 1985; Rinn and Weir, 1984; Toomey & Eldridge, 1982). For example, some studies indicate that students have benefits as a result of having multiple instructors in a course (Rinn & Weir, 1984; Troen & Boles, 1988; Wenger & Hornyak, 1999). Team teaching methods bring various expertises to the class and allow students to optimize their learning processes that go beyond the direct instruction. In addition, team teaching approaches create an authentic environment which reflects real life situations through active interactions among learners and instructors (winter, 1993). Student achievements vary depending on timing of the unit and instructional approach. The timing of the unit and the instructional approach could have a significant effect upon student achievement scores

Bichi (2002) investigated the effects of two instructional strategies on the learning and retention of evolution concepts among senior secondary school biology students in Giwa education zone of Kaduna state. Pre-test and post test data were analysed using t-test statistical tool to determine the effectiveness of the two instructional strategies. Some of the

findings were: students exposed to problem-solving instructional strategy achieved significantly higher than their counterparts exposed to traditional method of teaching. Students exposed to problem-solving instructional strategy retained the learnt concepts significantly better than their counterparts exposed to traditional instructional strategy. There was no significant difference in students' achievements with reference to the following variables: Gender and problem-solving strategy, gender and traditional method, gender and historically enriched curriculum, gender and conventional biology curriculum.

Abdu-raheem (2011) investigated the effectiveness of discussion method of teaching on students' performance and retention in biology. The study adopted quasi-experimental, pre-test, post-test control group design. The sample for the study consisted of 240 Junior Secondary School Class II Students. The data were analyzed using student t-test and ANCOVA statistical tools. The result indicated that there was a significant difference between the pre-test and achievement mean scores of students in the experimental and control groups. There was a significant difference between the achievement mean scores of students in the experiment and control groups. There was a significant different between the retention mean scores of students in the experimental and control groups. There was a significant difference between the achievement mean scores and retention mean scores of students in the experimental and control groups. On the basis of the findings, it was concluded that discussion method was better than the conventional lecture method in improving students' performance and retention in biology.

Anaso (2008) investigated the effects of class-size on the academic achievement and Retention of different ability groups among chemistry students at the secondary school level. 150 students selected from 3 co-educational schools were used as sample. The data collected

were analyzed using One –way analysis of variance. Some of the findings were: students in small-size of 25 achieved significantly higher than their counterparts in medium and high class- sizes. Gender was not a significant factor on student's academic achievement in chemistry across the different class-sizes.

Gadzama (2011) investigated the effects of science process Skills Approach on Academic Performance and Attitude among integrated science student with varied ability. The sample comprised 504 students. Student's performance scores were analysed using Cronback Alpha technique. It was found that students exposed to science process skill approach performed better than the lecture method approach. No significant difference was found male and female students' performance.

Afolabi and Akinyemi (2009) investigated the effects of constructivist problem based learning technique on the academic performance of physics students with low ability level in Nigerian secondary school. 105 secondary school level II physics students were used for the study. Physic Performance Test (PPT) and Physic Ability Level Test (PALT). Data analyzed using t-Test statistical tools. The results of the findings showed that the physics students with low ability taught with problem based learning technique performed better than those taught with conventional learning method. In addition there was no significant gender difference in the performance of students taught with problem based learning technique.

Adeniyi (1995) carried out a study on performance in the concept of ' motion' in physics when computers are effectively used as a resource material, found that there is a significant difference in the performance score of students in physics in schools where computers were used than in schools where they are not used. In this study, selected senior

secondary school physics students were taught physics concepts using team teaching and Conventional Teaching strategy to find the effect of each instructional strategy on students' performance. Students' retention was also assessed by applying post-post test of physics to the subjects. The study investigated if performance in physics is stereotyped.

2.10 Implications of Literature Reviewed on the Present Study

In the foregoing paragraphs, a lot of literature has been reviewed leading to greater insights into the topic being investigated. This collection of theories and informed criticisms exposed by the literature search has some implications for the present study. Many studies have been reported about team teaching its organization, varieties, its forms considered as weak or strong depending on the level of collaboration between team members involved in it. Some of its benefits are well established and challenges are great but easy to overcome through good collaboration. Team teaching works on the principle that knowledge and ideas of several people are more likely to find solutions or answers to specified problems or topics. This is in line with the proverb "two good heads are better than one". If Team Teaching is properly managed, it will go a long way to improve students' outcomes.

Secondary Students' poor performance and difficulty to retain physics concepts being taught are a matter of grave concern in Maradi. The students' failure which is attributed to poor teaching methods used to teach them was observed in both internal and external examinations in Maradi, Republic of Niger. Even schools where team teaching has been conducted in its weak form, characterized by little collaboration between members have been found to be of great benefit. This produces the need to design a study on strong form of team teaching to investigate its efficacy on student's performance and retention ability within

secondary schools. In science teaching there is a serious controversy on gender issue. Therefore there is a need to investigate the issue of gender difference on performance in physics using team teaching strategy. Therefore this study investigated gender variable among the students under study.

For the last couple of decades, science teachers have been restless searching for effective instructional strategies that would foster the teaching and learning of science to the younger generation. The findings of most studies concluded that performance is enhanced by using effective instructional strategies, well-designed curriculum and knowing the students being taught in order to design the teaching strategies to enhance learning. Students' performance is strongly related to the teaching method and the ability of students to understand and retain facts. An appropriate teaching method influence positively the performance and make easy the retention of concepts and their connections.

Permanent and meaningful learning is the ultimate target of our educational endeavours. Understanding and retention are products of meaningful learning, which results only when teaching is effective (Bichi, 2002). Instructional strategies have been a major concern of science education. The traditional method of science instruction has been found to be relatively inferior to several other strategies in terms of effectiveness and students' performance. In this study, conventional method was compared with team teaching to see which of the two would yield greater performance and retention for Nigerien secondary school students. It is hoped that the findings of the study would throw more light on the usefulness and effectiveness of the instructional strategies under study for the teaching of physics in secondary schools.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the methodology used in conducting the study. The chapter is presented under the following sub-headings:

- Research Design
- Population of the Study
- Sample and Sampling Technique
- Instrumentation
- Pilot Testing
- Data Collection Procedure
- Data Analysis

3.2 Research Design

The research design for this study is the quasi experimental, pre-test, post-test control group. Both experimental and control group were pre tested to determine the equivalence of the groups before the commencement of the study (mean of scores of experimental group and mean of scores of control group are the same). After treatment post test was administered to test the two groups the first to test the performance then the second to test the retention ability. The design of the study is illustrated graphically thus:

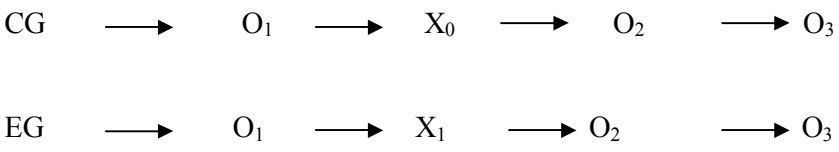


Figure 3.1: Research Design illustration

Key:

CG- Control Group (comprising subjects with high, medium and low level)

EG- Experimental Group (comprising subjects with high, medium and low level)

X_0_ Control (Teaching by Conventional Teaching Strategy)

X_1 –Treatment (Team Teaching Strategy)

O_1-Pre test

O_2-Post test

O_3-Retention test

3.3 Population of the Study

The population of the study consists of all government SSII physics students who registered for 2009/2010 session in secondary schools located in Maradi, Niger Republic. The schools are College of General Teaching I (Bagalam), College of General Teaching II, College of General Teaching III, College of General Teaching IV, College of General Teaching V, College of General Teaching VI, and College of General Teaching VII. The total student population of the secondary schools is 1287 consisting of 654 male and 637 female

students. The students' average age is seventeen years. The students are in Maradi town and originate from the five ethnic groups (Hausa, Fulani, Zarma, Kanuri and Touaregs). The secondary schools are co-educational and offer courses in science with physics in particular which is relevant to this study. They offer physics as one of their science courses. Details of the population are given in Table 3.1

Table 3.1: The Study Population

Name of schools	Females students	Males students	Total n° of SSII physics students
CEGII	141	133	274
CEGIII	136	156	292
CEGV	104	112	216
CEGVI	19	15	34
CEGI	136	142	278
CEGVII	91	85	176
Total	637	654	1287

*Source: School Records Ministry of Education, Maradi.

3.4 Sample and Sampling Technique

The sample for this study is science students offering physics in College of General Teaching II and College of General Teaching III. The secondary schools selected are public secondary schools and are accredited by National Commission for Secondary School Education (N.C.S.S.E.). Manpower, student population and quality of staff and infrastructure are very much similar among the secondary schools in this zone. The sample was selected using random sampling techniques employing "balloting" method in which one hundred and eight students were selected. The researcher selected two schools with ninety students from both CEGII and CEGIII (45 males and 45 females) in each school totalling one hundred and

eighty study subjects. This in line with Rosoce and Tuckman (1975) that a sample size minimum of 10% of the larger population is viable for experimental study of this nature. The summary of the sample is presented in Table 3.2.

Table 3.2: Sample for the Study

Samples	Name of School	Number of SSII Physics Students selected		Total	Designation
		Female	Male		
S_1	CEGII	45	45	90	Experimental
S_2	CEG III	45	45	90	Control

The 90 study subjects (45 males and 45 females) selected from CEGII and CEGIII were grouped into experimental and control study subjects as shown in Table 3.2. Ninety (90) subjects selected in one of the two schools were assigned to team teaching while the same number of subjects in the other school was assigned to teaching by one teacher.

3.4.1 Selection of Topics for the Study

The topics selected for the study were topics from the physics curriculum approved by the Ministry of Education. They are as follows: Mechanics, Electrostatics, Electricity, Archimedes's principle. Dennis (1986) reported that the above Physics concepts need higher academic ability to understand them. Therefore the use of appropriate teaching strategy is required. These topics were taught using Team Teaching strategy and teaching by Conventional Teaching strategy to see which of the method is more effective.

3.5 Instrumentation

The instrument used for data collection is the Physics Performance Test (PPT) constructed by the researcher. It was used as Pre-test, post-test and Retention test. Each time the students' scripts were marked and scores were collected. Base on the pre test students' scores subjects were divided in two equivalent groups which were called control and Experimental Groups. Also based on students scores, and in line with Tuckman (1975) within each group subjects were categorized thus: Students who scored 60°/° and above were categorized as high ability students, those who scored between 40°/° to 59°/° were graded as medium ability students. Lastly those students who scored below 40°/° were categorized as low ability students Achila & Collia in Anaso (2008)

3.5.1 Physics Performance Test (PPT)

Physics performance Test (PPT) has to do with the measuring of students' competence in physics that is to determine students 'performance in physics. The purpose of this Performance test is to find out how individuals can cope with the study in physics. A 20 objective items involving multiple choice true or false tests was used as pre test, post test, and Retention test. The instrument has 13 multiple choice and 7 true or false items. Details of the instrument and its marking scheme are provided in Appendix D at the end of the report .A maximum of 40marks can be scored on Physics Performance Test.

