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Impact of Teaching Methods on Students Negative Attitudes towards Physics

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ABSTRACT

This research was to investigate how teacher's teaching methods can change students' negative attitudes towards physics to positive. To verify this, four hypotheses were formulated and tested. The research design was Quasi-Experimental. Data were collected using a standardized test and an attitude questionnaire. A standardized test was used to test the students after they were taught using, lecture, lecture-demonstration / performance, cooperative and inquiry teaching methods. Pre-test and post-test were administered to the four groups before and after teaching using the attitude questionnaire. Reliability factor for questionnaire on student's attitude towards physics had Cronbach's alpha coefficient of 0.80. This study was carried out in two secondary schools in Fako Division, South West Region of Cameroon. The sample of the study was made up of 41 physics students of form three. To select schools for this study, purposive sampling technique was used. The three experimental groups and one control group were taught the concepts of temperature, heat-conduction, convection and radiation for three weeks. The data collected were subjected to both descriptive and inferential statistics. The data collected were analyzed descriptively using frequencies, means and percentages. Inferentially, the data were analyzed using one-way analyses of variance, (ANOVA). The results showed that, students taught using lecture – demonstration/ performance teaching method performed best followed by those taught using cooperative teaching method and the lecture – inquiry teaching method while those taught using traditional lecture method performed last. The conclusion was that, effective teaching methods can change students' negative attitudes towards physics to positive. Based on the above findings the following recommendations were proffered; practicing physics teachers who are not professional should undergo in-service training through seminars and workshops, and physics teachers should also use appropriate teaching aids. For example, in the case of inquiry, this cannot be effectively carried out in schools where the libraries are not well stocked. Government should endeavour to equip the libraries with more physics text books and physics laboratories with equipment so that the learning experiences of the students can become more meaningful and interesting. This is because, it will enable the teachers to use the lecture-demonstration/performance, cooperative and inquiry teaching methods frequently.

INTRODUCTION

Social psychologists have noticed that people respond to objects (ideas) with different degrees of positive or negative evaluations. Responses could be affective (e.g., frown or smiling); cognitive (e.g., stating rational thoughts) or behavioural (clapping or running away). Social psychologists conceived a driving force behind these responses and name it attitude. They proceeded to measure attitude by measuring what they conceived to be the effects of it (Ajzen, 1989).

According to petty and Cacioppi (1986), attitudes are general evaluation of people and issues. To Greenwald (1989b), attitudes are pervasive, predict behaviours, are a force in perception and memory and they serve various psychological functions. Though there is an ongoing debate about the structure of attitude (Newbill, 2005), however, instructional designers have long assumed that attitude is made up of three components; a cognitive component, an emotional component and a behavioural component (Bednar and Levie, 1993; Kamradt and Kamradt, 1991). The debate of the existence of the component structure of attitude may never be completely resolved because attitudes are constructs and are therefore not directly observable (Newbill, 2005). Gagne (1979) define attitude as an internal state that influences the personal actions of an individual; he recognized attitude as a major factor in subject choice. He considers attitudes as a mental and neutral state of readiness organized through experience, exerting a directive or dynamic influence upon the individual's responses to all objects and situations with which it is related. The measurement of attitude is inextricably tangled with theoretical debate on the nature of attitude.

A plethora of research has been carried out in recent years concerning attitudes towards science and the relationship between these attitudes and science achievements (Gunger *et al*, 2007; Papanastasion and Zembylas, 2002; Reid and Skyabina, 2002). Several factors have been highlighted as main contributors to the negative attitudes that students possess towards the science subjects. These factors are related to school and science classes, the individual and even external factors relating to the status and rewards that different countries bestow into physics-based careers (Woolnough, 1994).

Attitudes of students can be influenced by the attitudes of the teacher and his method of teaching (Yara, 2009). Keeves (1992), asserted that attitudes towards science are known to decrease as students' progress through their schooling years. He further submitted that attributes such as enthusiasm, respect for the students and personality traits have been shown to influence students' attitude towards science as well as in other subjects. The implication of Keeves findings is that attention should be given to science teaching early so as to enable students have favourable disposition towards science later in life. Review of relevant literature depicts varying opinions and findings on students' attitude towards science and their performance. According to Keeves (1992) and Postlethewaite and Wiley (1991), attitudes towards science are in general highly favoured, indicating strong support for science and the learning of science. The researchers, however, concluded that there is marked decline in attitude towards science between the ten- years old and fourteen –years old levels. Greenfield (1995); Parleer, Revinue and Fraser (1996); Mullis, Bealon, Gonsale, Kelly and Smith (1998), in their findings revealed that in countries where there was an emergent thirst for industrial and technological development, there were very favourable attitudes towards science. However, in countries where a high level of technological and industrial development had been achieved, the findings showed that attitudes towards science were more neutral. When students have positive attitudes, they show positive behaviours and they fulfil their academic necessities (Ali, et.al., 2010).

Attitudes are acquired through learning and can be changed through persuasion using variety of techniques. Attitude once established, help to shape the experiences the individual has with object, subject or person. Although attitude changes gradually, people constantly form new attitudes and modify old ones when they are exposed to new information and new experiences (Adersina and Akinbobola, 2005). Students' attitudes towards science significantly alter their achievement in science (Pavol, et.al, 2007). Therefore, identification and influence of attitudes become an essential part of educational research. This study has been initiated by the idea that research in students' attitude towards science often involves science in general but particular disciplines like biology, chemistry and physics have been overlooked this can partly camouflage students' attitude because science is not viewed as a homogenous subject. This study is about students' negative attitudes towards physics and the role of an effective teacher.

