EFFECT OF COOPERATIVE LEARNING ON STUDENTS' ACHIEVEMENT AND RETENTION IN ELECTRICAL WORK MAINTENANCE IN GOVERNMENT TECHNICAL COLLEGE

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CERTIFICATION

I, AJAYI TOLULOPE MARY MATRIC N: 2007/1/27254BT an undergraduate student of the department of industrial technology education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other university.

_____ _____

Name Signature and Date

APPROVAL PAGE

This project has been read and approved as meeting the requirements for the award of B. Tech Degree in Industrial and Technology Education of the Department of Industrial and Technology Education, School of Science and Science Education, Federal University of Technology, Minna.

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DEDICATION

This research work is dedicated to God Almighty and to my loving parents Mr. and Mrs. Ajayi for their untiring effort in watering the seedling that has now grown into a fruit bearing tree, the size and taste of whose fruit awaits the testimony of time.

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AJAYI TOLULOPE M

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ABSTRACT

The research was designed to study effect of cooperative learning on achievement and retention of electronic work students in Government Technical College, Niger state. The major purpose of this study is to determine the difference in mean achievement scores between the students taught with cooperative learning and those taught with Conventional method in electrical work maintenance and determine the difference in mean retention scores between the student taught with cooperative learning and those taught with Conventional method in electrical work maintenance. Literature has been reviewed in line with two research questions and six hypotheses were formulated to guide the study. Twenty objective questions and two theories were used to collect data for the study. The study used the quasi-experimental design. Specifically, the pretest-posttest design with experimental and equivalent control group was used. The target for the population consists of 4 technology teachers in technical colleges and 179 students in TC 2 in Government Technical Colleges both in Minna and Eyagi-Bida. Data obtained were analyzed using mean, standard deviation and z-test statistics. The null hypotheses were formulated and tested at 0.05 level of significance. The findings of the study showed that the cooperative learning methods as an active learning have affected students' achievement and retention positively. Based on the finding, it was recommended among others that cooperative learning method should be put to use and students are likely going to perform well in internal and external examination.

CHAPTER 1

INTRODUCTION

Background of the Study

The concepts of teaching and learning are most central to education. Kalusi (2005) defined teaching as a way of giving instruction to somebody or causing somebody to know or be able to do something. It is also regarded as a skill for promoting performance in learning. Ogwo and Oranu (2006) defined learning as the process by some activities enable the learner acquire experience that tend to influence (change) his/her future behaviour; provided that the characteristics of the change in behaviour cannot be explained on the basis of negative response tendencies, maturation or temporary states of the learner. To achieve the desired teaching and learning, Teachers have the option of structuring lessons competitively, individualistically, or cooperatively. The decisions teachers make in structuring lessons can influence students' interactions with others, knowledge, and attitudes (Johnson & Johnson, 1987).

Co-operative learning, this is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources the learners develop a plane of social system in learning. Johnson, Johnson, and Smith, (1999) said that cooperative learning is an instructional approach in which students work in a team on a learning task structured to have the following features: Positive independence; Individual accountability; Face-to-face primitives' interaction; Appropriate use of interpersonal and teamwork skills; Regular self-assessment of team functioning**.** Cooperative learning is one of the recommended teaching – learning techniques in which students achieve learning goals by helping each other in a social setting (Krivickas, 2005). Cooperative learning which is also called Team Approach is a successful teaching

strategy in which small teams, each with students of different levels of ability, use a variety of learning activities and a number of activities to achieve academic objectives and improve their understanding of subject matter, Griffin and Griffin (1988). Okoro (2006) explained that each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement. Students work through the assignment until all group members successfully understand and complete it. Cooperative efforts result in participants striving for mutual benefit so that all group members gain from each other's efforts. Students should gain experience sharing responsibility for learning with each other. In the process of coming to common understandings, students in a group must frequently inform each other about procedures and meanings, argue over findings, and assess how the task is progressing. Cooperative learning is a way to facilitate student-student interactions efficiently and systematically.

The field of cooperative learning is built upon the premise that it can be used to enhance both academic excellence and affective development (Schmuck & Schmuck, 1997), it is recognized that learners need to be trained to cooperate and that the learning context must foster cooperation for a cooperative approach to succeed and be superior to the standard individualistic approach (Johnson &Johnson, 1989 and Slavin, 1995). Kagan (1994) recognizes the need for cooperative learning as a global answer to education. He believes that there is a need to incorporate cooperative learning for three major reasons: Socialization practices, economy, and the demographics of society. Socialization practices include the need for students to interact with each other regularly. Students today generally do not come to school with the same pro - social values once common; they are not as respectful, caring, helpful or cooperative as they were twenty years ago. The loss of pro-social values and behaviors among students is a result of a number of converging economic social factors.

As schools move closer to the goal of providing education for all children within, increasing amounts of attention and energy are being devoted to developing pedagogical approaches that are appropriate in heterogeneous classrooms. Teachers must structure the educational and social environment so that students develop the knowledge, skills, and attitudes required to interact across both perceived and actual differences and disabilities. Many teachers who are working in diverse or inclusive classrooms are particularly eager to develop modes of instruction that do not isolate and stigmatize learners with different needs: complete individualization is not a practical or even desirable solution to meeting the diverse needs of children within a single classroom has led many inclusion advocates to promote cooperative learning as the pedagogy of choice. Over the last ten years, cooperative learning has become accepted as one of the "best practices" in education. Consequently, many teacher education programs have increased the number of courses and opportunities for novice and experienced teachers to learn how to design and implement cooperative/collaborative learning. This might bring significant improvement in the teaching and learning of technical courses in technical colleges which are facing serious challenges of failure rate and high cases of examination malpractices.