The topics selected for the instrument construction are from secondary school SS2 physics syllabus. Time allowed for each test was one hour. The instrument was subjected to validity and reliability measures explained below in the following paragraphs.

3.5.2 Validation of the Instrument

Physics Performance Test (PPT) and corresponding marking scheme were validated by specialists who assessed the components of the instrument. The specialists were requested to critically examine and assess all the items of the instrument paying attention to the following:

- Whether the test items tests what they meant to test.
- Whether the questions are clear, precise and free from ambiguity;
- Whether the questions match the ability of the students; and
- Whether the language of expression is simple and unambiguous.

The specialists made constructive criticisms and corrections that were incorporated to make the instrument valid.

3.5.3 Reliability of the Instrument

To determine the reliability of the instrument, the test retest method was employed in the pilot study. The first test was given to the students of different schools that were not part of this study. After 2 weeks interval, the second test was administered, in line with Tuckman (1975) recommendation of the use of two weeks interval for the test-retest procedure. Pearson Product –Moment Correlation Coefficient statistics was used to calculate the reliability of the instrument. Details of the calculations are given in Appendix D at the end of the report. On the basis of the data obtained from pilot testing the instrument was found to have a reliability coefficient of 0.79, which is reliable.

3.5.4 Items Characteristics of the Instrument

For the purpose of standardization of the instrument, the difficulty and discrimination indices of the physics Performance Test (PPT) were determined using Inyang' (1998) and James' (2000) formula and procedure. The difficulty index is used to identify high or low performing students. This difficulty index of test items is its ability to separate or sort out high and low ranking students in a test. Items showing little or no difficulty or items that show a percentage of success in favor of the poor group were either eliminated or re-examined for vagueness and ambiguity and such items were re-worded. The formula of difficulty index is:

$$D = \frac{RU=RL}{1/2N}$$

D _difficulty index

RU _number among upper27%of respondents who scored the item

RL _number among lower 27% of respondents who scored the items correctly

N _number of respondents in each of the upper and the lower groups

According to Inyang (1998) and James (2000), items with difficulty index which range between 0.3 and 0.49 are moderately positive. Those with difficulty index above 0.49 are high positive showing that a large proportion of the knowledgeable students got the items correctly. For this study, items with difficulty index of between 0.3-0.7 where selected and those with very low index were discarded in line with Inyang (1998) and James (2000). The detail of the scores is presented in appendix E.

3.6.0 Pilot Testing

Physics Performance Test (P.P.T) was pilot-tested using 2009/2010 SSII physics students of CGT III. The set of students, one hundred in number, were used for the pilot study immediately after completion of the physics course during 2009/2010 session hence they were equivalent to the target population for this study. Pilot study result is in Appendix C. The pilot study was done to:

- Find out the characteristics of P. P. T item analysis.
- Determine the appropriateness of the length of time required to take the test.
- Determine the appropriateness of the vocabulary used in PPT
- Find the reliability of PPT.

3.7.0 Treatment Administration

The treatment administered to the study subjects involved teaching physics using Team Teaching Strategy and Conventional Teaching Strategy. The students were first exposed to pre-test to determine their entry knowledge in physics and to establish group equivalence. The students were randomly assigned to experimental and control groups. Both groups were taught physics concepts for six weeks. i.e. The experimental group was taught through Team Teaching Strategy as shown in Figure 3.3 and the control group was taught through the Conventional Teaching Strategy as shown the Figure 3.2. The subjects with low, medium and high ability levels were taught together within their group. At the end of the treatment, the subjects were post-tested using physics performance test (PPT) and two weeks

later were giving Retention Test in line with Tukman (1975). The subjects scores collected were analyzed using t-test and ANOVA statistical tools.

Physics teachers of the two colleges were used to teach the study subjects. The Ministry of Education in Maradi helped the researcher to ensure their training on the use of team teaching for a period of four weeks. The ministry also assisted the researcher in the supervision and management of the study activities within the schools. The flow chart of practical lesson procedure for control and experimental groups are presented in figure 3.2 and figure 3.3 respectively.

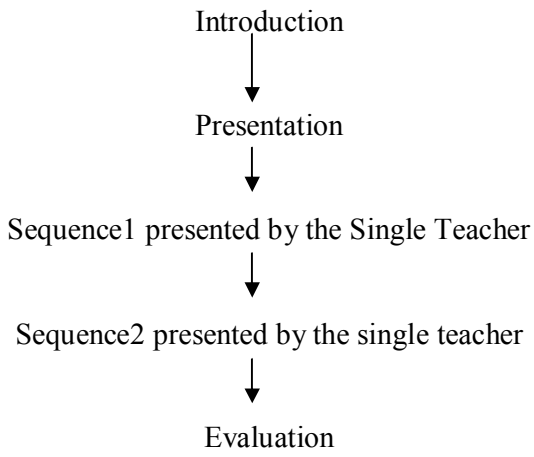


Figure 3.2: Flow Chart of Conventional Teaching Strategy for Control Group

*Source Usman (2000)

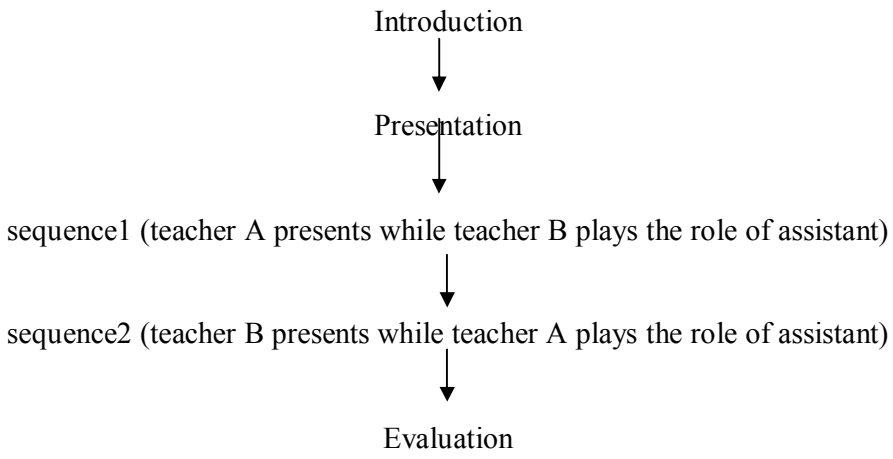


Figure 3.3: Flow Chart of Team Teaching Strategy for Experimental Group

3.7.1 Data Collection Procedure

Both experimental and control groups were pre tested to determine the equivalence of the groups before the study. Then the groups were taught physics for six weeks. The experimental group was taught concepts of mechanics, electricity and optics by two teachers using team teaching strategy while the control group was taught the same topics by Conventional Teaching. After the treatment all the groups were given post test in form of Physics Performance Test (PPT). Two weeks later Retention Test was administered to test the retention ability level of the two groups. The post-test and Retention Test administered, were marked out of 40 as observed in the marking scheme. The scores were collected after marking the students' scripts. The scores were divided into those of experimental and control groups. Later they were further divided based on gender. After sorting out the scores, the data were subjected to analysis.

3.7.2 Data Analysis

The data collected from the study were used to test the hypotheses stated in chapter one. Each of the hypotheses is restated below along with the statistics to be used for testing it.

H_{O1}: There is no significant difference between the mean academic performance scores of students with low, medium and high ability levels taught physics using Team Teaching Strategy.

H_{O2}: There is no significant difference in the retention of learned concepts of students with low, medium and high ability levels taught physics using Team Teaching.

Both null hypotheses one and two stated above were analysed using one- way ANOVA statistics to determine the effect (if any) between the two mean scores of groups i.e. experimental and control groups, a significant level of P= 0.05 is used to reject or to retain the hypothesis tested.

H_{O3}: There is no significant difference in the mean performance of male and female students taught physics concepts using Team Teaching Strategy.

H_{O4}: There is no significant difference between the mean retention ability of male and female students taught physics concepts using Team Teaching Strategy.

Both null hypotheses three and four stated above were analysed using t-test statistic to determine the effect (if any) between the mean scores of the two groups. Significant level of P<0.0 is used to reject or retain the hypothesis tested.

CHAPTER FOUR

ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

In this chapter the data collected are analyzed in relation to the research questions and their corresponding null hypotheses. Descriptive statistics, means and standard deviations are computed and used to answer research questions. T-test and one-way analysis of variance are used to analyse the data to test the null hypotheses. The results are then discussed in relation to literature available. The chapter is presented in the following order:

4.2 Hypotheses Testing

4.3 Summary of Findings

4.3 Discussion

4.2 Hypotheses Testing

Four hypotheses were formulated and tested using one-way analysis of variance (ANOVA) and t-test for possible differences in the performance and retention ability of students taught physics concepts using Team Teaching and Conventional Teaching Strategies.

4.2.1 Testing Null Hypothesis I

The means and standard deviations of students' post test scores were analysed to answer research question one regarding the effects of Team Teaching on senior secondary school students' performance in physics.

Research question 1: What is the effect of Team Teaching and Conventional Teaching Strategies on the performance of students with high, medium and low ability levels taught physics concepts? The results of the analysis are presented in Table 4.1

Table 4.1: Mean Performance Scores of Students in the Control and Experimental Groups by their Ability Levels.

	Control		Experimental	
Ability levels	Mean	Std. Deviation	Mean	Std. Deviation
High	12.9333	.90719	14.2333	1.35655
Medium	10.2000	1.78885	13.6667	1.42232
Low	8.9333	1.52978	9.6667	3.24126
Total	10.6889	2.21153	12.5222	2.97642

It can be seen in Table 4.1 that the total mean performance scores of students in the experimental group (12.52) is greater than the total mean performance scores of their counterparts in the control group (10.68). Also the means scores of students from high, medium, and low ability levels (14.23, 13.66, and 9.66) in the experimental group are respectively greater than that of their counterparts in the control group (12.93, 1020, and 8.93). That is the students with high, medium, and low ability levels who were taught using Team Teaching Strategy had respectively higher scores compared to those with high, medium, and low ability levels who were taught using the Conventional Teaching Strategy. This means that each ability group level taught using Team Teaching performed better than the corresponding group level taught using Conventional Teaching Strategy in physics. This finding answers research question one.

In relation to null hypothesis one which is to find out whether significant differences exist or not among the means of the three experimental sub-groups and the three control sub-groups, one –way analysis of variance (ANOVA) and thereafter post hoc based on Scheffe least Significance Difference (LSD) method, was carried out on the post test performance scores of the groups

Ho_1: There is no significant difference between the mean performance scores of students with high, medium and low ability levels taught physics concepts using Team Teaching Strategy.

To test this hypothesis, one-way Analysis of Variance (ANOVA) at $P \leq 0.05$ was carried out on the post test performance scores of the groups. The results of the analysis are presented in Table 4.2

Table 4.2: One-way Analysis of Variance of Post Test Physics Performance Scores of Students with Different Ability Levels (high, medium and low).