When students are successful, they view the subject matter with a positive attitude because their self-esteem is enhanced. This creates a positive cycle of good performance building higher self-esteem which in turn leads to more interest in the subject and higher performance (Aleinyemi, 2009). Schunk and Hanson (1985), suggest that, the attitude of pupils is likely to play a significant part in any satisfactory explanation of variable level of performance shown by students in their school science subject. Cgunleye (1993), in his findings reports that many students develop negative attitudes to science learning, probably due to the fact that teachers are unable to satisfy their aspiration or goals. Alao (1990), showed that there is a positive correlation between attitudes and performance in science subjects.

The first stumbling block for research into attitudes towards physics is that such attitudes do not consist of a single unitary construct, but rather consist of a large number of sub constructs all of which contribute in varying proportions towards an individual's attitudes towards physics. Studies Breakwell and Beardsell (1992); Brown (1976); Crawley and Black (1992); Gardner (1975); Haladyna, et.al (1982); Koballa, (1995); Oliver and Simpson (1988); Ormerod and Duckworth (1975); Piburn (1993); Talton and Simpson (1985, 1986, 1987); Woolnough (1994) have incorporated a range of components in their measures of attitudes to science and physics in particular which include; the perception of the science teacher; anxiety towards science; the value of science ; self-esteem at science ; motivation towards science ; enjoyment of science ; attitudes of peers and friends towards science ; attitudes of parents towards science ; the nature of the classroom environment; achievement in science ; and fear of failure on subject.

The second stumbling block towards assessing the significance and importance of attitudes is that they are essentially a measure of the subject's expressed preferences and feelings towards an object. This study is to find out how teaching methods can influence students' negative attitudes towards physics.

STATEMENT OF THE PROBLEM

This researcher carried out a study on students' attitudes towards physics and its effects on their academic achievements in all the six Divisions of the South West Region of Cameroon in 2009. A Likert survey questionnaire was used. The simple random sampling technique was used to obtain the sample of the study which consisted of 1167 students in all the co-educational high schools offering Advanced Level Physics. Data collected were analyzed using the Chi-square test of independence and the major finding was that most students have negative attitudes towards physics and this has negative effects on their academic achievement.

Physics is one of the most problematic areas within the realm of science, and it traditionally attracts fewer students than chemistry, biology and other science subjects (G.C.E ordinary level results booklets, 2020). Exploratory research has revealed that one of the reasons while students develop negative attitudes towards physics is the way it is taught and that students' positive attitudes towards physics highly correlate with their achievement in physics. (Craker, 2006; Normah & Salleh, 2006; Hough & Piper, 1982; Long, 1981; Newble, 1998; Ajzen & Fishbein ,2000; Wilson, *et al*. 2000 and Gonen &Basaran , 2008). Attitudes, whether positive or negative, affect learning in science and physics in particular. However, it is well known that a negative attitude towards a certain subject makes learning or future learning difficult. Therefore, helping students develop positive attitudes towards physics is an important step in physics education.

Demystification of physics requires that teachers vary their teaching methods because, a one-size lesson fits all usually does not fit all the students because of the fact that they have different learning styles. It because of the above reasons that this researcher wants to find out whether, lecture – demonstration – performance, inquiry – teaching method, cooperative teaching method can change students negative attitudes towards physics to positive.

THEORETRICAL REVIEW

This study was guided by Gagne's (1979)theory of instruction and Muzafer and Hovland (1961) theory of attitude change.

Robert Gagne's theory of instruction has provided a great number of valuable ideas to instructional designers, trainers, and teachers. Driscoll (1994) breaks Gagne's theory into three major areas - the taxonomy of learning outcomes, the conditions of learning, and the events of instruction. This study is focused on each of these three areas while briefly describing the theory of instruction. This study attempts to turn this theory "back upon it" while examining the strengths and weaknesses of its various assumptions. As previously explained Gagne's theory of instruction is commonly broken into three areas. The first of these areas that will be discussed is the taxonomy of learning outcomes. Gagne's taxonomy of learning outcomes is somewhat similar to Bloom's taxonomies of cognitive, affective, and psychomotor outcomes (some of these taxonomies were proposed by Bloom, but actually completed by others in 1956). Both Bloom and Gagne believed that it was important to break down humans' learned capabilities into categories or domains. Gagne's taxonomy consists of five categories of learning outcomes - verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills. Gagne, et.al (1992) explain that each of the categories leads to a different class of human performance. Essential to Gagne's ideas of instruction are what he calls "conditions of learning." He breaks these down into internal and external conditions. The internal conditions deal with previously learned capabilities of the learner. Or in other words, what the learner knows prior to the instruction. The external conditions deal with the stimuli (a purely behaviourist term) that are presented externally to the learner. For example, the type of instruction that is provided to the learner.