Technical college/school provides preparation by training students with skills needed for a particular type of employment such as culinary arts, photography, audio technology, web development, electronics, computer engineering (Calaveras 2002). It is a leading organization that helps people find trade and develop skills. Several courses are offered in Technical Colleges, such as electrical work maintenance, Automobile technology, woodwork, electronics and others but the study focus on electrical work maintenance as a Technical college course.

Electrical work maintenance provide the youth with practical skills in work pertaining to electrical and electronic circuits, domestic industrial installation, cable jointing and winding. Electrical

work maintenance is vast in Nature and has continued to experience changes and improvement from time to time. According to Anaele (2005), there is hardly any human activity where electricity has not made impact. Electrical work maintenance as one of the trade studied in technical education covers electrical maintenance and repair, domestic industrial installation, cable jointing and winding. Electrical work maintenance according to Theraja and Theraja (2001), is the application of scientific knowledge in the design, selection of materials, construction, operation and maintenance of electronics and electrical appliances. College Board (2008) explained that in Electrical work maintenance, students learn the basic skills needed to operate, maintain, install and repair electrical and electronics equipment. Electrical work maintenance is one of the courses in the technical colleges as stipulated in the National Policy on Education (Federal Republic of Nigeria 2004). Students should be able to apply what was taught after graduation, if their level of achievement and retention is high. Learning and teaching method is therefore very important.

Achievement is the outcome of level of accomplishment in a specified programme of instruction in a subject area or occupation which a student had undertaken in the recent past. Academic achievement of students is the translation of the students' performance in achievement test into scores obtained in a cognitive test. Anene (2005) contended that achievement is quantified by measures of students' academic standing in relation to those of other students tested with the same instrument (NABTEB 2006). The report showed that the low level of achievement in vocational and technical courses was lower than expectation. The low academic achievement of students in electronic work may be as a result of inappropriate usage of instructional methods by the technical teachers and thereby affect students retention of what is taught.

Retention of learning is defined as the repeat performance of a learner of the behavior earlier acquired after an interval of time. Momoh-Olle (2007). According to this Learning Pyramid, retention

rates increased with the amount of student involvement. The rates were the highest with teamwork which included (a) discussion groups: 50%, (b) practice by doing: 75%, and (c) teaching others/immediate use of learning: 90%. As a sharp contrast, the retention rate of the traditional ways of individual and passive learning like lecturing (5%), reading (10%), and demonstration (30%) lasted no more than 30 percent. In contrast, the retention rate of the long existing method of lecturing was as low as only five percent (Krivickas, 2005). Base on the benefit of electrical work maintenance to the society and also the benefit of cooperative learning, the research intend to investigate on the effect of cooperative learning on achievement and retention of electrical work maintenance student in Government Technical Colleges in Niger State.

Statement of the Problem

In Nigeria There is a growing concern over the decline in students' achievement in electrical work maintenance in Technical College (Umunadi, 2007). He further observed that the students' achievement and retention in electrical work maintenance trades has been the winding in recent time and the situation calls for immediate attention in the technical colleges. Ezenyika (1995) lamented that inadequate instructional treatment have contributed to this state of poor achievement in both internal and external examinations, and therefore arises for exploring some effective teaching and learning techniques. In support to this, Akinlagunla and Ogbonnaiye (2011) cried out of the need for urgent intervention in the areas of training teachers as it is the panacea against poor performance of students in both internal and public examinations across the country. Akinlagunla and Ogbonnaiye traced the poor performance of students in the country to the increasing decline in teacher quality of instruction.

Kalusi (2005) Education is a teaching learning process and learning depends upon instruction. During instruction, a child cannot be treated like an empty vessel into which any type of information can be passed down. A teacher must think of ways and means of stimulating and encouraging learning

in the students. He should provoke their interest and motivate them to learn. He should create conditions in which they feel the need to learn. In most of the government schools, a teacher has to teach a large class in which sixty to seventy students learn together and the students of a large class have to cover the syllabus in a limited period of time. The teacher has no opportunity to give individual attention to all students in a large class while using conventional learning method. The result is that gap between weak and able students' increases. Active learning is also known as cooperative learning, in which students work in small teams on problems or projects in order to improve their understanding of a subject (Johnson, Johnson, and Smith, 1999). Each member of a team is responsible not only for his/her learning, but also for helping teammates to learn. Cooperative learning claims to help the students in such a situation. It seems, there is little or no evidence in literature to show the application of cooperative learning style in the teaching of domestic industrial installation. Would the application of cooperative learning style increase the achievement and retention level of students in domestic industrial installation?

Purpose of the Study

The major purpose of this study was to determine the effects of cooperative learning on students' achievement and retention of electrical work maintenance. Specifically, the study determined;

1. Difference in mean achievement scores between the students taught with cooperative learning and those taught with Conventional method in electrical work maintenance.
2. Difference in mean retention scores between the student taught with cooperative learning and those taught with Conventional method in electrical work maintenance.

Significance of the Study

The result of this will be of benefit to electrical work maintenance teachers, students, society, industry, government, educational Psychologist and researchers.