Source of variation	Sum of Squares	*df*	Mean Square	*F*	P-value	Remark
Between groups	151.250	2	75.625	23.899	.000	Sig
Within groups	560.078	177	3.1642			
Total	601.233	179				

$F_{Critical}$ values at (2,177) degree of freedom is = 3.84 , $P< 0.05$

The result in Table 4.2 revealed that the F-critical value is 3.84 while the F-calculated is 23.899 with degree of freedom =177 at P=0.001. This shows that there is significant difference in the level performance of subjects in their post test scores at $p< 0.05$ level of significance; This means that the null hypothesis that there is no significant difference in the mean performance scores of students of different ability levels in the experimental and control groups is therefore rejected. The mean scores of the students in the control and experimental groups by their different ability levels are presented in Table 4.3 to determine the group that was significantly different in their ability levels from the others in their physics performance, the means were further subjected to a mean separation test using the Scheffe's procedure. The result of the test is presented in Table 4.3

Table 4.3: Post Hoc Test Results on the Mean Scores of Different Ability Levels Using Scheffe Posttest Procedure

(I)Types	(J)Types	Mean Difference (I-J)	Std.Error	Significance	Remarks
High	Medium	1.6500(*)	.33938	.000	S
	Low	4.2833(*)	.33938	.000	S
Medium	High	-1.6500(*)	.33938	.000	S
	Low	2.6333(*)	.33938	.000	S
Low	High	-4.2833(*)	.33938	.000	S
	Medium	-2.6333(*)	.33938	.000	S

* The mean difference is significant at the .05 level.

The result of the mean separation test as indicated in the Table 4.3 revealed that the students in the high ability level were significantly different from those in the medium (mean difference with medium 1.6500) and low ability level (mean difference with low 4.2833) and likewise, those in the medium ability levels were significantly different from their counterparts in low ability level (2.6333). There is significant difference in performance between the high, the medium and low subjects across the groups.

4.2 .2 Testing Null Hypothesis II

The means and standard deviations of students' post test Retention scores were analysed to answer research question two, regarding the effects of Team Teaching on senior secondary school students' retention ability in physics.

Research question 2**:** What is the effect of Team Teaching and Conventional Teaching Strategy on the retention of learned physics concepts among students with high, medium and low ability levels? The results of the analysis is presented in Table 4.4

Table 4.4: Retention Mean Scores of the Students in the Experimental and Control Groups by Ability Levels

	Control		Experimental	
Ability levels	Mean	Std. Deviation	Mean	Std. Deviation
High	13.0333	1.15917	14.8333	1.53316
Medium	10.2000	1.54026	13.8333	1.80198
Low	8.7333	1.61743	11.0333	2.48420
Total	10.6556	2.29881	13.2333	2.53980

It can be seen in Table 4.4 that the total mean scores of students in the experimental group (13.2333) is greater than the total mean scores of their counterparts in the control group (10.6556). Also the means retention scores of students with high, medium, and low ability levels (14.8333, 13.8333, and 11.0333) in the experimental group are respectively greater than the means retention scores of their counterparts in the control group with high, medium, and low ability levels (13.0333, 10.2000, and 8.7333). That is the students with high, medium, and low ability levels who were taught using Team Teaching Strategy had respectively higher scores compared to those with high, medium, and low ability levels who were not exposed to Team Teaching. That means Team Teaching enhances the retention of learned physics concepts of students with high, medium and low ability better than the Conventional Teaching Strategy.

Hypothesis H_{O2}: There is no significant difference in the mean retention scores of students with high, medium, and low ability levels taught physics concepts using Team Teaching Strategy.

To test this hypothesis, One-way Analysis of Variance (ANOVA) at $P \leq 0.05$ was carried out on the post test performance scores of the groups. The results of the analysis are presented in Table 4.5.

Table 4.5: Analysis of Variance of Physics Retention Scores of Students of Different Ability Levels.

Source	Sum of Squares	DF	Mean Square	F	P-value	Remark
Between groups	299.022	2	149.511	53.72	.000	Sig
Within groups	492.544	177	2.78273			
Total	524.933	179				

F-Critical values at (2,177) degree of freedom is = 3.84, P< 0.05 calculated F value 53,72 at P<0.05

The result in Table 4.2 revealed that the F-critical value is 53.72 while the F-calculated is 53.72 with degree of freedom =177 at P=0.001. F-calculated is greater than the F-critical this shows that there is significant difference in the level performance of subjects in their post test scores at p< 0.05 level of significance. This clearly revealed that all the ability levels in the experimental or control group were significantly different one from the other (P < 0.05). This means that the null hypothesis that "there is no significant difference in the mean retention scores of students with high, medium, and low ability levels taught physics concepts using Team Teaching Strategy and their counterparts taught the same concepts using Conventional Teaching Strategy" is therefore rejected.

To determine the group that was significantly different in their ability levels from the others in their physics retention scores the means were further subjected to a mean separation test using the Scheffe's procedure. The result of the test is presented in Table 4.6.

Table 4.6: Post hoc Test Results on the Mean Scores of Retention Scores of Students with Different Ability Levels Using Scheffe's procedure.

(I)Types	(J)Types	Mean Difference(I-J)	Std. Error	Significance	Remarks
High	Medium	1.9167(*)	.31712	.000	*S
	Low	4.0500(*)	.31712	.000	*S
Medium	High	-1.9167(*)	.31712	.000	*S
	Low	2.1333(*)	.31712	.000	*S
Low	High	-4.0500(*)	.31712	.000	*S
	Medium	-2.1333(*)	.31712	.000	*S

* The mean difference is significant at the .05 level.

The result of the mean separation test as indicated in the Table 4.6 revealed that the students in the high ability level were significantly different in their retention score from those in the medium (mean difference 1.9167) and low ability levels (mean difference 4.9500) and, those in the medium ability level were significantly different from their counterparts with low ability level (2.1333).

4.2.3 Testing Null Hypothesis III

Research Question 3: What is the effect of gender on the performance of students taught physics concepts using Team Teaching Strategy?

The means and standard deviations of students' post test scores were analysed to answer research question three regarding the effects of gender on the performance of students taught physics concepts using Team Teaching Strategy.

Hypothesis H_{O3}: There is no significant difference between the mean performance scores of male and female students taught physics concepts using Team Teaching Strategy.

The scores of the males and female students in the three ability levels in the experimental groups were used for this test. The two sample t-test statistics was used for the analysis. A summary of the test is presented in Table 4.7.

Table 4.7: Comparison of the Post test Mean Scores of the Experimental Group by Gender

Variables	N	Mean	Std. Deviation	Std. Error	t-value	df	P-value	Remark
Males	45	13.11	2.367	0.353	1.34	88	.53	NS
Females	45	12.16	2.899	0.432				

(Critical value is 1.98, $P < 0.05$) NS: not significant

From the Table 4.7, it is observed the mean score and standard deviation for males and females as (13.11 and 2.367), (12.16and 2.899) respectively. Also the calculated t-value of 1.34 is less than critical value of 1.98 at the same degree of freedom. This result indicated that gender has no significant effect in the performance of males and females taught using Team Teaching. Therefore the null hypothesis that there is no significant difference between the mean performance scores of male and female students taught physics using Team Teaching Strategy is retained. This means that Team Teaching Strategy improves equally the performance of male and female physics students.

4.2.4 Testing Null Hypothesis IV

Research Question 4: What is the effect of gender on the retention ability of physics students taught using Team Teaching Strategy?

Hypothesis H_{O4}: There is no significant difference between the mean retention ability of male and female students taught physics concepts using Team Teaching Strategy.

The retention physics scores of males and females in the experimental groups were subjected to t-test statistics. This is to investigate if there is a significant difference in the retention ability between males and females in the experimental group taught using Team Teaching Strategy. Summary of the t-test analysis are given in Table 4.8

Table 4.8: Comparison of Posttest Retention Mean Scores of male and Female Subjects in the Experimental Group.

Variables	N	Mean	Std. Deviation	Std. Error	t-value	df	P-value	Remark
Males	45	13.38	2.471	0.368	1.36	88	.61	NS
Females	45	13.06	2.666	0.397				

(Critical value is 1.98, $P < 0.05$) NS: not significant

From Table 4.8, it is observed that the mean score and standard deviation for males and females as (13.38 and 2.471), (13.07 and 2.666) respectively. Also the calculated t-value of 1.36 is less than critical value of 1.98 at the same degree of freedom. Therefore the null hypothesis that "there is no significant difference between the mean retention ability of male and female students taught physics concepts using Team Teaching Strategy" is retained. This implies that gender has no significant effect in the retention ability of males and females taught using Team Teaching Strategy.

4.3 Summary of Findings

In the course of this study, the following findings were made:

i. There is a significant difference in the academic performance of students with different ability levels (high, medium, low) taught physics concepts using Team Teaching strategy and their counterparts in the control group taught using Conventional Teaching Strategy. The former achieved significantly better than the latter.

ii. There is a significant difference between the retention level of subjects with different ability levels (high, medium, and low) taught physics concepts using Team Teaching Strategy and their counterparts in the control group taught using Conventional Teaching Strategy. The former retained significantly higher than the latter.

iii. There is a significant difference between the mean performance of subjects in high ability level and those in medium and low ability levels taught physics concepts using Team Teaching strategy. The former achieved significantly higher than both medium and low level.

iv. There is a significant difference between the mean performance of subjects in medium ability level and those in low ability levels taught physics concepts using Team Teaching strategy. The former achieved significantly better than the latter.

v. There is a significant difference between the mean retention level of subjects in high ability level and those in medium and low levels when taught physics concepts using Team Teaching strategy. The former achieved significantly higher than both medium and low levels.

vi. There is a significant difference between the mean retention level of subjects in medium ability level and those in low ability levels taught physics concepts using Team Teaching strategy. The former performed significantly better than the latter.

vii. There is no significant effect in the performance of males and females taught physics using Team Teaching. Females performed as well as males in their test.

viii. There is no significant effect in the retention ability of males and females taught physics using Team Teaching. Females performed as well as males in retaining physics concepts.

4.4 Discussion

The intent of this study is to investigate effects of Team Teaching and Conventional Teaching Strategy on the academic performance and retention of physics concepts among secondary School students of different ability levels in Maradi Republic of Niger. To achieve this aim, subjects in the experimental group were taught physics concepts using Team Teaching Strategy while their counterparts in the control group were exposed to the same concepts using Conventional Teaching Strategy. The subjects in the experimental and control groups were post tested, and scores were analyzed to test six null hypotheses.

Null Hypothesis I: The results from testing null hypothesis I show that students with different ability levels taught physics concepts using Team Teaching strategy achieved significantly better than their counterparts taught using Conventional Teaching Strategy. The students in the experimental group improved significantly as a result of the Team Teaching method used to teach them. The finding is in agreement with that of Ayodele (2007) who reported that teachers' methodology favors learning, initiative and curiosity and thereby

making reliance and survival difficult beyond increasing students' outcomes. The possible reasons for this were the use of small group interaction in practical and teachers can attend to students individually. Unlike the Conventional Teaching which does not permit active participation of learners, and it is largely unsuited to the teaching skills, which require constant practice.