To tie Gagne's theory of instruction together, he formulated nine events of instruction. When followed, these events are intended to promote the transfer of knowledge or information from perception through the stages of memory. Gagne based his events of instruction on the cognitive information processing learning theory. The way Gagne's theory is put into

practice is as follows. First of all, the instructor determines the objectives of the instruction. These objectives must then be categorized into one of the five domains of learning outcomes. Each of the objectives must be stated in performance terms using one of the standard verbs (i.e., states, discriminates, classifies, etc.) associated with the particular learning outcome. The instructor then uses the conditions of learning for the particular learning outcome to determine the conditions necessary for learning. And finally, the events of instruction necessary to promote the internal process of learning are chosen and put into the lesson plan. The events in essence become the framework for the lesson plan or steps of instruction. Changing students' negative attitudes to positive towards physics will require that teachers apply this Gagne's theory in their teaching – learning process.

Another important theory guiding this study is the theory of attitude change developed by Muzafer and Hovland (1961). As its name suggests, it is a model of judgement, which means that it declares that the audience interprets (judges) a message. Specifically, a listener judges how much the message agrees or disagrees with his or her own attitude. Second, Social Judgement/Involvement theory holds that a listener's involvement in the topic of the persuasive message -- that is, how important a topic is to a listener -- is an important factor in attitude change. In the fifth century, Pythagoras was a Greek sophist, or travelling teacher. He rebelled against the idea that there were absolute truths. Instead, he declared (in the gender-biased language of the time) "Man is the measure of all things" (Schiappa,1991). Two friends can see the same movie and one will like it and the other will hate it. And two people can hear the same persuasive message but have quite different reactions to it. Social Judgement/Involvement theory explains how two people can react so differently to the same message.

When this researcher uses this theory during teaching in class, the researcher brings three buckets of water: hot, cold, and room temperature. Two students are asked to volunteer to participate in a "science experiment." One is asked to put his or her hand into the hot water and the other places his or her hand into the cold water -- but they aren't told anything about the temperature of the water in any of the three buckets. They are then asked to put their hands into the third bucket of tap water at the same time and then describe the temperature of the water in the third bucket. What do you think happens? The student whose hand was in the hot water says, "cool" while the student whose hand was in the cold water says, "warm." These students both put their hands into the same bucket of water, yet they described it differently. The reason they gave different answers is that they had different comparison points or anchors. The water felt warm to the student whose hand had just been in the cold water (this is his anchor point), and that water felt cool to the student whose hand had just been in the hot water (This is his own anchor point). This process is just what Social Judgement/Involvement theory says happens when people hear or read a persuasive message. Each listener or reader judges the main idea of the message, how much it agrees or disagrees with him or her, by comparing the message with his or her anchor point, which in Social Judgement/Involvement theory is his or her existing attitude on the message topic.

If the researcher really wanted to know the temperature of the water in the three buckets, a thermometer would have been used. This is a simple device that accurately and objectively measures temperature. It could easily tell us that the water in one bucket was 10 degrees, the other was 40 degrees, and the last was 25 degrees. However, we do not have any such thing as a "message thermometer." We have to make judgments about how much a message agrees or disagrees with us because there is not accurate or objective way to measure message position. Social Judgment/Involvement theory holds that the process of judging or perceiving the position of a message is important to understanding how persuasion works.

The key point of the social judgment theory is that, attitude change (persuasion) is mediated by judgmental processes and effects. Put differently, persuasion occurs at the end of the process where a person understands a message then compares the position it advocates to the person's position on that issue. A person's position on an issue is dependent on:

- the person's most preferred position (his anchor point),
- the person's judgement of the various alternatives (spread across his latitudes of acceptance, rejection, and no commitment), and
- the person's level of ego-involvement with the issue(Muzafer, and Carl 1980).

To change an attitude, the first step is to judge how close or far away one's position is. The next step is to shift one's position in response to the argument made. We adjust an attitude once we have judged a new position to be in our latitude of acceptance (Muzafer, and Carl 1980). If we judge that message to be in our latitude of rejection, we will also adjust our attitude, but in the opposite direction from what we think the speaker is advocating. Sometimes an attitude change may be incidental. In the boomerang effect, an attitude changes in the opposite direction from what the message advocates - the listener is driven away from rather than drawn to an idea. A major implication of social judgement theory is that persuasion is difficult to accomplish. Successful persuasive messages are those that are targeted to the receiver's latitude of acceptance and discrepant from the anchor position, so that the incoming information cannot be assimilated or contrasted. The receiver's ego-involvement must also be taken into consideration (Muzafer, and Carl, 1965). This

suggests that even successful attempts at persuasion will yield only small changes in attitude. We know that effective teachers produce the desire learning outcome. For a teacher to be effective, he/she must vary his/her teaching methods. It against this background that this study investigated the relationship between this parameter and student's attitudes towards physics so as to find out how this quality can change student's negative attitudes towards physics to positive.

REVIEW OF RELATED LITERATURE

When parents send a child to school, they expect the teachers to educate him or her. By education, it is meant to train the child whole being, helping his or her mind, body and personality to grow to the full. Therefore, the aim of education is to help the child to develop as well as possible mentally, physically, morally, socially and emotionally. To do these, there are usually curricula on the various school subjects. The teachers are expected to prepare their lesson notes as guides since they cannot give a good lesson unless it has been well prepared. Also, the teacher must decide on the best method(s) for the lesson to be delivered that would enable the students develop positive attitudes towards the subject.