This study will benefit teachers in the following ways; it will help teachers to cater for range of individuals (students) needs; increased opportunity to interact effectively with range of individual students; more effectively use of time; greater coverage of individual need; opportunities to observe students at work and assess skills processed by the students and thereby improve the academic achievement of the students. There will be a little relieve for the teachers in their multitudinous duties and responsibility as the student act as teachers and later as learners. It may also prove helpful to technical teachers trainers. The prospective teachers may be prove given practice in this approach along with methods of teaching Electrical Maintenance Work.

The findings of this study is found to have positive effect, and implementation of the findings will also be of benefit to students, they will become creative, social, self- confident and self meditating. It will also enable student acquire collaborative skills, problem solving skills, and higher order thinking skills. It prove helpful to bring change in behaviour of the students and learn to cooperate with one another not only in classroom but through their daily life, It also help to improve students communication Skills.

The result of the study will be of great benefit to the industry, if appropriate teaching methods applied in teaching the students, the industry will have well trained technical college graduate who processes problem solving skills and thinking skills that can enable them to face challenges in their workplace.

The society will benefit from the study as skilled Craftsmen will be produced to maintain, install and repair electrical/electronic gadgets presented then will be produced.

The findings of this study will provide the government; curriculum planners and developers may use the results of this study as guide line for improving electrical work maintenance and also in other vocational subjects at various level of education.

The study will attract educational psychologist, as it provide ample evidence about the effective utilization of Elements of cooperative learning method that is positive interdependence, face-to-face promotive interaction, individual accountability/personal responsibility, interdependence and small group skills, and group processing in enhancing the understanding of the students.

Lastly, this study will also serve as source of literature to scholars and educational researchers.

Research Questions

The following research questions were used to guide this study.

1. What is the mean achievement scores of students taught domestic industrial installation using cooperative learning and students taught using conventional method?
2. What is the mean retention scores of students taught domestic industrial installation using cooperative learning and students taught using conventional method?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance

HO_1; There is no significant difference between the mean scores of students taught domestic industrial installation using conventional method on pre-test and post-test.

HO_2: There is no significant difference between the mean scores of Students taught domestic industrial installation using cooperative learning on pre-test and post-test.

HO_3: There is no significance in the mean scores of student taught domestic industrial installation using cooperative learning and students taught with conventional method.

HO_4; There is no significant difference between the mean scores of students taught domestic industrial installation using conventional method on post-test and retention test.

HO_5: There is no significant difference between the mean scores of domestic industrial installation using cooperative learning post-test and retention test.

HO_6: There is no significance in the mean retention scores of student taught domestic industrial installation using cooperative learning and students taught with conventional method.

Scope of the study

The study focuses on TC II second term syllabus in domestic industrial installation, except insulation and ring circuit test and result of test which was covered before commencement of field work, topics covered includes; illumination, spacing and mounting height ratio, different types of lamp, cosine law, inverse square law, brightness glare and photometry.

CHAPTER II

REVIEW OF RELATED LITERATURE

The review literature for the study is presented under the following sub-headings:-

1. Technical College Education in Nigeria
2. Concept of Electrical Work Maintenance
3. Concept of Cooperative learning
4. Student's Achievement in Electrical work maintenance
5. Student's Retention in Electrical work maintenance
6. Summary of review of related literature

Technical College Education in Nigeria

Development has been described to involved efforts to stimulate more employment opportunities to upgrade the skills and adaptability of work force, and to link job and man more effectively (Olaitan, 1986). Technical colleges are regarded as the principal vocational institutions in Nigeria. They give full vocational training intended to prepare students for entry into the various occupations (Okoro, 1993). The products of this institution are employed as operatives, artisans and craftsmen in industries and allied organizations.

Technical colleges are emerging as critical factors and key institutions in technology based development to fill industry's requirements for more highly skilled and technically proficient workers. "It is not the number of robots and computers, size and technical perfection of work centers' or the degree of automation which will decide upon our future success," the Chairman of Volkswagens AG's Supervisory Board in Nigeria noted, "but our human

resources."Evidence of rapidly growing demand in industry for technical workers with upper secondary or less-than-university tertiary education is based on changes and projections in enrollment and employment patterns, surveys of employers, and anecdotal information. In a 1999 punch Magazine cover story, "The New Worker Elite:

Technicians are taking on a bigger role and commanding respect as the core employees of the Information Age," the authors projected increases in demand between 1992 and 2005 for engineering technicians of 19 percent; science technicians, 25 percent; and computer programmers, 30 percent. Other indications of the pattern can be found in France, where the number of students entering programs to train "higher technicians" increased 150 percent between 1980 and 1992, and in the Netherlands, where enrollments in higher technical education increased 40 percent between 1980 and 1990.In the United States in 1992, more than 28 percent of all workers had some college education, up from just 22 percent two years earlier. Large employers working in many OECD nations, such as Intel, now request workers with tertiary degrees and contract with two-year colleges to offer associate degree programs inside their factory. Small employers trying to adopt new technologies, according to trade and employers associations, are increasingly seeking workers with post-compulsory education.

In conjunction with their education and training programs, technical colleges are proving capable of helping small and mid-sized businesses learn about and adopt newer technologies and techniques and generally become better connected and integrated into their regional production systems. Peripheral, education-related technology services and resources of the colleges have become increasingly important, particularly in rural and less advantaged regions.

This is largely a result of emerging views in the 1990s that the public sector ought to be more proactive in advancing the deployment of new technologies. In the early 1980s, the popular public sector role was transferring and commercializing technologies and innovations developed at

universities and government labs and encouraging entrepreneurial companies. But it soon became evident that focusing on the latest technologies and university-based research neglected the large majority of the world's value-adding companies, the small and mid-sized enterprises, whose requirements for technology and innovation were for something less than cutting edge research and who lacked the capacities, capabilities, and connections to effectively adopt already commercially available technologies and proven production innovations (i.e., to modernize). In some less populated regions, these SMEs also were distant and isolated from support agencies and each other.