This finding is similar to that of Karin (2000), who supported that team teaching increases the students' level of understanding and enables the students to obtain higher performance. The finding is also in line with that of Anderson (2006) who stated Team Teaching improved students learning outcomes and helped them to boost their final performance in examination by offering increased student-teacher interaction and students received more individualized attention and assistance from teachers. Mellissa (2006) asserted that teachers' collaboration was one of the factors responsible for students' high performance. She considered that the cooperation and active learning which students were engaged in Team Teaching developed in students positive teamwork skills. Stephen (2005) reported that the problems are likely to be solved with the contribution of knowledgeable people to tackle greater problems. The collaborative teachers taught in different ways that were helpful in solving problems, and providing students with opportunities to learn to think differently. Furthermore, he noted that more than half of students taught with team teaching favoured team teaching over traditional teaching methods.

Null Hypothesis II: The result from testing null hypothesis II shows that physics students taught using Team Teaching Strategy retained physics concepts longer and recall significantly better than those taught using Conventional Teaching Strategy. This is attributed to the application of Team Teaching. This finding is similar to that of Jimoh (2001) who discovered that Team Teaching develops students' interest and increases students' motivation. This is also in line with the study of Miller (1994) who observed that Team Teaching as collaborative approach enhances understanding which in turn ensures motivation, confidence and invariably lead to enhanced retention. The finding also supported Anyagh's (2006) study who discovered that the ability to remember takes place more effectively when experiences are passed across to the learner via an appropriate instructional method. Goetz (2000) noted that learners who were exposed to a variety of effective teaching styles are more likely to be efficient learners who develop high performance as well as greater retention and attention. So the variety of learning and teaching styles within Team Teaching could have been the reason for the higher retention demonstrated by those in the treatment group.

Null Hypothesis III: the result from testing null hypothesis III shows that there is no significant difference in the mean retention scores of female and male physics students exposed to team teaching. Females performed as well as males in retaining physics concepts. This finding is similar to that of Grandall (1998) who also reported that both male and female benefited almost equally from team teaching, in language courses. The collaboration by both males and females in the treatment group could have removed gender related disadvantage in physic learning. The more individualized assistance and guidance in team teaching could have motivated both genders to actively participate in the physic learning process. This is also in agreement with Nworgu (2005) who stated that if boys and girls are given equal opportunity

they will perform equally well. Bichi (2008) also observed that when girls are given opportunity to participate in science activities and opportunity to manipulate objects in teaching and learning they excel as well as boys. The small group interaction in practicals could have help to fight against girls' shyness and up tightness.

Null Hypothesis IV: the result from testing null hypothesis IV shows that there is no significant difference in the mean performance scores of female and male physics students exposed to team teaching. Females performed as well as males in their performance. This finding is similar to that of Labey (2004) who also reported that there are no gender differences in performance in many school subjects. There are some areas in which females excel, and some in which males excel.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

In the last chapter an attempt was made to analyze the data collected in relation to null hypotheses and the results or findings were accordingly discussed. This chapter summarizes the study, draws conclusions on the basis of which recommendations are given. The chapter is presented under the following subheadings:

5.2 Summary

5.3 Major Findings of the Study

5.4 Conclusions

5.5 Recommendations

5.6 Limitations of the Study

5.7 Suggestions for Further Studies.

5.2 Summary

Students' poor performance in physics and their low ability to grasp and memorize physics concepts or topics that was taught were the basic problems in senior secondary schools. These problems might be due to inappropriate teaching methods being used to teach these topics. The hiring of effective and well-trained teacher is one of the most important problems science schools are facing in Niger Republic. According to Darling-Hammond (1997), teacher expertise has a direct correlation to high student performance. High-quality professional development is intricately linked to improved teaching and learning. Studies

conducted by Ronald Ferguson revealed that "every dollar spent on more highly qualified teachers gave greater increase in student performance than did less instructionally focused uses of school resources" (Darling-Hammond, 1997). In addition, reviews of more than 200 studies make it clear that teacher education is critical and that more appears to be better than less (Darling-Hammond, 1997). "In fields ranging from mathematics and science to early childhood, elementary, vocational, and gifted education, teachers who are fully prepared and certified in both their discipline and in education are more highly rated and are more successful with students than are teachers without preparation, and those with greater training in learning, teaching methods, and curriculum are found to be more effective than those with less" (Darling-Hammond, 1997).

Schools in Niger Republic face the growing challenge of hiring highly trained teachers. The number of graduates from teacher training programs has been steadily declining over the last several years. As a result, schools in many parts of the country with Maradi in particular have no choice but to hire under-prepared teachers with emergency credentials. This is particularly important when considering the need for specially trained teachers to work in intervention programs. The situation in which most teachers were not trained nor had enough teaching experience, required teachers to collaborate with one another. This study adopted Team Teaching and Conventional Teaching Strategies to investigate their effectiveness on students' performance and retention in physics. The specific research question was student performance and retention ability concerning Team Teaching Method

The study adopted quasi-experimental, pre-test, post-test control group design. The sample of the study consisted of 180 senior secondary school class II students. Two senior secondary schools were randomly selected. From each selected school 90 students of different ability levels (high, medium and low) and different genders (males and females) were selected. They were pretested to be sure that the two groups were equivalent. Simple random sampling was used to allocate the groups into experimental and control groups. After the pre test both the two groups were assigned to treatment for six weeks. The experimental group was taught physics concepts by Team Teaching Strategy while the control group was taught the same topics using Conventional Teaching Strategy. After the treatment all the groups were given post test in form of Physics Performance Test (PPT) to test their performance. Later post test Retention was administered to test retention ability of the two groups. Six hypotheses were used to measure students' performance and retention and tested at 0.05 level of significance. The data were analyzed using student t-test and ANOVA statistical tools. The results were summarized:

i. The result revealed that each ability levels in the team teaching group were significantly different from their counterparts in the group taught by a Conventional Teaching ($P < 0.05$) in favor of the former. This means that the null hypothesis that "there is no significant difference in the mean performance scores of students of different ability levels in the experimental and control groups" is therefore rejected.
ii. Concerning the retention ability, the experimental and control groups differ significantly in their retention scores in favor of the former. At the ability levels, the students also differ significantly. Therefore the null hypothesis that there is no

significant difference in the mean retention scores in physics of students of different ability levels in the experimental and control groups is thus rejected.

iii. The result revealed that there is no significant effect in the performance of males and females taught physics using Team Teaching. This means that the null hypothesis is accepted.

iv. There is no significant effect in the retention ability of males and females taught physics using Team Teaching. This means the null is thus accepted.

5.3 Major Findings

On the basis of the results obtained it was observed that Team Teaching was more effective than Conventional Teaching Strategy in improving students' performance and retention. When used properly Team teaching improved performance and retention ability of students at different levels (high, medium and low). That is, team teaching is suitable to students of all types.

The study also showed that Team Teaching improved students' performance and retention of student females and males. Team Teaching is suitable to students of different sexes. It also indicated that boys and girls achieved and retained equally well in team teaching, this implied that team teaching is gender friendly. In the course of this study, the following findings were made:

i. There is a significant difference in the academic performance of students with different ability levels (high, medium, low) taught physics concepts using Team Teaching strategy and their counterparts in the control group taught using

Conventional Teaching Strategy. Each of the ability levels in Team Teaching achieved significantly better than their counterpart taught by Single Teaching Strategy.

ii. There is a significant difference between the retention level of subjects with different ability levels (high, medium, low) taught physics concepts using Team Teaching Strategy and their counterparts in the control group taught using Conventional Teaching Strategy. Each of the ability levels retained significantly higher than their counterpart taught by Conventional Teaching Strategy.

iii. There is a significant difference between the mean performance of subjects in high ability level and those in medium and low ability levels taught physics concepts using Team Teaching strategy.

iv. There is a significant difference between the mean performance of subjects in medium ability level and those in low ability levels taught physics concepts using Team Teaching strategy. The subjects in medium ability level achieved significantly higher than the low level subjects.

v. There is a significant difference between the mean retention level of subjects in high ability level and those in medium and low when taught physics concepts using Team Teaching strategy. The former achieved significantly higher than both medium and low latter.

vi. There is a significant difference between the mean retention level of subjects in medium ability level and those in low ability levels taught physics concepts using Team Teaching strategy. The former retained significantly better than the latter.

vii. There is no significant difference in the mean retention scores of female and male physics students exposed to team teaching. Females performed as well as males in retaining concepts retention.

viii. There is no significant difference in the mean performance scores of female and male physics students exposed to team teaching. Females performed as well as males in their performance.

5.4 Conclusions

On the basis of the findings of this study, the following conclusions are made:

i. That Team Teaching Strategy tends to improve significantly students' performance in physics.

ii. That Conventional Teaching Strategy appears inferior to Team Teaching in enhancing students' performances in physics

iii. That students' retention of learned concepts seems to be significantly enhanced by Team Teaching.

iv. That Conventional Teaching Strategy appears inferior to Team Teaching in enhancing student's retention ability in physics.

v. That gender has no significant effect on the performance of males and females taught using Team Teaching Strategy.

vi. That gender has no significant effect in the retention ability of males and females taught using Team Teaching Strategy.

vii. Team Teaching Strategy removes gender bias which renders students passive and uptight. Male and female students are actively involved which is not so in Conventional Teaching Strategy.

viii. Team Teaching equalizes interactions between male and female physics students.

5.5 Recommendations

On the basis of the findings of this study the following recommendations are suggested:

i. Since Team Teaching is found to enhance /improve student's performance in physics, teachers should be encouraged to teach physics using Team Teaching Strategy in schools in Niger Republic.

ii. The Ministry of Education should organize on-the-job trainings, workshops, seminars, symposia and conferences at intervals for the teachers of physics in secondary schools to update their knowledge on the application of the Team Teaching method in teaching the subject.

iii. The Ministry Of Education should provide educational environments that support all learners, males and females to benefit from Team Teaching.

iv. Schools should give teachers opportunities and create an enabling situation for effective Team teaching in physics to ensure all students inclusion for effective learning.

5.6 Limitations of the Study

Despite the many advantages of Team Teaching, its proper organization and success may be difficult to achieve. Some factors were identified as sources of difficulties and have affected the effective functioning of the study. These are:

i. Any group is bound to have members of varying personalities. As a result of personality differences, several situations occur which affect the proper functioning of the team. This may influence the result of the study.

ii. No remuneration is attached to members, very few teachers willingly accepted to participate. This may affect in one way or another the results of the study

iii. It was difficult to find a common convenient free time for team members to meet in order to plan and evaluate the work. Besides, very few teachers accepted to stay even one hour later than the regular school closing time. This too may influence the findings.

iv. Some teachers did not like to be observed by their peers while teaching. A hard working member embarrasses the lazy and nonchalant ones. This may affect the findings too.