One of the objectives of physics education is to develop students' interest in physics, as today's society depends largely on development in physics and its application called technology. Teachers are expected to devise ways of making their students to develop positive attitudes towards physics and science-related disciplines. This can only be achieved when the correct teaching methods are used. However, the superiority of any one method of teaching for all learning situations has not been established by research. There is much evidence to show that a variety of methods and procedures improves the teaching-learning situation and hence students' attitude towards the subject-Physics. Thus, teachers need to draw upon a variety of teaching methods so as to improve on students' attitudes towards physics.

The poor performance of students in physics has assumed a dangerous dimension. In the light of this, physics educators need to seek suitable ways of tackling the current mass failure if they are to halt the drifts of students to arts and social science subjects (CGCE Results, 2020). The relevance and importance of physics amongst the science subjects is formidable, hence the need for proper teaching of the subject in the secondary schools so that students' scores in internal and external examinations will be high, thereby making the candidates' entrance into higher schools easier. According to Onwu (1981) teachers of physics are expected to make physics more relevant, enjoyable, easy and meaningful to students. Teaching methods need to be improved as the teaching- learning situation may demand. Teaching methods such as inquiry, lecture-demonstration, lecture - demonstration and performance, cooperative or group learning, and project, have been recommended for the teaching of science in schools (Mcdonald and Nelson, 1954; Webb, 1982; Rogus, 1985; Adedoyin, 1990; Ajewole, 1991, Newcomb *et al*., 199). There is however the need to understand that for different topics in science especially physics; the teaching approaches may differ depending on the complexity and structure of the topics. Teachers should be concerned with the use of variety of teaching methods. The most enjoyable aspect of teaching and learning can occur when a variety of teaching methods are used. This study assessed and compared the relative effectiveness of four teaching methods for teaching of physics that can lead to positive improvement in students' attitudes towards physics. These methods are; Lecture method, Lecture – Demonstration and Performance, Inquiry – Teaching Method and Cooperative Teaching Method.

The lecture method is used primarily to introduce students to a new topic, but it is also a valuable method for summarizing ideas, showing relationships between theory and practice, and re-emphasizing main points. The lecture method is the most widely used form of presentation. Every instructor should know how to develop and present a lecture. They also should understand the advantages and limitations of this method. Lectures are used for introduction of new subjects, summarizing ideas, showing relationships between theory and practice, and reemphasizing main points. The lecture method is adaptable to many different settings, including either small or large groups. Lectures also may be used to introduce a unit of instruction or a complete training program. Finally, lectures may be combined with other teaching methods to give added meaning and direction.

The lecture method of teaching needs to be very flexible since it may be used in different ways. For example, there are several types of lectures such as the illustrated talk where the speaker relies heavily on visual aids to convey ideas to the listeners. With a briefing, the speaker presents a concise array of facts to the listeners who normally do not expect elaboration of supporting material. During a formal lecture, the speaker's purpose is to inform, to persuade, or to entertain with little or no verbal participation by the students. When using a lecture method, the teacher plans and delivers an oral presentation in a manner that allows some participation by the students and helps direct them toward the desired learning outcomes.

A lecture-demonstration method is a teaching technique that combines oral explanation with "doing" to communicate processes, concepts, and facts. It is particularly effective in teaching a skill that can be observed. A skilled educator may wish to both tell and show what steps to take in an educational process. A

demonstration is usually accompanied by a thorough explanation, which is essentially a lecture.

Lecture – Demonstration – Performance method of teaching is based on the simple, yet sound principle that we learn by doing. Students learn physical or mental skills by actually performing those skills under supervision. An individual learns to write by writing, to weld by welding, and to fly an aircraft by actually performing flight manoeuvres. Students also learn mental skills, such as speed reading, by this method. Skills requiring the use of tools, machines, and equipment are particularly well suited to this instructional method.

The lecture-demonstration-performance method is widely used. The science teacher uses it during laboratory periods, the aircraft maintenance instructor uses it in the shop, and the flight instructor uses it in teaching piloting skills. In the lab physics teachers use it for example, to demonstrate the basic law of magnetism which states that like poles repel while unlike poles attract. Explanations must be clear, pertinent to the objectives of the particular lesson to be presented, and based on the known experience and knowledge of the students. In teaching a skill, the teacher must convey to the students the precise actions they are to perform. In addition to the necessary steps, the teacher should describe the end result of these efforts. Before leaving this phase, the teacher should encourage students to ask questions about any step of the procedure that they do not understand.

The teacher must show students the actions necessary to perform a skill. As little extraneous activity as possible should be included in the demonstration if students are to clearly understand that the teacher is accurately performing the actions previously explained. If, due to some unanticipated circumstances the demonstration does not closely conform to the explanation, this deviation should be immediately acknowledged and explained.

Because these two phases, which involve separate actions, are performed concurrently, they are discussed here under a single heading. The first of these phases is the student's performance of the physical or mental skills that have been explained and demonstrated. The second activity is the teacher’s supervision. Student performance requires students to act and do. To learn skills, students must practice. The teacher must, therefore, allot enough time for meaningful student activity. Through doing, students learn to follow correct procedures and to reach established standards. It is important that students be given an opportunity to perform the skill as soon as possible after a demonstration. In flight training, the teacher may allow the student to follow along on the controls during the demonstration of a manoeuvre. Immediately thereafter, the teacher should have the student attempt to perform the manoeuvre, coaching as necessary. In another example, students have been performing a task, such as a weight and balance computation, as a group. Prior to terminating the performance phase, they should be allowed to independently complete the task at least once, with supervision and coaching as necessary.