The need for technology and innovation among small and mid-sized enterprises (SMEs) was more apparent to regional technical colleges, which in many places are closer to local industry, more apt to be called upon to fill the increasing numbers of jobs that require upper secondary or tertiary but less than baccalaureate education, more flexible, and generally better positioned to help SMEs innovate and modernize. To meet that challenge, entrepreneurial technical colleges in many parts of the industrialized world altered or amended their core mission statements to enable them to address technology development and skill needs of companies in their regions. This allows them to enhance and supplement their core education and training mandate and, in effect, function as "technology intermediaries", strengthening ties to industry, facilitating inter-firm collaboration, performing technology and skill needs assessments and consultancies, and providing technical information—often in alliance with other service agencies and sometimes tailored to the specialized needs of regional clusters.

According to Auta (2005), the earlier technical institutions in Nigeria were the trade centers established by public services such as railways, P&T, centre and institutes for training of agricultural, veterinary and forestry assistants for the colonial administration. The Yaba Higher College established in 1936 was the first college of technology in the country. In the 1950s, technical institutes were also

founded in Kaduna and Enugu. These including similar institutions at Ibadan and Auchi in the early 1970s became the pioneers of the first generation polytechnics.

Post-independence witnessed a rapid expansion of technical college education. In 1996, there were about 73 institutions (trade-centers, craft schools and technical institutes) across the country with pupil enrolment of 15,509 out of which 412 were females (Auta, 2005). Like the secondary education sector, shortage of technical instructors and high running costs were then as at now the bane of technical education programmes.

The National Policy on Education (FGN,2004) identified five types of technical education institutions outside the universities. The institutions include the pre-vocational and vocational schools at post primary level, science and technical colleges, polytechnics and colleges of education (technical) at post secondary level, Okoro (1993),maintained that the development of technical colleges, seven trade centers, and eighteen handcraft centers between 1952 and 1960, today we have 176-Technical colleges of which 12 are federal owned. A recent record by Abu-Bakr (2009) shows that number of federal owned science and technical colleges now stood at nineteen (19) and that it is only a total of 160 technical colleges that are recognized by National Board for Technical Education (NBTE).

The country is mindful of the fact that for it to establish a strong technological base for the production of goods and services for its citizens, Technical college education must be given the desired attention. It is in the realization of this that the Federal Government not only recognized it in the National Policy on Education, but also stress that greater proportion of education expenditure shall continue to be devoted to vocational education at federal and state levels (NPE,1998).The National policy on education revised edition (2004) defined Vocation and Technical Education as that aspect of education, which leads to the acquisition of practical and applied skills as well as basic scientific

knowledge .The policy statement further enumerated the following as the broad objectives of Vocational and Technical Education in Nigeria.

i. To provide trained manpower in applied science, technology and commerce especially at sub-professional level:

ii. To provide technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development:

iii. To train people who can apply scientific knowledge to the improvement and provision of solutions to the environmental problems for the use and convenience of man:

iv. To give an introduction to professional studies in engineering and other technologies:

iv. To provide training and impart the necessary skills leading to the production of craftsmen Technicians and other skills personnel who will be enterprising and self-reliant: and

v. To help the nation's youth to have an intelligent understanding of the increasing changes and complexity of the world of science and technology.

vi. To improve our economy technologically, we need a collaborative effort of individuals, the private sector and other government agencies that are saddled with the responsibility of implementing the above government policies regarding Vocational and Technical Education.

Ajayi (1989) contended that technical colleges are responsible for the training and preparation of craftsmen for the industrial and technological development of the country. Jamgbadi (1993), supporting the objectives of Technical colleges as contended by Ajayi, define Technical Colleges as institutions for full time and part time education, especially in Science technical colleges is basically in the acquisition of skills in technology. Grant (1979) however maintained that technical college education is based on the fundamentals of industrial production. He averred that the main objectives of

technical college education is to make students familiar with most important branches of production in industry, commerce, imparting of skills and practical competences in handling of tools, materials and generally equipping the students with both theoretical knowledge and work habits.

According to Chiweyite Ejike (1990) development normally means faster and greater economic growth leading to enhancement of wealth of the nation, higher level of Medicare and faster and greater improvement in the quality of living environment of the people'. Therefore Technical Colleges has really developed in that it provide the workers and young people with vocational competencies needed in various disciplines required in the world of work. Therefore the Technical colleges in Nigeria are established to fulfill the objectives of producing skilled personnel needed for provision of the maximum economic security (Atsumbe, 2002).

Concept of Electrical Work Maintenance

Electrical Work Maintenance, according to the federal Republic of Nigeria National Policy of Education (1998) is one of vocational subjects offered at the tertiary level for the purpose of (a) acquiring technical skills (b) exposing student to career awareness by exploring usable options in world of work (c) enable youths to have an intelligent understanding of the increasing complexity of technology. This, electrical work maintenance exposes the student to career in both the academic field and the technical trades. Initially, the subject was taught in parts focusing on such areas as basic electricity, cable jointing, domestic industrial installation, winding, instrumentation, electrical power and machinery, and digital electronic.