5.7 Suggestions for Further Studies

Based upon this and previous research, inconsistencies and disagreements still exist regarding the best type of organizational structure Additional research is recommended in the following areas:

i. A Similar study to examine the effect of Single Teaching Strategy and Team Teaching Strategy on other grade levels is needed.
ii. A replication of the study in order to increase the generalizability of the findings to physics and other sciences is required.
iii. A comparison between different models of team teaching can be carried out.
iv. A comparison of team teaching with other teaching methods in order to determine if they are equally effective in producing desired students outcomes' in physics is required.
v. A study on attitude of administrators on team teaching the perception of students and parents is necessary.

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Appendix A: Lesson Notes for Experimental Group

	Lesson one / Week I	
Subject: Physics		Class Level – SSII
Topic – Electrostatic		Time – 40 minutes

Instructional materials:

Plastic ruler, sheets of paper, comb; two balloons, two small wire cuttings of 1m long, metallic ruler, balloons.

Behavioral objectives: At the end of the lesson, the students should be able to

1. give three examples of electrostatic events
2. carry out experiment on electrostatics given sheets of paper and plastic ruler
3. distinguish the two types of electric charges
4. state the attraction and repulsion law of electric charges
5. show that electric charges can move from one matter to another by direct contact

Previous Knowledge: Students have been taught atom structure

Presentation

Sequence 1:

Teacher A presented while teacher B helped him in organizing the groups, by arranging the materials and managing class.

Introduction

The teacher asks the students to describe atom, to list three parts of an atom, to list any five atoms. The students answer: there are different types of atoms. Each atom consists of three types of particles. These are the protons, neutrons, and electrons. A proton has a positive charge while an electron has a negative charge. The teacher tells the students we will discuss about electrostatic in this lesson.

Step1: Teacher A asks students to act small sheets of paper then to bring the plastic ruler near these sheets then to describe what they observe.

Teacher B guides the students on what to observe or show them what is relevant.

The students cut small sheets of paper and experimented. They observe that the ruler that was not rubbed did not attract the small sheets of paper.

Step2: Teacher A asks students to rub the plastic ruler then to bring it near the sheets of paper to observe the reaction.

The teacher B observes and identifies what the students missed and shows them how to do it. The students observe that the ruler that was rubbed attracts the small sheets of paper

Step3: Teacher A asks students to carry out similar experiments using different kinds of objects. Teacher B helps students and shows them what to do and informs them what to avoid doing. The students carry out the various experiments assisted by the two teachers

Step4: Teacher A asks the students to explain why when an object is rubbed attracts small sheets of paper. The students explain that any particle rubbed attracts small sheets of paper because it becomes electrically charged. The phenomenon is called electrification. Teacher B helps in the explanation using various examples. The students guided by teacher A take notes. An object which is not rubbed does not attract small sheets of paper while the one which is rubbed attracts small sheets of paper. This is because it has acquired electric charges on its surface.

Sequence 2

Teacher B presents while teacher A helps in organizing the class or the groups, in arranging the materials and managing the class

Step1: Teacher B asks students to blow up beach balls and to attach a small wire to each one. They should then bring the wires close together and say what they observe. Teacher A helps students those who could not perform the experiment correctly and shows them how to do it. The students observed that the balloons did not rub against each other nor push.

Step2 Teacher asks students to rub two balls many times against the wool, then to bring the wool balls one near to each other through the wires, and to say what happens?

Teacher A helps students who could not perform the experiment and guides them to observe what happened? The students observed that the two balloons rubbed against the wool pushed back against each other.

Step3: Teacher tells the students to touch the balls with their hands, rub each one many times against the plastic pellicle, and brings the balloons near each other through the wires then to explain what they see? The teacher helps the students and shows them how to do it and inform them what they should to avoid doing. The students stated that the two balloons rubbed against plastic pushed back each other.

Step4: the teacher asks students to rub one balloon many times against the wool and the second against the plastic pellicle, then bring them closer and describe what happens?

Teacher B helped the students then shows them what to do and what to avoid doing.

The students explained that the balloon rubbed against wool attracts the one rubbed against the plastic pellicle.

Step5: Teacher asked students to explain what happened.

Then the teacher guides the students to explain what is happening in another form, by using various examples. The students explained that when two balloons were rubbed against wool and brought closer, there was a manifestation of electrical forces opposites which attracted. The students observe the same manifestation when the two balloons rubbed against where brought together. But when they tried to bring together a balloon rubbed against wool and another rubbed against plastic, there was a manifestation of electrical forces.

Step6: Teacher helped students to summarize and gave them complementary information, that positive and negative charges attract one another. They are called opposite charges .The smallest known charge of electricity is the charge associated with an electron. This charge is called a "negative" charge. The opposite charge is called positive charge. When matters get electrons they become negatively charged. But when they loose electrons, they become positively charged.

Evaluation: What is electrostatic? Give any two examples of electrostatics. Describe or carry out one experiment on electrostatic. How can you create static electricity? What are the types of electrical charges? State the attraction law?

	Lesson II /second week	
Subject: Physics		Class Level – SSII
Topic – Electricity		Time – 40 minutes

Measures of electric intensities

Instructional materials:

Conductor wires, three bulbs, ampere meters, interrupter, Electrical apparatus, three resistors, eight conductors wires, an ammeter, 4 volt meter

Behavioral Objectives of the lesson At the end of the lesson the students should be able to:

1. State the law of electrical intensities of currents for apparatus in series
2. measure the electrical potential between the electrical poles of an apparatus
3. state the law of electrical intensities of currents for apparatus in derivation

Previous knowledge: The students have been taught the notion of electric current

Introduction

The teacher asked the students to explain the concept of electric current. The teacher reminded students that electrical charges can move from one matter to another by direct contact with an electrified object or through electrical conductors'. When electric charges are in motion there is a flow of electrons charges called electric current.

The teachers presented the lesson following these sequences. When one of them is presenting the other will help in organizing the class or the groups and arranging the materials

Presentation

Sequence 1: The teacher B presented the lesson while teacher A assisted in organizing the class or the groups and arranging the materials, then managing the classroom.

Step1: the teacher informed the students the procedure and the operating mode: The positive electric borne of the apparatus should be related to the positive electric borne of the electric source of current while the negative pole is related to the negative born of the apparatus. Then the teacher asked students to experiment as follows: Relate the electric source to the three bulbs predisposed in series. Regulate the potential of the electric source at 6V. Turn on the switch. Note the values of the intensities of the current from the source and each bulb. Teacher B helped the students to perform the experiment.

Step 2: The teacher asks students to read the intensity values and to insert the reading on the following table.

The students experiment while teacher B guided them on what to observe or showed them what is relevant.

I	I_1	I_2	I_3	I’

Step 3: The teacher asked students to compare the intensities and to find the relationship between the intensities. The students observed that $I=I_1=I_2=I_3=I'$

Step4: The teacher will ask students to interpret the following relation $I=I_1=I_2=I_3=I'$

The assistant teacher identified the students that needed helped and explains again or used another example. The students deduced that the intensity of electric current is the same at any point of the circuit.

Step 5: Students concluded that the apparatus in series were crossed by the same intensity of electric current. The assistant teacher observed the process to diagnose the learning problems and procedures.

Sequence 2:

Teacher A presented the lesson while teacher B helped him in organizing the class arranging the materials and managing the class,

Step1: The positive electrical pole of the apparatus should be related to the positive electrical pole at the electrical source of current while the negative pole is related to the negative borne of the apparatus. Then the teacher asks students to experiment as follows:

a) Relate the electric source to the three bulbs disposed in derivation.
b) Regulate the potential of the electric source at 6V.
c) Turn on the switch.
d) Note the values of the intensities of the current from the source and from each bulb.

The students experimented while teacher A identified the students with problems and showed them how to experiment.

Step 2: The teacher asks students to read the intensity values and to complete the following table. The teacher observed the students to identify those experiencing difficulty then guides them on what to do.

I	I_1	I_2	I_3	I'

Step 3: The teacher asks students to:

a) Add the intensities of the current I_1, I_2, I_3

b) Compare the intensity I to I' and to the sum of I_1 , I_2, and I_3

c) Find what relationship there was between the current intensities I_1, I_2, I_3, I, and I'

The students observed that $I=I_1+I_2+I_3=I'$

Step4 The teacher asked students to interpret the following relation: $I=I_1+I_2+I_3=I'$

The assistant teacher observes students' responses to identify those with problems and explained in another form, by using various examples.

The students observed that the electric intensity in the principal branch is equal to the sum of the electric intensities in the branches given.

The assistant teacher set the learning process to diagnose the learning problems and procedure,

Evaluation: State the law of electric intensities for the apparatus arranged in series.

How can you measure the difference of electric potential between the poles of an apparatus?

State the law of electric intensities of currents for the apparatus in derivation.

	Lesson III / Week three	
Physics		Class Level – SSII
Archimedes' principle		40minutes

Instructional materials of the lesson: Vase or a kettle, transparent plastic vase, a dynamometer, a beaker or a bottle, a stone, a wire and water

Behavioural Objectives: At the end of the lesson the students should be able to:

a) determine the Archimedes principle using an experiments
b) Quote the characteristics of push of Archimedes.
c) Recognize the push of Archimedes as the Sum of all the forces exerted by the fluid.
d) calculate the push of Archimedes of a simple object plunged in a liquid

Previous knowledge: The students have been taught notion of force and weight

Presentation

Sequence1: The teachers presented the lesson following these sequences. Teacher B presented while teacher A helped in organizing the class, arranging the material and managing the class.

Introduction: A solid plunged in a liquid seems less heavy than in the free air and moves a certain volume of the liquid. Why? In this lesson we will try to explain what is really happening.

Step1 Teacher A gave students task to perform. Dynamometer was hung in a vase. This was connected to a stone by a wire. Then he asked the students to perform the experiment as follow:

a) Connect the dynamometer to the vase and the stone, then read the indication p;
b) Immerse entirely the stone to a full vase of water and to collect the water in beaker adapted close its opening;
c) Read the new indication P' of the dynamometer;
d) Put the water collected in the vase placed between the dynamometer and stone and then read the indication P" of the dynamometer.

Teacher B observed students' responses to identify those with problems performing the experiment and show them the steps.

Step2: Teacher A asks students to read at each step the dynamometer indication P, P', P" at each step and to complete the following table. The teacher guided the students on what to do.

Solid	Indication of the dynamometer
In the air	P=
Immersed in water	P' =
Immersed with water collected versed in the light vase	P" =

Sequence2

Teacher B presented the lesson while teacher A helped in organizing and managing the class

Step3: Teacher A asked students to compare the indications P to P' and indicate the difference between the indications P and P', then weight the liquid that was displaced.

The students compared then related: The spring of the dynamometer was less prolonged when the stone was plunged in water. The indication P' is lower than P. By pouring the water collected in the empty vase, the dynamometer indicated P again; thus the intensity of the force was equal to the weight of the displaced liquid.

Step4: Teacher A asked the students to explain why the indication P' is lower than P? as interpreted the dynamometer indicated the value equal to P when the displaed water was put in an empty vase?