In this phase, the teacher judges student performance. The student displays whatever competence has been attained, and the teacher discovers just how well the skill has been learned. To test each student's ability to perform, the teacher requires students to work independently throughout this phase and makes some comment as to how each performed the skill relative to the way it was taught. From this measurement of student achievement, the teacher determines the effectiveness of the instruction.

Obviously, the aviation teacher is the key to effective teaching. An experienced teacher’s knowledge and skill regarding methods of instruction may be compared to a maintenance technician's toolbox. The teacher’s tools are teaching methods. Just as the technician uses some tools more than others, the teacher will use some methods more often than others. As is the case with the technician, there will be times when a less used tool will be the exact tool needed for a particular situation. The teacher’s success is determined to a large degree by the ability to organize material and to select and utilize a teaching method appropriate to a particular lesson.

Inquiry Teaching (sometimes known as the inquiry method) is a student-centered method of education focused on asking questions. Students are encouraged to ask questions which are meaningful to them, and which do not necessarily have easy answers; teachers are encouraged to avoid giving answers when this is possible, and in any case to avoid giving direct answers in favour of asking more questions. The method was advocated by Neil Postman and Charles Weingartner in their book teaching as a Subversive Activity (1990, p. 34–37).

Teacher adhering to the inquiry method in pedagogy must behave very differently from a traditional teacher. Postman and Weingartner suggest that inquiry teachers have the following characteristics (1990):

- They avoid telling students what they "ought to know".
- They talk to students mostly by questioning, and especially by asking divergent questions.
- They do not accept short, simple answers to questions.
- They encourage students to interact directly with one another, and avoid judging what is said in student interactions.
- They do not summarize students' discussion.
- They do not plan the exact direction of their lessons in advance, and allow it to

develop in response to students' interests.
- Their lessons pose problems to students.
- They gauge their success by change in students' inquiry behaviors.

Inquiry is a style or method of teaching where the learner with minimum guidance from the teacher seeks to discover and create answers to a recognized problem through procedure of making a diligent search (Callahan & Clark, 1977; Adedoyin, 1990). Inquiry is a term used in science teaching that refers to a way of questioning, seeking knowledge or information, or finding out about phenomena. It involves investigation, searching, defining a problem, formulating hypothesis, gathering and interpreting data and arriving at a conclusion. In inquiry situation, students learn not only concepts and principles but self-direction, responsibility and social communication. It also permits students to assimilate and accommodate information. Inquiry is the way people learn when they're left alone. The lecture method is used primarily to introduce students to a new subject, but it is also a valuable method for summarizing ideas, showing relationships between theory and practice, and re-emphasizing main points.

To summarize, inquiry-based teaching is helpful for students to construct their own meaning and understanding and to gain some important skills that they can use throughout their lives. Therefore, physics teachers should encourage inquiry-based learning among students and create opportunities for them to conduct inquiry about a particular problem or issue. The main setback is the lack of ICT tools in most of the schools in the Southwest Region Cameroon.

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. Numerous research studies in diverse school settings, and across a wide range of subject areas, indicate promising possibilities for academic achievement with this strategy. For example, advocates have noted that students completing cooperative learning group tasks tend to have higher test scores, higher self-esteem, improved social skills, and greater comprehension of the subjects they are studying. Numerous other benefits for students have been attributed to these programs. Perhaps the most significant characteristic of group learning is that it continually requires active participation of the student in the learning process.

Encouraging students to work or co-operate with each other in constructing their own understanding has been a highly valued principle of effective teaching in science (Slavin, 1990; Kagan, 1992& Munro, 1999). The popularity of co-operative learning rose rapidly during the early 1980s as the use of individualistic 'mastery learning' declined (Jones & Carter, 1998). Educators realized that the motivational and mediating impact of peer-peer interactions was the missing part of the individualized mastery instruction. Therefore, educators viewed co-operative learning to be a more efficient way of meeting the range of needs of students in a science classroom.

Theoretical foundations of co-operative learning have been strongly affected by Vygotsky's ideas about learning. Vygotsky (1928) indicates that learners do not construct knowledge in isolation but through social interaction with their peers and thus, the interactions among learners affect each other's learning. This implies that working with other students is a critical component of the process of knowledge construction. Therefore, social constructivist views imply a social context where ideas and conceptions are communicated, shared, tested, negotiated, and reported by students and the teacher (Vygotsky, 1928; Tobin *et al,* 1990; Driver, Asoko, et.al 1994). Consequently, the prevailing view of learning in science has been a social constructivist perspective (Solomon, 1993; Yager, 1995; Jones & Carter, 1998; Tytler, 2002a). Social constructivist views put a great emphasis on language and communication.

This suggests that students need to talk with their peers and teacher in order to articulate their prior ideas about a concept and their explorations made in an investigation, to clarify their thinking and to correct their misconceptions (Driver *et al,* 1994; Watts, 1994; Osborne, 1997). Classroom-based research suggests that students can meet these aims in co-operative learning groups (Jones & Carter, 1998). Co-operative learning groups promote community aspects of the classroom and the role of discussion with peers in helping students to learn science. This offers many benefits for students for their learning and growth. For example, peer-peer discussions in co-operative learning groups can promote meaningful learning by helping learners to help each other to incorporate new experiences and information into their existing cognitive structures in a non-arbitrary and non-verbatim way (Ausubel, 1968; Novak & Gowin, 1984; Mintzes & Wandersee, 1998). Therefore, it is believed that co-operative learning can foster the development of deep understanding (Spitulnik, et.al, 1998; Joyce *et al*, 2000a).