According to National Commission for colleges of education minimum (2002), while stressing the need for electrical work maintenance, said it introduce student to the component and different type, the active the reactive component (resfor, capacitor and induction) and their different characteristic

when applied energy act upon them and mode of connecting them (Series and parallel) and the type of component as to whether, passive or active component (transistor, diodes, thyristors group). Adediran (2000) observed that electrical work maintenance acquaints students to the laws such as Drins law of electricity, Kerchiefs law, lambert cosine law of illumination and others. Considering the impact of this electrical work maintenance on the practical content of the teaching and learning of electrical/electronic NCE, it will certainty enhance the practical content. This will eventually enhance the practical skill and acquisition for the student concern. Yabani(1989) stated the specific objective of electrical work maintenance curriculum that curriculum specifically designed to produce graduate that would be able to construct simple electrical circuit, cable jointing and installed simple electrical equipment. These days, this exercise is left for the students till their final semester in the school, when it will be final year project. The point the writer is trying to drive here is that NCE technical students is meant to be functional, the practical content in the curriculum must be put in place to see to its implementation. Akinsende (1991) said most technical schools suffer from the acute shortage of teachers who bare academically, and professionally competent to translate what has been taught in the class to practical and have poor teaching method, therefore, technical teacher need to be effective in dispensing their statutory responsibilities training and updating, of their professional skills is imperatives, it is poor pedagogical skill that compel NCE technical teachers to restrict their activities to the classroom. He further affirms that in so far as vocational teachers are restricted with the ambits of the classroom without adequate intellectual experience, updating their skill and knowledge become imperative.

Onyeukwe (1989), said in the teaching and learning of electrical work maintenance, which include winding, domestic industrial installation, cable jointing etc are needed so often in various homes and offices. Therefore the establishment of Semiconductor Company that can mass produce

this electronic component will go a long way to enhance practical activities in tertiary institution and hence high practical content in electrical work maintenance programme. Students who are well developed in this course can get themselves employed in most of the modern electrical and telecommunication system. Moreover, UNESCO (1998) while stressing the importance of scientific and technological society, sustainable development and implored quality of live are to large extent dependent on our ability to understand and utilize science and technology effectively.

Electrical work maintenance students help design, develop, test, manufacture, and repair electrical and electronic equipment. Electrical components of equipment provide power. Electronic components control the equipment, although many types of equipment still are controlled with electrical devices. Electrical work maintenance students generally work under the supervision of electrical engineers. Technicians perform a wide variety of different tasks depending on the needs of their employer. Some electrical work maintenance students work for power companies that generate and transmit electricity, or they work for companies that use electricity to power machinery and lights. Others are employed by manufacturers of electrical equipment or telephone and telegraph companies. Still others have jobs with private firms that design and build factories, houses, and other buildings. A few technicians work as safety inspectors, electrical work maintenance students' work in all areas of the country, most work for private companies.

However, some work for public institutions that use electricity or for government agencies that regulate the electrical industry. Many electrical work maintenance students work where electricity is generated. They are often employed by public utility companies, but some work for companies and institutions that generate their own electricity. These employers may include large industries, military bases, and institutions such as hospitals and colleges. Electrical work maintenance students are often directly involved in the generation of electricity. They may monitor switch- boards to make sure that

the plant is operating efficiently. Sometimes they test and inspect generators, transformers, and other equipment. They may supervise crews of electrical workers who do routine work in the generating station.

They often use their knowledge of electrical engineering technology to diagnose electrical problems. They may make repairs themselves or direct other electrical workers to do them. Some electrical work maintenance students work for industrial plants that use electricity. They often study a plant's needs. They consult with engineers and offer advice on lighting and other uses of electrical power in the plant. They may plan, direct, and record tests done on electrical equipment, or recommend changes in equipment that is not operating efficiently. Sometimes they help companies solve production problems. For example, they may suggest a backup source of energy in case the circuits become overloaded at a particular point in the production process. Electrical work maintenance students often work with electrical engineers in the design of new electrical equipment, ranging from small household appliances to huge power generating plants.

Akinsende (1991) affirms they perform a variety of tasks to assist the engineers, such as assembling and testing experimental electrical parts or making changes in parts according to an engineer's instructions. They may also prepare wiring diagrams, layout drawings, or engineering specifications for new equipment. Once a design for new equipment has been perfected, electrical work maintenance students may direct the crew of workers who produce or install it. Electrical work maintenance students work with such hand tools as wrenches, screwdrivers, wire cutters, pliers, and soldering irons. They also use precise instruments such as voltmeters, which measure electricity. In addition, they must be able to read and understand blueprints, as well as engineering handbooks. Much of the work of electronics engineering technicians involves troubleshooting. They test circuits and parts to find out why a piece of equipment is not working properly.

Education and Training Requirements can get training in electrical work maintenance at a technical institute, community college, and extension divisions of colleges. Most programs take about two years to complete. The armed services also run schools designed to prepare enlisted personnel for technical work in this field. A number of companies offer on-the-job training. Sometimes these company-sponsored training programs include some formal schooling at a college or technical institute. Training programs vary considerably in quality, so you should check out a prospective program thoroughly. Getting the Job Private Companies looking for trained electrical work maintenance students often send lists of their job openings to placement offices at schools that offer courses in electrical technology. You can also apply directly to utility companies and other companies that hire technicians. Your state employment service may be able to help you find a job with a private company that will give you on- the-job training. State employment services are also good sources of information about jobs with government agencies. Sometimes positions for electrical work maintenance students are listed in newspaper classifieds or job banks on the Internet. Advancement Possibilities and Employment Outlook Electrical work maintenance students often specialize and become highly skilled in one area of electrical technology.