Teacher A helped the students to interpret or explain in another form.

The students explained that: The indication P' is lower than P because water exerted on stone a force whose direction is bottom up. The intensity of this force was equal to the weight of the displaced liquid.

The teacher asked students to determine the characteristics of the force using Archimedes principle.

The students related that Archimedes principle force has as a vertical direction and its direction is top to bottom and its intensity is equal to the weight of the displaced liquid.

Step5: the teacher asked the students to conclude. The students noted that when a solid is immersed in a liquid, the liquid exerts on the solid a force whose intensity is worth the weight of the displaced liquid and direction opposed is to that of the weight. This force is called force of Archimedes.

Evaluation: Giving the real height and the apparent force calculate the force of Archimedes. List the characteristics of the force of Archimedes. What is the force of Archimedes?

Calculate the force of Archimedes exerted on an object which have moved $50dm^3$ of water.

	Lesson IV Week four	
Subject: Physics		Class Level – SSIII
Pressure		40minutes

Measure and transmission of pressure

Instructional materials

Dynamometer, ruler, object of simple geometric form (a piece of parallelepiped),

- 1 plastic bottle on smooth board or failing this on board stripe with stopper; 1 basin;1 stove + tripod stand; 1 beaker of 450 DC; Peace of ice. Tube in form of u, oil, 2 pistons and some charges

Behavioral Objectives: At the end of the lesson the students should be able:

- To determine the pressure exerted by a solid on a plane surface.
- to prove the transmission of the pressure
- to explain the principle of a hydraulic pressure.
- to determine the relation between the pressure exerted and the surface pressed

Previous knowledge: students already know the notion of force and calculation of surface

Introduction: Why a surface of a liquid is rippled when an object settles on it. The teacher asks students to remember: a force is any action able to deform, to make a corps in movement, to modify the movement of the object, and to maintain this object in balance.

Presentation

Sequence 1

Teacher A presented the lesson while the teacher B help him in organizing the class or groups, arranging the materials and managing the class.

Step1: The teacher asked students to perform as follow:

Measure the weight of the object (parallelepiped rectangle)

Measure the dimensions of the object

Compute the surfaces (the biggest, the smallest and the medium)

Complete the following table.

S			
P			
P/S			

The students experiment while teacher A helped them and showed them how to perform the experiment and guided them on what to read.

Step2 The teacher asked the students to define pressure; to give the expression of the formula and to list the factors on which depends the pressure.

The students define and list the quotient of the force on the value of the pressed surface is called pressure. It is shown by the symbol p. The formula is p=P/S. Its unit is the Pascal which is the force exerted on a surface of $1m^2$ by a force of one Newton.

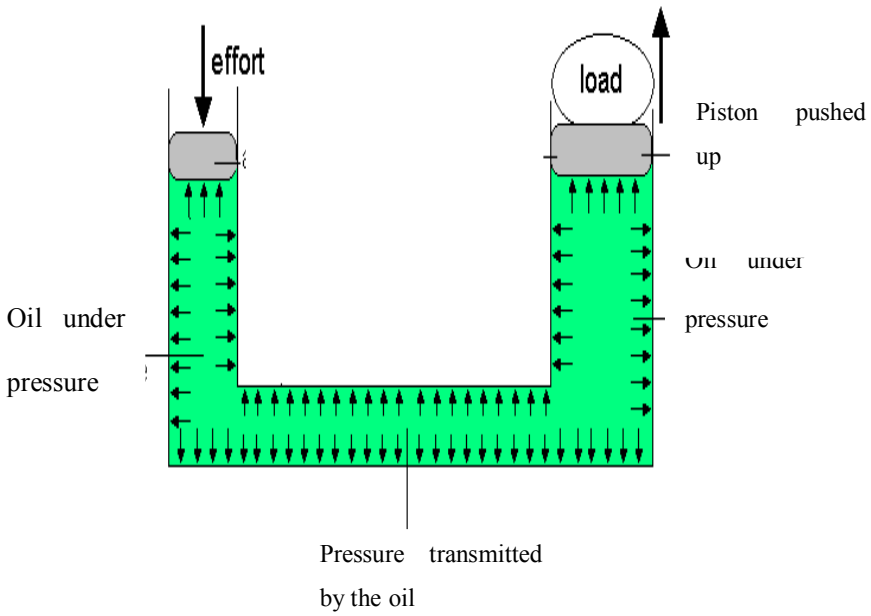
Step3: Teacher A asked the students to conclude

The students concluded by saying that the pressure represents the intensity of the force exerted on each point of the surface. The pressure is proportional to the weight and inversely proportional to the surface. The assistant teacher observed the learning process to diagnose the learning problems and procedure,

Sequence2

Teacher B presented the lesson while teacher A helped him in organizing the class, arranging the materials and managing class. The figure opposite shows the working of a ***typical hydraulic machine***.

Hydraulic machine



Step1: Teacher asked students to follow the procedure as follows:

Press the small piston and note your observations.

Then press the big piston and note your observations.

The students experiment while teacher A helped them and showed them how to perform the experiment. He guided them on what to do and observe.

Step2: The teacher asked the students to explain the principle of the hydraulic press.

Teacher A explains again using various examples.

The pressure of the small piston causes the big piston to move inversely.

Giving the dimensions of the object, the teacher asked students to calculate the transverse sectional surface of the pistons; compute product FS and F'S', then compare these products

The teacher observed that F.S=F'.S' is the product of the big force and the big surface is equal to the product of the small force and the small surface.

Step3: The teacher asked the students to interpret the equality of the products (F.S=F'.S')

The students analyzed and interpreted giving the two products as the same, observing that the surface of the big piston is greater than to that of the small one, the force produced by the great surface on the larger piston is much bigger, i.e., a small force applied to a smaller piston produces a big force on the larger piston.

The teacher explains again using various examples.

The teacher asked the students to explain how this idea can be developed to solve the numerical problems

The students observed that F.S=F'.S' that if giving any three of these values the fourth one can be calculated. I.e. giving the weight of one load one can find the weight which can be raised

Evaluation

What is the pressure exerted by solid on a plane surface. What relation is there between the pressure and the pressed surface? Explain the principle of hydraulic pressure.

Show the existence of pressure on a vertical surface. How is the pressure transmitted?

A force of 2500N is exerted on the small solid of hydraulic press, S= $0.25m^2$ and S'=$0.75m^2$, find the weight that can be raised.

	Lesson V week five	
Subject: Physics		Class Level – SSII
Variation of pressure		40minutes

VARIATION OF PRESSURE EXERTED BY LIQUID

- Test-tube of glass or water carafe 1- Plastic funnel 1- Tube of glass 50 cm- Elastic membrane1- Elastic arm-band 1- Flexible plastic pipe (10cm) 1- Water, Gas ring butane - limps of matches 1 NB: all the connection can be replaced by a single pipe communicated to the funnel-1 plastic bottle;- 1 needle- 1 broad basin of Water

Behavioral Objectives: At the end of the lesson the students should be able:

1. Quote the two factors intervening in the pressure inside a liquid
2. Measure a pressure using a pressure gauge.

Presentation: The teachers will present the lesson following these sequences.

Sequence 1

Teacher A presented while teacher B helped him in organizing the class, in arranging the materials and managing the class.

Step1: Teacher asked the students to experiment on the following:

a) Cut 10 cm of tube;
b) bend the remainder C to 15 cm tube;
c) connect the tubes in a glass and funnel as indicated in the figure;
d) Vary the position of the cell in the liquid and observe the pressure gauge.

The students experiment while the teacher B identified the slow students and showed them how to proceed.

Step 2: The teacher asked the students to read the pressure and the depth then to complete the following table:

The assistant teacher observed students identify those having problems then guided them.

Table: Variation of the pressure with the depth

Depth(cm)					
Pressure(cm)					

Step3: Teacher A asks the students to compare the different pressures and to try to find the relation if there is any then say what they observed.

The students observed: The pressure grows with the depth. It becomes low when the depth is small, and becomes high when the depth is big.

Sequence 2:

Teacher B presented while teacher A assisted

Step 1: experiment and repeat the experiment using water and later changing it with oil then alcohol, read the fixed depth, the pressure and then complete the following table:

Table: variation of the pressure with the nature of the liquid

Liquids	Water	Oil	Alcohol
Pressure(cm)			

The students experimented while the teacher helped the students and showed them how to do, and he guided them in observing what was happening.

Step2: The teacher asked the students to compare the pressures of the different liquids of the same depth. The students related that; for the same depth the pressure changes from one liquid to another. The dense the liquid is the higher the pressure. The teacher helped the students to compare, showed them how to compare helped in observing the variations

Step3: The teacher asked the students to conclude

The students concluded by saying; the pressure depends on the depth and the nature of the liquid. The higher density of the liquid is the higher the pressure. Also, the more the depth is the higher the pressure.

Evaluation

What are the two factors intervening in the pressure inside a liquid? State how the pressure varies with the height. Describe how to measure the pressure using a pressure gauge

	Lesson six Week VI	
Subject: Physics		Class Level – SSII
Atmospheric pressure		Time – 40minutes

Instructional materials:

- glass;- break into leaf of paper rows;- water - 1 small mineral water bottle (or small transparent bottle);- 1 tube of adhesive ;- 2 basins;- 2 pieces of flexible tube;- 2 pieces of glass tubes(or biro tubes)- Water

Behavior Objectives: At the end of the lesson the students should be able to:

1. Justify the existence of the atmospheric pressure by
2. Measuring atmospheric pressure.
3. To explain the principle of distribution of water in the cities based on the siphon.

Presentation

Sequence 1

Teacher A presented the lesson while teacher B helped in organizing the class or groups, in arranging the material and controlling the class to observe safety measures.

Step1: Teacher A asked the students to experiment as follow:

a) Fill the glass bottle with drinking water;
b) cover the glass with paper (diam10cm x10cm)
c) turn the glass upside down quickly and observe what happens

The students experimented while teacher B observed the students identified students not paying attention and advise them to concentrate on what is going on, identified students having trouble discussing the result and guided them, also showed those that could not perform the experiment and showed them how to do.

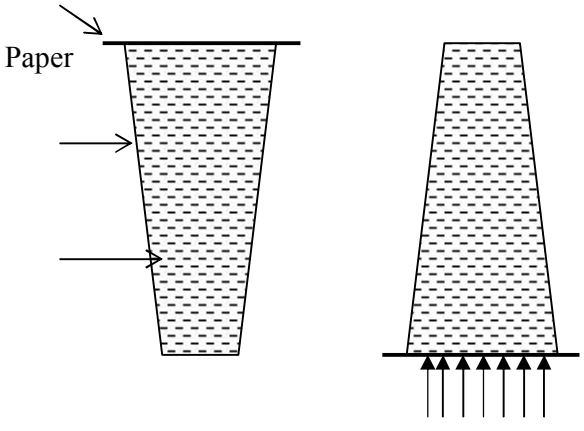
Step2: Teacher A asked the students to observe what happened.

The students observe d that the paper remained stuck against the glass

Teacher B guided the students on what to observe or showed them what is relevant.