In co-operative learning groups, peers can moderate each other's learning in ways that are distinctively different from the teacher's methods (Jones and Carter, 1998). As students are at similar developmental levels (Piaget, 1960 & Vygotsky, 1928), they can sometimes be more effective than adults in helping individuals to construct meaning. In other words, since they generally use similar words and terms while speaking, peers can understand each other's talk and explanations more easily. For example, a peer may help a confused student by rewording the teacher's

explanation. Co-operative learning groups are useful contexts for promoting productive discussions among students (Kagan, 1992; Osborne, 1997; Johnson *et al,* 1998), providing an environment free of some of the social pressures of teaching science with the teacher (Abrams, 1998). Students may have the opportunity to reveal their existing ideas and clarify them, ask questions and challenge each other's ideas and provide rich interactions for creating connections among concepts (Spitulnik *et al,* 1998). Such discussions may create a pool of students' ideas and productive arguments over disagreements. As a result, the exchange of ideas in small groups may promote the development of complex conceptions (Millar &Driver, 1987).

Furthermore, effective co-operative learning groups can provide an opportunity for students to give and receive feedback from other students regarding their understanding (Brown, 1994 & Joyce *et al*, 2000a, 2000b). Consequently, students can learn from each other and develop a shared understanding of the topics they are learning. Sharing diverse experiences enriches a group's problem solving and creativity skills (Jones &Carter, 1998). Moreover, seeing that others' views can enrich and help their thinking can encourage students to tolerate and accept alternative points of view as well (Abrams, 1998). In addition, group members benefit from each other's existing competencies and skills (Jones & Carter, 1998). For example, a student who already knows how to handle a thermometer, a balance or other science laboratory tools can help other members' in knowledge construction and skills development. Overall, because of these benefits, numerous studies in very diverse school settings and across a wide range of content areas have reported that co-operative learning can positively increase students' achievement and develop their skills and attitudes towards the subject being studied (Sharan & Shacher, 1988; Slavin, 1990; Kagan, 1992; Stahl, 1994; Osborne, 1997 & Johnson *et al*, 1998). For example, Sharan & Shacher (1988) reported that students with poor achievement taught by using a group investigation method throughout a year-long course in social studies achieved average gains nearly two and a half times those of the lower achievement students taught by the whole-class method. In fact, they scored more highly than the higher achieving students taught with whole-class method. These can be explained by the fact that the shared responsibility and interaction produce more positive feelings toward tasks and others, generate better inter-group relationships and result in better self-images for students (Joyce *et al,* 2000b). This usually lead to positive attitudes towards the subject.

However, co-operative learning requires teachers to carefully plan tasks and to closely monitor students' access to power and authority within the group, which can vary according to a myriad of factors including gender, race, personality and socio-economic status. Without careful planning and monitoring, despite its wide advantages, co-operative learning can be of little help to the learner (Jones & Carter, 1998), as it can isolate and restrict a group member's access to the materials, ideas and peer assistance. Physics teachers should encourage cooperative learning in their classrooms because this will lead to significant improvement in the academic achievement and positive attitudes of their students toward physics.

RESEARCH METHODOLOGY

This study used quasi experimental design. In the quasi experimental, three experimental groups were used with one control group. These groups were; Lecture-demonstration-performance teaching method, n = 10; Cooperative teaching method, n = 10; Inquiry teaching method, n= 10 and control group using lecturer method, n =11. The instruments utilized for the study were a students' attitudes questionnaire and a standardized test adapted from demonstration in teaching physics designed by Svedružic (2006).

The two instruments were adapted from some standardized ones. The questionnaire for form three students' evaluation of teacher's effectiveness was adapted from perceptions of 'good' college teaching and student evaluation of teachers designed by Nasser (2011). The second was adapted from Physics students Attitude Questionnaire, designed by Hasan and Uğur, (2011). The items in these instruments were rearranged and reframed so as to make them fit well with the specific objectives of this study. The questionnaire consisted of five option Likert Scale type of statements in which the students had to indicate their degree of agreement by choosing either strongly agreed (SA), agree(A), Undecided (UD), disagree(D) or strongly disagree (SD) for each of the statements by ticking his/her chosen option corresponding to each statement

This study assessed and compared the relative effectiveness of four teaching methods by teaching the students the concepts of temperature, internal energy, heat-conduction, convection, and radiation. A pre-test post-test experimental design with a control group was used. A total of forty-one students were involved in the study. The research instruments developed for the study were thirteen item Students Attitudes towards Physics Questionnaire (SAPQ) and a standardized test on the physics concepts taught. The students were divided into three experimental groups and one control group. Students in the three experimental groups were subjected to treatment using lecture - inquiry, lecture-demonstration/performance and cooperative teaching methods respectively while the students in the control group were taught using the traditional lecture method. The pre-test was administered to students in all the four groups before teaching started and after the teaching, a

post-test was administered using the same attitude questionnaire.

In most classrooms around the country today, teachers lecture and give notes to students. The students are then tested on what they have learned. However, experiential or "hand-on" teaching is fast replacing or supplementing the traditional lecture method in the world today. This is because, through experiments, demonstrations and other participatory activities, Students discover concepts on their own. Experiential learning increases retention, motivate students to learn and encourage peer or group cooperation.