Moreover, UNESCO (1998) while stressing the importance of scientific and technological literacy stated that Technicians can become supervisors and managers of crews of electrical workers. Experienced technicians can also advance to positions as technical writers, sales representatives, and instructors in technical schools. Many technicians continue their education and become engineers. Employment for skilled electrical work maintenance students is expected to grow at an average rate through 2014. This is due to the increasing demand for more sophisticated electrical systems. However, employment may be influenced by varying economic conditions. Those with practical work experience and knowledge of new technology will have the best opportunities. Working Conditions

Even though electric current can be dangerous, the safety record of the electrical industry is good. In general, working areas are in laboratories, offices, manufacturing or industrial plants, or on construction sites. 'Electrical work maintenance students working in generating plants or on production lines may be exposed to high noise levels. Most engineering technicians work at least forty hours a week. Some may be exposed to hazards from equipment, chemicals, or toxic materials' Akinsende (1991)

Electrical work maintenance students must be able to work well as part of a team. They often come into direct contact with engineers, other electrical workers, and users of electricity. They need to be able to get along with all of these people. They should also be able to work by themselves at times. Their work requires them to pay close attention to details. They should also work well with their hands and have an aptitude for science and mathematics. The Skills, Knowledge, and Abilities of Electrical work maintenance students include:

- Troubleshooting-Determining causes of operating errors and deciding what to do about it
- Repairing- Repairing machines or systems using the needed tools
- Equipment Maintenance-Performing routine maintenance on equipment and determining when and what kind of maintenance is needed
- Equipment Selection- Determining the kind of tools and equipment needed to do a job
- Time Management-Managing one's own time and the time of others
- Mathematics- Using mathematics to solve problems
- Critical thinking- Using logic and reasoning to identify the strengths and weakness of alternative solutions, conclusions or approaches to problems

- Engineering and Technology- Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Computers and Electronics- Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- Mechanical- Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

Concept of Cooperative Learning

While reviewing literature on cooperative learning, many definitions of cooperative learning were given. In this section, the researcher will examine a few of the definitions and their similarities and differences. According to Artzt and Newman (1990), cooperative learning is a small group of learners, who work together as a team to solve a problem, complete a task, or accomplish a common goal. Johnson, Johnson, and Johnson Holubec (1994) characterize cooperative learning as working together to accomplish shared goals. These are straightforward descriptions of cooperative learning. Davison and Worsham (1992) characterize cooperative learning as:

> *"Cooperative learning procedures are designed to engage students actively in the learning process through inquiry and discussion with their peers in small groups. The group work is carefully organized and structured so as to promote the participation and learning of all group members in a cooperatively shared undertaking." (P4)*

These definitions are similar; the differences is that Davison and Worsham emphasize the idea that cooperative learning is engaging and structured to promote participation among members of the group. The similarities revolve around inquiry, discussion of thought, and a shared goal. Along with the

definition of cooperative learning, this section will also include what cooperative learning looks like in the classroom. It would be beneficial for educators to witness the effectiveness of cooperative learning in classrooms. Since it is almost impossible to have teachers visit another teacher's room during instruction, an explanation of how a cooperative classroom ideally works will be provided here.

Cooperative learning may be incorporated in many different ways. Since cooperative learning presents itself so diversely, it would be impossible to detail all of the tactics. Johnson, Johnson, and Johnson Holubec (1994) describe normal, daily cooperative classrooms. Typically, "Class members are split into small groups after receiving instruction from the teacher. They then work through the assignment until all group members have successfully understood and completed it" In these groups, students are expected to discuss ideas, help each other uncover connections, complete a task and so on. Students work in groups to clarify their understanding, think and reason together, solve problems, make and test conjectures, and complete other tasks (Davison & Worsham, 1992). From the previous statements, I conclude that cooperative learning presents itself differently in classrooms.

However, it is clear that students work together on a given task, help each other clarify concepts, and reason together. It has become apparent to me while reviewing literature and observing cooperative classrooms that student cannot just be placed into groups for cooperative learning to be effective. According to Johnson, Johnson, and Johnson Holubec (1992), there are five components that need to be considered in order for cooperative learning to be effective. The five components are positive interdependence, face-to-face promotive interaction, individual accountability/personal responsibility, interpersonal and small group skills, and group processing. More in-depth explanations of these will follow. Kagan (1994) suggests that there are six key components to assure cooperative learning's effectiveness. The six components introduced by Kagan (1994) are teams, cooperative management, will to cooperate, skill to cooperate, basic principles, and structure. Baloche (1998) has

examined Johnson, Johnson, and Johnson Holubec elements for high quality small group cooperation and also focuses on the same five elements.

The differences between Johnson, Johnson, and Johnson Holubec (1992) elements and Kagan (1994) are in Kagan cooperative management, structures, and teams components. These components are not present in Johnson, Johnson, and Johnson

Holubec elements. This does not mean that Johnson, Johnson, and Johnson Holubec do not feel that these are important in cooperative learning, just that they did not feel the need to incorporate them into the elements. Positive interdependence is stressed in Johnson, Johnson, and Johnson Holubec (1992) and Kagan (1994) elements as the most important aspect of cooperative learning. Positive interdependence is the need for students to perceive that they are linked with their group mates in such a way that they will not succeed unless they all succeed or that they must work together to complete the goal. Positive interdependence and individual accountability are incorporated into the 'basic principles' component of Kagan's elements. This part is when the individual is assessed and held accountable by their group.