Step3: Teacher A asked the students to explain why the paper remained stuck against glass.

Diagram: Atmospheric air pressure



The students explained that: the paper remained stuck against the glass because the atmospheric air propels the paper against the glass. The force of pressure is opposite and stronger than the weight of the water.

Teacher B explained in another way, by using various examples especially for students who did not understand.

Step4: Teacher A asked students to conclude the experiment.

The students concluded that atmospheric air pressure exists. It is sufficiently important and not to be neglected.

Sequence 2

Teacher B presented the lesson while teacher A helped him in organizing the class or groups, the in arranging the materials then controlled for safety measures then managed the class.

Step1: Teacher B asked the students to experiment as follows:

a) To bore two holes on the level of the stopper
b) Pass a piece of the tube through one of the holes to reach half of the bottle?
c) Through the other hole, insert the other piece of the tube from the glass.
d) Adapt the flexible tubes to the two pieces of glass.
e) place the longer flexible tube in the basin containing of water,
f) Blown in to the other tube before putting it in the empty basin as shown the diagram.

The students experiment teacher A helped the students by showing them how to perform the experiment.

Step2: Teacher B asked the students to observe then describe what happened.

The students observed then described that: the water moved up from basin A to the balloon then from the balloon to basin B

Teacher A guided the students on what to observe, indicated what is relevant helped them to describe what happened.

Step3: Teacher B asked the students to explain why the water moved up from basin A to the balloon then from the balloon to the basin B.

The students explained that: the difference of pressure between the atmospheric pressure and the pressure in the balloon produced the movement of water from basin A to the glass balloon.

Then the water was pushed by its weight to move from the balloon to basin B. Teacher A explained again using various examples.

Step4: The teacher asked the students to explain the distribution of water based on the functioning of the siphon in the preceding experiment

Teacher A explained again by using various examples.

The students helped by the teacher explained that: in cities, water is pumped by the pressure of the bigger piston by hydraulic pressure which produces the movement of water from the well to the reservoir then pumped by the force of its weight to move from reservoir to all the taps. The assistant teacher diagnosed the learning problems and procedure,

Evaluation: Give two examples showing the existence the atmospheric air pressure. Describe how to measure atmospheric pressure

Appendix B Lesson Notes for Control Group Using Conventional Teaching Strategy

	Lesson one –Week I	
Subject: Physics		Class Level – SSII
Topic – Electrostatic		Time 40 minutes

Instructional materials: Plastic ruler, sheets of paper, comb, Two balloons (beach ball), two small wools, two small wires of 1m of long, metallic ruler,

Behavioural objectives: At the end of the lesson, the students should be able to:

1. Give examples of electrostatics
2. carry experiment on electrostatics effectively
3. distinguish the two types of electric charges
4. state the attraction and repulsion law of electrics charges
5. Show that electrics charges can move from one matter to another by direct contact.

Previous Knowledge: Students have been taught atom structure

Presentation: The teacher will present the lesson following these sequences

Sequence 1

Introduction

The teacher asked the students questions based on their previous knowledge for example: to describe an atom, to list three parts of an atom, to list any five types of atoms. The teacher informed students that there are different types of atoms. Each atom constitutes three types of particles. These are the protons, neutrons, and the electrons. An atom has a positive charge while electron has a negative charge.

Step1: the teacher asked the students to get small sheets of paper then to bring the plastic ruler near these sheets. The students got small sheets of paper by observing the teachers and experiment

Step2: the teacher asked the students, what happened? What they observed?

The students observed that the ruler none rubbed did not attract the small sheets of paper.

Step3: the teacher then asked students to rub the plastic ruler then to bring it near the sheets of paper and asked them, what to observe?

The students observed that the ruler attracts when rubbed the small sheets of paper

Step4: The teacher asked the students to carry out other experiments using news kinds of objects. The students carried out the various experiments assisted by the two teachers

Step5: The teacher asked the students to explain why a rubbed object attracts small sheets of paper. The students explained that any object rubbed against something attracts small sheets of paper because it becomes electrically charged. He also informed them that the phenomenon is called electrification.

Step6: The students guided by the teacher made notes. An object that is not rubbed against something does not attract small sheets of paper while the one rubbed one attracts small sheets of paper, because electric appears on its surface.

Sequence 2: determination of types of electrics charges

Step1: the teacher asks students to blow up the beach balls and to attach a small wire to each one. Then take the balloons through their wire to bring them one near to another, and tell what they observe. The students observe that the balloons did not attract each other nor push each other.

Step2 The teacher asked the students to rub two balloons many times with the wool, then bring the balls one near each other through the wires and say what happened.

The students observed that the two balloons rubbed against the wool push each other.

Step3: the teacher told the students to touch the balloons with their hands, then to rub each one many times against the plastic pellicle, to bring the balloons one near each other through the wires then to tell what happened? The students stated that the two balloons rubbed against the plastic pellicle pushed against each other.

Step4: the teacher asked the students to rub one balloon many times against the wool and the second one against the plastic pellicle, then bring them closer together and then describe what happened?

The students described that the balloon rubbed against the wool fur attracted the one rubbed against the plastic pellicle.

Step5: the teacher asked the students to explain what happened.

The students explained that when two balloons rubbed against the wool were brought closer, there was a manifestation of electric opposite forces. They observed the same manifestation when the two balloons rubbed against plastic pellicle were brought together.

But when they tried to bring closer together a balloon rubbed against fur and another rubbed against plastic pellicle, there is a manifestation of attractive electrics forces.

Step6: the teacher helps students to summarize and gives them complementary information.

The positive and negative charges attract one another. They are called opposite charges .The smallest known charge of electricity is the charge associated with an electron. This charge has been called a "negative" charge. The opposite charge is called positive charge. When matters get electrons they become negatively charged. But they lost electrons they become positively charged.

Evaluation

What is electrostatic? Give any two examples of electrostatics. Describe or do any experiment on electrostatic. How to create static electricity? What are the types of electrics charges? State the attraction or repulsion laws.

	Lesson II second week	
Subject: Physics		SSII level
Measure of the electric intensities		40 minutes

Instructional materials:

Conductors wires, three bulbs, ampere meters, interrupter Conductor wires, three bulbs, ampere meters, interrupter Conductors wires, three bulbs, ampere meters, interrupter Electric apparatus, three resistors, eight conductor wires, an ammeter, 4 volt meter

Behavioral Objectives of the lesson

At the end of the lesson the students should be able:

- To state the law of electrical intensities of currents for apparatus in series
- to measure the electric potential between the electrics poles of an apparatus
- to state the law of electric intensities of currents for apparatus in derivation

Previous knowledge: The students have been taught the notion of electric current

Presentation

Introduction: The teacher asked the student to explain the concept of electric current. The teacher reminded the students that electric charges can move from one matter to another by direct contact with an electrified object or through electric conductors'. When electric charges are in motion there is a flow of electron charges called electric current.

Sequence 1: measure of electric intensities of current for apparatus arranged in a series

Step1 The teacher gave explains to the students. The positive electric borne apparatus should be related to the positive electric source of current while the negative pole is related to the negative born of the apparatus. Then the teacher asked the students to experiment as follows:

- Relate to the electric source to the three bulbs predisposed in a series.
- Regulate the potential of the electric source at 6V.
- Switch on the interrupter.
- Note the values of the intensities of the current from the source and each bulb.

Step 2 The teacher asked the students to read the intensity values and to complete the following table

I	I_1	I_2	I_3	I’

Step 3: The teacher asked the students to compare the intensities and to try to find the relationship between the intensities. The students observed that $I=I_1=I_2=I_3=I'$

Step4: The teacher asked the students to interpret the following relation $I=I_1=I_2=I_3=I'$

The students deduced that the intensity of electric current is the same at any point of circuits in which the apparatus are arranged in series.

Step 5: Students concluded that the apparatus arranged in series are traversed by the same intensity of electric current.

Sequence2: measure of the electrics intensities of currents for apparatus arranged in derivation

Step1: The teacher gave explained to the students. The positive electric borne part of the apparatus should be related to the positive electric borne of the electric source of current while the negative pole is related to the negative borne of the apparatus. Then the teacher asked the students to experiment as follow:

- Relate the electric source to the three bulbs disposed in derivation.
- Regulate the potential of the electric source at 6V.
- Bring down the interrupter.
- Note the values of the intensities of the current from the source and from each bulb.

Step 2 The teacher asked the students to read the intensity values and to complete the following table

I	I_1	I_2	I_3	I’

Step 3 The teacher asked the students to: _Add the intensities of the current I_1, I_2, I_3

- Compare the intensity I to I’ to the sum of I_1, I_2, and I_3
- Find the relation between the currents intensities I_1, I_2, I_3, I, and I’

The students observed that $I=I_1+I_2+I_3=I'$

Step4 The teacher asked the students to interpret the following relation $I=I_1+I_2+I_3=I'$

The students explained that the electric intensity in the principal branch is equal to the sum of the electric intensities in the branches derived.

Evaluation: State the law of electric intensities for apparatus arranged in a series. How can you measure the difference of electric potential between the poles of an apparatus?

	Lesson III /third week	
Subject: Physics		Class Level: SSII
Archimedes principles		40 minutes

Instructional materials: a full vase, transparent plastic vase, a dynamometer, a beaker or a bottle, a stone, a piece of wire, water

Behavioural Objectives: At the end of the lesson the students should be able:

1. To determine the push of Archimedes with the assistance of an experimental device
2. To quote the characteristics of push of Archimedes.
3. To recognize the push of Archimedes like the resultant of the whole of the compressive forces exerted by the fluid.
4. To calculate the push of Archimedes for a simple object plunged in a liquid

Previous knowledge: The students have been taught notion of force and weight

Presentation

Introduction: A solid plunged in a liquid seemed less heavy than in the free air and moved a certain volume of the liquid. Why? In this lesson we will try to explain what is really happening.

Step1 The teacher explained to the students. With dynamometer is hung a vase then connected to stone by a wire.

The teacher asked students to experiment as follow:- Connect the dynamometer to the vase and the stone, read the indication P;- immerse entirely the stone in the water in the vase full of water then fill the beaker with water; Read the new indication P' of the dynamometer;- Put the water collected in the vase placed between the dynamometer and stone and then read the indication P" of the dynamometer.

Step2: The teacher asked the students to read at each step the dynamometer indication P, P', P" by Completing the following table.

Solid	Indication of the dynamometer
In the air	P=
Immersed in water	P' =
Immersed with water displaced in the light vase	P" =

Step3: the teacher asked students: - to compare the indications P to P', the spring of the dynamometer is shortened less when the stone plunges in to the water. The indication P' is

lower than P.- Compare the difference between the indications P and P' to the weight of the displaced liquid.

The students responded by pouring the water collected in the light vase, the dynamometer indicated P again; the intensity of this force is equal to the weight of the moved liquid.

Step4: Explain why the indication P' is lower than P?

The indication P' is lower than P because water exerted on the stone a force whose direction is bottom up. Explain why by pouring the water collected in the light vase, the dynamometer indicated P again?