According to Hendrickson, attitudes are the best predictor for estimation of students' success (Hendrickson, 1997). Activities must be planned, organized and implemented so that students may develop more positive attitudes (Pintrich, 1996). As a science, Physics plays an important role in explaining the events that occur in the universe. In all events that are around us can be found physical laws and principles. Although physics is in every area in our life and facilitate our lives, national and international studies show that success in physics education is lower than other disciplines (Gok and Silay 2008; Dieck 1997; Rivard and Straw 2000, Mattern and Schau, 2002). In physics education, various methods and techniques can be used according to the content. Laboratory method, which are the mostly used method that provides permanent learning, is an educational method encouraging mental activities and allowing students to work individually or in groups (Stack, 1995). Laboratory method ensures that students learn ways to use the knowledge with this method rather than memorizing it. Students improve their skills to better understand concepts, and adapt them to daily life as well as their personal skills, and it provides a positive attitude towards physics lessons (Algan, 1999 and Stack, 1995)

Hypotheses of the Study

The following four hypotheses guided this study;

- The first null hypothesis states that, there is no significant relationship between lecture – demonstration – performance on students' attitudes towards physics while the alternative hypothesis states that there is a significant relationship between lecture – demonstration – performance on students' attitudes towards physics
- The second null hypothesis states there is no significant relationship between inquiry – teaching method and students' attitudes towards physics while the alternative hypothesis states that there is a significant relationship between inquiry – teaching method and students' attitudes towards physics
- The third null hypothesis states that there is no significant relationship between cooperative teaching method and students' attitudes towards physics while the alternative hypothesis states that there is a significant relationship between cooperative teaching method on students' attitudes towards physics
- The fourth null hypothesis states that there is no significant relationship between lecture method and students' attitudes towards physics while the alternative hypothesis states that there is a significant relationship between lecture method and students' attitudes towards physics

ANALYSIS AND RESULTS

Table 1: Shows the means scores of the students after they were taught using; lecture – demonstration/ performance, cooperative teaching method, lecture- inquiry teaching method and traditional (lecture) teaching method.

	lecture – demonstration/ performance	cooperative teaching method	lecture- inquiry teaching method	Traditional (lecture) teaching method
Mean	15.8	14.3	12.8	9.6

This means that students taught using lecture – demonstration/ performance teaching method performed best followed by those taught using cooperative teaching method and the lecture – inquiry teaching method while those taught using traditional lecture method performed last.

Table 2: Summary of the processed data for calculating analysis of variance of mean scores of the test administered to the four groups.

Source of variation	Sum of squares	Degree of freedom	Measuring of squares (variance)	F - value
Between group major	220.1	3	73.37	
Within group (error)	95.8	37	2.59	**28.3**
Total	**315.9**	**40**		

Analysis of the individual items for the responses of students in the experimental groups before and after they were taught

Item 1: I like physics more than other subjects.
Before the teaching, all the 30 (100%) students disagreed. But after the teaching 25 (83.33%) agreed. This change of mind showed a positive attitude toward physics as compared to other subjects.

Item 2: Working with physics equipment during physics lessons is very interesting.
The entire student body did not response to any of the options probably because the teacher was not using equipment from the lab during his lectures. But after teaching them using the three teaching methods, all the students 30 (100%) agreed that working with physics equipment during physics lessons is very interesting.

Item 3: Physics is a simple subject. All the students 30 (100%) disagreed. But after the teaching, 28 (93.33%) of the students had a change of mind. That is, agreed that physics is a simple subject.

Item 4: I hate my physics teacher's attitude 20 (66.67%) students agreed, but after the teaching all the 30 (100%) disagreed. That is, were of the option that they like their physics teacher's attitude.

Item 5: I have a better understanding of practical physics. All the respondents avoided this statement. But after the teaching all the students 30 (100%) agreed that they have a better understanding of practical physics.

Item 6: I don't see physics relevance to everyday life and society. 21 (70%) students agreed but after the teaching all the students 30 (100%) disagreed. That is, the entire student agreed that physics has a relevance to everyday life and society.

Item 7: I would like to make a career in physics or field related to physics. Only five students(16.7%) disagreed. But after teaching 24 (80%) agreed that they will like to make a career in physics or field that is related to physics.

Item 8: I entertain fear when my physics teacher enters the class. 21 (70%) agreed while 9 (30%) disagreed. But after the teaching 27 (90%) disagreed. This means that the teachers' teaching method enable more students not to be affair when the teacher is entering the class. May be the few that still had fear had perceived ideas about the subject and teacher of physics.

Item 9: Teachers in other departments are better than the ones in the physics department.
Before the teaching, twenty five students (83.3%) agreed that teachers in other departments are better than the ones in the physics department. After the teaching was done, the 30(100%) students rejected. That is, disagreed that the teachers in other departments are better than the ones in the physics department.

Item 10: My physics teacher lacks innovation, encouragement and resourcefulness 20 (66.67%) agreed that their physics teachers lack innovation, encouragement and resourcefulness. But after the teaching, all the 30 (100%) students disagreed. That is, did not accept or rejected the statement.

Item 11: It is difficult to ask our physics teacher questions based on the content taught 18 (60%) students agreed but after the teaching, all the thirty students (100%) disagreed.