The other components of Kagan (1994) elements and Johnson, Johnson, and Johnson Holubec (1992) components are lengthy and will not be discussed further. They are crucial in implementing effective cooperative learning; but for the purpose of this paper, in depth discussion is not necessary. The focus will now be on the classroom approaches to cooperative learning. There are many different approaches to cooperative learning. Davison (2002) states that the common attributes in all the approaches include the following: Common task or learning activity, small-group learning, cooperative behavior, interdependence, and individual accountability. Davison also identifies a range of varying attributes, such as structuring the interdependence, climate, group structures, group leadership and teacher's role. Some of the approaches that have been compared and contrasted to

generate the previously stated commonalties and differences are the complex instruction approach, the structural approach, the group investigation approach and the learning together approach. Johnson, Johnson, and Johnson Holubec (1992) suggest that in order to effectively implement cooperative learning into a classroom, teachers must:

First, understand what cooperative learning is and how it differs from competitive and individualistic learning. Second, they [teachers] must be confident that using cooperative learning is the most effective thing to do…Third, faculty must realize that simply planting students in discussion groups will not magically produce these outcomes…Fourth, faculty must know that there are many different ways to use cooperative learning…Finally, what is good for students is even better for faculty. The above cited researchers of cooperative learning have given these considerations and teachers should account for them when planning to implement cooperative learning into the classroom. The teacher's role does not just include encouraging students to interact, clarify or adapt their goals, and involve those unlikely to participate; it includes preparing every aspect of cooperative learning. The teacher's role includes initiating group work, presenting guidelines, forming heterogeneous groups, preparing and introducing new material, interacting with small groups, tying ideas together, making assignments of homework or class work, and evaluating student performance (Davison, 1990).

Teachers must construct or search to find the right curriculum for the groups. The common element found in the many definitions of cooperative learning is a group of students working together to inquire about and engage in discussion to accomplish a goal. Investigations about why to consider cooperative learning in the classroom, what is said about it, and how this applies to math will occur in the following sections.

The Call for Cooperative Learning: This section will identify what researchers discovered about cooperative learning; but first, how did cooperative learning come about? Current issues of educational journals are often focused, either directly or indirectly, on cooperative learning.

Cooperative learning has been investigated for many years, but the exposure to cooperative learning is fairly recent, which is why the researcher finds it imperative to discuss. According to the National Council of Teachers of Mathematics (1989), classrooms do not facilitate learning if they have a passive climate. "Proponents of electrical and electronic reform have argued that traditional electrical work maintenance instruction, the predominant form of instruction in our nation's schools, has been unsuccessful in promoting conceptual understanding and application of electrical work maintenance to real-life context" (Aslup & Springler, 2003). Johnson (1992) states that the old paradigm is not working because Technical schools focus on "(a) selecting only the most intelligent students for admission to advanced classes and then (b) inspecting continually to weed out defective students". Because of these statements and others, it has become clear that the traditional method for teaching student's electrical work maintenance is not working.

Smith (1998) emphasizes the faults of the 'drill and practice structure' in schools and how people learn from others. Students forget information very quickly unless there are connections made between what they are attempting to learn and their lives; people learn by interacting with others and socializing. The numbers of people that agree with him, such as Battista (1999), confirm his theory. Battista states, "For most students, electrical work maintenance is an endless sequence of memorizing and forgetting facts and procedures that make little sense to them". Battista (1999) continues to imply that since this is the case, social interactions with others would increase retention of subject matter. The idea is, if students work in groups and learn from each other and with each other, they will be more likely to remember the concepts.

Economic and social factors include family structure and ideals presented to students on television. Kagan emphasizes the need to change the way we look at economics. At one time our nation was an agriculturally based; then it moved to industry, and finally it moved to information-management. The last of the three major reasons for the need to implement cooperative learning is the demographics of society. Kagan states that the 'new majority' is racially diverse. "The new majority does not come to school with the same values and background as did the old majority. They are not responding well to traditional educational structures" (Kagan, 1994, p. 2:7). Sapon-Shevin, Ayres, and Duncan (2002) state that, there is increasing cognition that all students, even those currently educated in what appears to be relatively less diverse settings, will need to live and work successfully in diverse, multicultural environments.

Cooperative learning can provide students with the skills demanded by our increasingly diverse society. It has become clear that there is a need for additional teaching methods in schools, including cooperative learning. Now that consideration has been given for why there is a need for cooperative learning, I will focus on what is said about cooperative learning. In the following section what proponents say about cooperative learning and whether it has shown to be an effective teaching method in schools will be discussed?

Proponents' Position on Cooperative Learning: There are many proponents of cooperative learning. Johnson, Johnson, Johnson Holubec, and Kagan have researched cooperative learning and have very positive ideas about the effects of cooperative learning. According to Kagan (1994), the three most important outcomes of cooperative learning are "(1) academic gains, especially for minority and low achieving students, (2) improved race-relations among students in integrated classrooms, and (3) improved social and affective development among all students". Johnson, Johnson, and Johnson. Holubec (1994) feel that the major outcomes are student effort to achieve, positive relationships,

psychological adjustment/social competence, promotive interaction and positive interdependence. Even though Kagen's outcomes are a bit more general, the similarities between them are clear.