The intensity of this force is equal to the weight of the displaced liquid.

The teacher asked the students to determine the characteristics of the force of Archimedes

This force has as a vertical direction, its direction is bottom to the top and its intensity is equal to the weight of the displaced liquid.

Step5: The students concluded that when a solid is immersed in a liquid, the liquid exerts on the solid a force whose intensity is worth the weight of the displaced liquid and the direction opposed to that of the weight. This force is called force of Archimedes.

Evaluation: Giving the real height and the apparent force calculate the force of Archimedes. Quote the characteristics of the force of Archimedes. What is the force of Archimedes? Calculate the force of Archimedes exerted on an object immersed into $50dm^3$ of water.

	Lesson IV / Fourth week	
Subject: Physics		Class Level :SSII
Topic : pressure		Time 40 minutes

Instructional materials: Dynamometer, ruler, object of simple geometric form, - 1 plastic bottle on smooth board or; 1 basin;1 stove + tripod; 1 beaker of 450 DC; Peace of ice. Glace tube in form of U, oil, 2 pistons and some charges.

Behavioral Objectives: At the end of the lesson the students should be able:

- To determine the pressure exerted by a solid on a plane surface.
- to prove the transmission of pressure
- to explain the principle of a hydraulic press.
- to determine the relation between the pressure exerted and the surface pressed

Previous knowledge: Notion of force and determination of surface

Presentation

Introduction: The teacher asked the students to define the concept of force. Why water moved through holes? And why a plane surface became deformed when pressed by a solid object. The teacher reminded the students that a force is any action able to deform, to modify a subject in movement, to modify the movement of the object, and to maintain this object in balance.

Sequence 1: measure of pressure exerted by a solid on plane surface

Step1: The teacher asked the students to experiment as follow:

- Measure the weight of the object (parallelepiped rectangle)
- Measure the dimensions of the object
- Then compute the surfaces (the biggest the smallest and the medium)

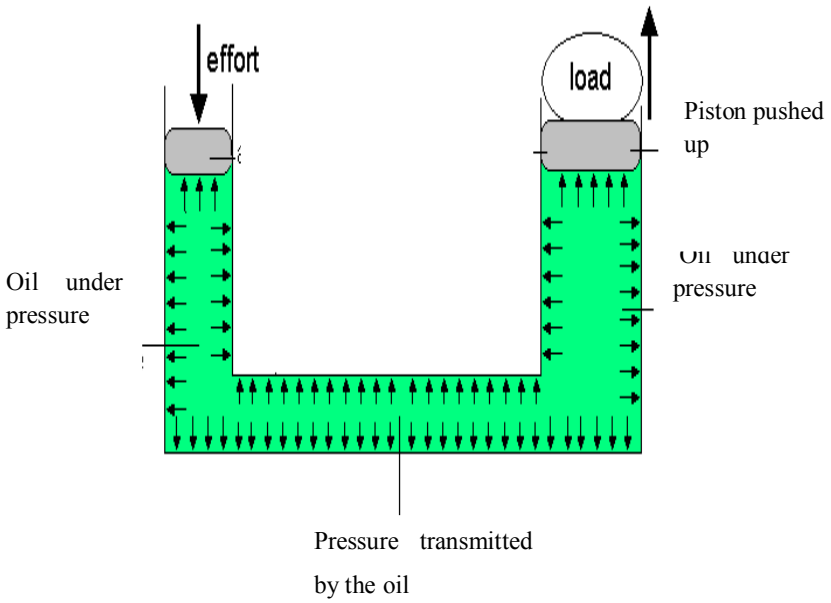
Step2 The teacher asked the students to define pressure; and to give the expression of the formula then to list the factors of the pressure?

The quotient of the force on the value of the pressed surface is called pressure. It is designed by the symbol p. The formula is P=P/S. Its unit is the Pascal which is the force exerted by a force of one Newton on a surface of $1m^2$

Step3: The pressure represented the intensity of the force exerted on each point of the surface. The pressure is proportional to the weight and inversely proportional to the surface

Sequence2 The figure shows the working of a simple model of a typical hydraulic machine.

Hydraulic machine



Step1: The teacher asked the students to experiment as follows:

- Press piston one (small)
- Note your observations.
- Then press piston two (big)
- Note your observations.

Step2 The teacher asked the students to describe what happened?

Step3 The teacher asked the students to explain the principle of the hydraulic press.

The pressure of one piston of the machine produces the movement of the second inversely.

Giving the dimensions of the object, the teacher asked the students to determine the transverse

sectional surface of the pistons; then to compare the product FS to product F'S'. The teacher observed that F.S=F'.S', the product of the big force and the big surface is equal to the product of the small force and the small surface.

Step4: The teacher asked students to Interpret the equality of the products (F.S=F'.S')

Since the two products are the same, and the big surface of the piston when compared to the small surface of the piston, the force produced by the big surface on the largest piston is much larger, i.e., a small force applied to a smaller piston produces a larger force on a larger piston.

The teacher asked the students to explain how this idea can be developed to solve the numerical problems

It is observed that F.S=F'.S' that is, giving any three of these values we can calculate the fourth one. I.e. giving the weight of one load we can find the weight which can be raised

Evaluation

What is the pressure exerted by solid on a plane surface.

What is the relationship between the pressure and the pressed surface?

Explain the principle of hydraulic press.

Show the existence of pressure on a vertical surface.

How is the pressure transmitted?

A force of 2500N is exerted on a small hydraulic press, S= $0.25m^2$ and S'=$0.75m^2$ find the weight which can be raised.

	Lesson five/ Week V	
Subject: Physics		Class Level – SSII
Variation of liquid pressure		40 minutes

Instructional materials: - Glass test-tube or water jug, Plastic funnel,- glass tube (50 cm) - Elastic membrane - Elastic bracelet (arm-band) - Flexible plastic pipe (10cm) - Water - Gas - matches. NB: all the connection can be replaced by a single pipe communicated to the funnel-1 plastic bottle;- 1 needle- 1 broad basin- Water

Behavior Objectives: At the end of the lesson the students should be able:

- To quote the two factors intervening in the pressure inside a liquid
- to measure a pressure using a pressure gauge.
- to show that the pressure varies with the height of the liquid.

Presentation

Sequence1: Variation of the pressure with the depth

Step1: the teacher asked students to experiment with the following: a tube 10 cm long - bend the remainder of tube to 15 cm of one of its ends;- connect the glass tubes to the funnel as the figure indicates ;- vary the position of the cell in the liquid and to observe the pressure gauge.

Step 2: The teacher asked students to complete the following table: Table: Variation of the pressure with the depth:

Depth(cm)					
Pressure(cm)					

Step3: The teacher asked the students to compare the different pressures and to try to find the relationship if there is any and say what they observe.

The pressure grows with the depth. It becomes small when the depth is small

Sequence2: Variation of the pressure with the nature of the liquid

Step 1: The teacher asked the students to repeat the precedent experiment, giving a fixed depth using water then changing it with oil then with alcohol. The students experimented.

Step2: The teacher asked the students to calculate the pressure for the fixed depth then to complete the following table: Table: variation of the pressure with the nature of the liquid

Liquids	Water	Oil	Alcohol
Pressure(cm)			

Step3: The teacher asked the students to compare the pressures of the different liquids for the same depth and say what they observed. For the same depth the pressure changes from one liquid to another. The denser the liquid is the higher the pressure.

Step5: The teacher concluded that the pressure depended on the depth and the nature of the liquid. The heavier the liquid is the higher the pressure. Also the deeper the liquid the higher the pressure

Evaluation: What are the two factors determining the pressure inside a liquid? State how the pressure changes with the height. Describe how to measure the pressure using a pressure gauge

	Lesson six/ Week VI	
Subject: Physics		Class Level – SSII
Topic – atmospheric pressure		Time 40 minutes

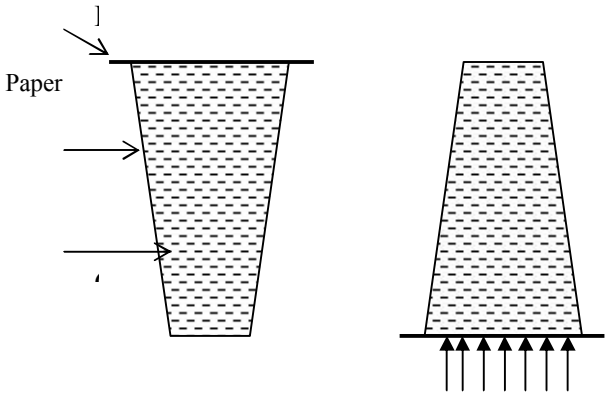
Instructional materials:- glass;- breaker leaf of paper ;- water - 1 small mineral water bottle (or small transparent bottle);- 1 tube of adhesive;- 2 basins;- 2 pieces of flexible tube;- 2 pieces of tube out of glass (or biro tubes)- Water

Behavior Objectives: At the end of the lesson the students should be able to:

- Justify the existence of the atmospheric pressure
- measure of the atmospheric pressure

Presentation

Sequence 1: The existence of the atmospheric pressure



Step1: the teacher asked the students to experiment as follows:

- To fill glass with drinking water;
- To cover the opening of the glass with paper (dim 10cm x10cm)
- To reverse the unit quickly and to observe

Step2: The teacher asked the students to observe what happened.

The students observed that the paper remained stuck against the glass

Step3: The teacher asked students to explain why the paper remained stuck against the glass?

The paper remained stuck against glass, because the atmospheric air pushes the paper against the glass. This force of pressure is opposite and stronger than the weight of the water.

Step5: The students concluded that atmospheric air pressure exists. It is strong enough not to be neglected.

Sequence 2: Application to the distribution of water in the cities

Step1: The teacher asked the students to experiment as follows:

- To drill two holes on the stopper
- Through one of the holes, pass a piece of the tube into the glass to reach half of the bottle?
- Through the other hole, insert the other piece of the tube out of glass a small length.
- Adapt the flexible tubes to the two pieces of glass tubes.
- place the flexible tube in the basin containing of water,
- Blow into the other tube before putting it in the empty basin as the diagram shows it below.

Step2: The teacher asked the students to describe what happened.

The water moved up from the basin A to the balloon then from the balloon to basin B

Step3: The teacher asked the students to explain or interpret why the water moved from the basin (A) to the balloon then from the balloon to the basin.

The difference of pressure between the atmospheric pressure and the pressure from the balloon was cause by the motion of water which moved from the basin A to the glass balloon. The water is pushed by the atmospheric pressure. Then the water is pushed by the weight and moved from the balloon to basin B.

Step5: The teacher asked the students to explain the distribution of water base, the functioning of the siphon of the preceding experiment

The teacher explained that in cities water is pumped by the pressure of the biggest piston which is a hydraulic press produces the motion of water from the water well to the reservoir. Then the water is pushed by its weight from the reservoir to all taps.

Evaluation

Give two examples showing the existence of atmospheric air pressure

Describe how to measure atmospheric pressure.