Question 12: Physics questions are too difficult to answer 17 (56.67%) students agreed that Physics questions are too difficult to answer. But after the teaching, all the thirty students disagreed. That is, the 17 students now had a change of mind

Item 13: My physics teacher teaching method has caused me to develop negative attitude towards physics. All the 30 students (100%) agreed that their physics teacher has caused them to develop negative attitudes towards physics. But after the teaching, all the 26 students (86.7%) disagreed. That is, the 26 students now had a change in mind.

Analysis of the individual items for the responses of students in the control group before and after they were taught using the lecture method

Item 1: I like physics more than other subjects.
Before the teaching, all the 11 (100%) students disagreed. After the teaching there was still no change in mind.

Item 2: Working with physics equipment during physics lessons is very interesting.
The entire student body did not response to any of the options before after they were taught using the lecture.

Item 3: Physics is a simple subject. All the students 11 (100%) disagreed even after the teaching.

Item 4: I hate my physics teacher's attitude 4 (36.36%) students agreed while the rest disagreed, but after the teaching 11 (100%) disagreed. That is, all were of the option that they like their physics teacher's attitude.

Item 5: I have a better understanding of practical physics. All the respondents avoided this statement even after teaching was done.

Item 6: I don't see physics relevance to everyday life and society. 8(72.72%) students agreed but after the teaching 6(54.54%) disagreed.

Item 7: I would like to make a career in physics or field related to physics. Only two students agreed even after the teaching was done.

Item 8: I entertain fear when my physics teacher enters the class. All the 11 (100%) agreed. But after the teaching 4 (36.36%) disagreed.

Item 9: Teachers in other departments are better than the ones in the physics department.
Before the teaching, ten students (90.91%) agreed that teachers in other departments are better than the ones in the physics department. After the teaching was done all the 11(100%) students rejected. That is, disagreed that the teachers in other departments are better than the ones in the physics department.

Item 10: My physics teacher lacks innovation, encouragement and resourcefulness 8 (72.72%) agreed that their physics teachers lack innovation, encouragement and resourcefulness. But after the teaching, all the 11 (100%) students disagreed. That is, did not accept or rejected the statement.

Item 11: It is difficult to ask our physics teacher questions based on the content taught all the students agreed but after the teaching, all the eleven students disagreed.

Question 12: Physics questions are too difficult to answer 11 (100%) students agreed that Physics questions are too difficult to answer. But after the teaching, only two students disagreed. That is, only two students now had a change of mind.

Item 13: My physics teacher has caused me to develop negative attitude towards physics.
11 (100%) students agreed that their physics teacher has caused them to develop negative attitudes towards physics. But after the teaching, only three students disagreed. That is, three students now had a change in mind.

CONCLUSION

One – way analysis of variant (ANOVA) was used to compare the relative effectiveness of the four teaching methods used. The calculated F – value (28.3) was greater than the critical value (2.9) at 0.05 level of significant. As a result, the null hypotheses were rejected and the alternative hypotheses upheld following the decision rule. Inference made lead to the conclusion that there is a significant relationship between teacher teaching method and students' attitude towards physics. Appling the response format and weighting, on the item (My teacher teaching method has enabled me to develop negative attitude towards physics). 86.7 % agreed that their physics teacher teaching method has enabled them to develop negative attitudes towards physics. This shows that the relationship is high following the decision rule.

All the students in the experimental groups had a change in attitude after participating in the lessons that were taught using inquiry, cooperative and lecture - demonstration/ performance teaching methods. It is generally believed that students' attitude towards a subject determines their success in that subject. In other words, favourable attitude result to good achievement in a subject. A student's constant failure in a school subject in particular can make him/her to believe that he/she can never do well on the subject thus accepting defeat. On the other hand, his successful experience can make him to develop a positive attitude towards learning the subject. This suggests that student's attitude towards physics could be enhanced through effective teaching strategies. It has in fact been confirmed that effective teaching strategies can create positive attitude on the students towards school subjects Bekee (1987), Balogun and Olarewaju (1992), Akinsola (1994), Akale (1997) and Olowojaiye (1999, 2000). Attitudes are psychological constructs theorized to be composed of emotional, cognitive, and behavioural components. Attitudes serve as functions including social expressions, value expressive, utilitarian, and defensive functions, for the people who hold them (Newbill, 2005). To change attitudes, the new attitudes must serve the same function as the old one. Instructional designers can create instructional environments to effect attitude change. In the greater realm of social psychology, attitudes are typical classified with affective domain, and are part of the larger concept of motivation (Greenwald, 1989d). Attitudes are connected to Bandura's (1977) social cognitive learning theory as one of the personal factors that affect learning (Newbill, 2005).

However, there was no significant change in attitude after the students in the control group were taught using the traditional (lecture) teaching method. These findings are also supported by other researchers. For example, Festus (2007), stated that performance appears general to be fundamental goal behind every life struggle, but the positive platform has consequential effects of improving the worth of the learners and can only be achieved through acquisition of positive learning attitudes. The attitudes of a student trigger his/her behaviour. Attitudes are antecedents which serve as inputs or stimuli that trigger actions. Wilson and Soyibo (1985) in their study reported that students' positive attitudes to science correlate highly with their science achievement. The results of this study show very clearly that teaching method is a significant determinant of students' attitudes towards physics. These teaching methods should be encouraged in order that students can develop researching, questioning, critical thinking, problem solving and decision making skills, so that they become lifelong learning individuals.

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