Slavin (1990) reveals that most of the theories supporting cooperative learning fall into two categories: motivational and cognitive. Slavin (1990) states that he and Johnson and Johnson have "found that cooperative learning methods tend to be generally effective in improving intergroup relations, increasing students' acceptance of mainstreamed academically handicapped students and supporting a range of affective concerns" (Owens, 1995,). Johnson, Johnson, and Johnson Holubec (1992) do not just acknowledge that cooperative learning helps minorities but extend it to bring different groups together. Individuals care more about each other and are more committed to each other's success and well-being when they work together cooperatively [rather] than when they compete to see who is best or work independently from each other…This is true when individuals are homogeneous as well as when individuals differ in intellectual ability, handicapping conditions, ethnic membership, social class, and gender. Slavin (1990) addresses the issues of whether cooperative learning increases student self-esteem. Besides academic achievement, other benefits are associated with cooperative group learning.

Some of these benefits increased retention of the subject matter; increased on-task behavior; increased school attendance; increased student respect for others from various backgrounds; a more positive student attitude toward teachers, school, and mathematics; and a greater student self concept. (Smith, Williams, & Wynn, 1995.). Campell (1996) states, "Researchers who started out with purely individual definitions of what they were trying to teach and arrived at the need for social interaction more through pedagogical trial and error than through theoretical analysis" (Kohn, 1999,). Kohn contends that many researchers begin by only wanting to explain the need for students to make sense of electrical work maintenance ideas but find themselves seeing the need for 'collaborative dialogue'

between students. Johnson & Johnson state, among other specialists, in the following: At its best, the practice of having students meet regularly in pairs or small groups not only helps them develop social skills and foster each child's concern about others, but also turns out to be powerfully effective in intellectual terms. This is true for several reasons.

1. A student struggling to make sense of an idea may understand it better when it is explained by a peer (who only recently figured it out himself) rather than by an adult.

2. The student who does the explaining can achieve a fuller understanding of the subject matter by having to make it understandable to someone else. This is why cooperative learning has been shown to benefit the one giving the explanation at least as much as the one hearing it.

3. Having a group tackle a task is typically far more efficient than having one person do it alone, since students can exchange information and supplement one another's investigations.

4. Cooperative learning often leads students to become more motivated to learn; their attitude improves, and that, in turn, facilitates their achievement.

5. Finally, remember that constructing meaning typically takes place through conflict, and conflict happens when students have the chance to challenge one another in an environment that feels caring and safe.

Disagreement doesn't imply an adversarial encounter; it's a "friendly excursion into disequilibrium," in the lovely phrase of David and Roger Johnson. The benefits listed earlier are just some of the advantages of cooperative learning; not all specialists are proponents of the advantages and certainly most do not limit the advantages to only these. Now that the advantages and benefits of cooperative learning have been reviewed .The cooperative learning (CL) method differs substantially from the classical passive lecturing way in which students merely take notes through the class time while looking at and listen to the teacher. The later represents the old paradigm of teaching, as

Johnson, Johnson and Smith stated, while the former represents a new paradigm of teaching with many advantages that can produce a great improvement of the learning process. Cooperative learning gets its strength in defining base groups by putting the students in small team environment to learn together the subjects for the whole semester.

Researchers have documented well the effectiveness of cooperative learning methods, especially at the elementary and secondary levels (Johnson & Johnson, 1987; Sharan & Sharan, (1990). Cooper and Mueck (1990) described the application of cooperative learning in college classrooms. Cooperative learning creates a learning community where students are nurtured and encouraged. One of the primary factors in student retention is associated with students feeling a sense of belonging in the classroom. Social skills that are developed in cooperative learning help students to become team players. Students who solve problem, analyze data, present material to fellow classmates, explain concepts and discuss case studies are learning critical thinking skills necessary to survive in today's workplace.

Cultural diversity is not only accommodated through cooperative learning, but it is celebrated. A student who has worked in culturally diverse learning groups through cooperative learning will be prepared to work side by side in the workplace with others who differ racially, ethnically and culturally. The value to the instructor is the 3R's:

Respect - Students have greater respect for instructors who relinquish dictatorial powers and become a guide or resource person rather than an authority figure.

Retention - Attendance in the classroom improves remarkably when students interact with peers. More students finish the course than in a traditional classroom. Retention of material presented in class also improves remarkably.

Resource - Instructors can modify their material and teaching style by monitoring students in cooperative learning groups. It becomes quickly apparent what material is not understood, needs more clarification or explanation.

Cooperative learning is of value for all students including those who have been identified as "at risk," "bilingual," "gifted," and "normal." Cooperative learning encourages mutual respect and learning among students with varying talents and abilities, languages, racial, and ethnic backgrounds (Marr, 1997). Sudzina(1993) reports that cooperative learning is effective in reducing prejudice among students and in meeting the academic and social needs of students at risk for educational failure. All students need to learn and work in environments where their individual strengths are recognized and individual needs are addressed. Many educators today strive to ensure that multiple intelligence theory and differentiated instruction are incorporated into their curricula (Gardner, 1993; Armstrong, 1994, Tomlinson, 1999).

Emotional intelligence is also an important facet of classroom community (Goleman, 1995) that requires teacher attention. All students need to learn within a supportive community in order to feel safe enough to take risks (Sapon-Shevin, 1999). Cooperative learning arrangements have been found to be useful for increasing achievement, encouraging student involvement, and enhancing motivation for learning (Polloway, Patton, & Serna, 2001.) One of the goals of cooperative learning is to disrupt typical hierarchies of who is "smart" and who is not; Cohen (1994) has extensively documented the ways in which issues of societal status are often reproduced within cooperative learning activities unless specific steps are taken to alter that relationship.

Cooperative learning can allow all students to work together, each student experiencing the role of teacher and of learner, and each student modeling recognition of and respect for many different skills and learning styles. If teachers or students are uncomfortable with cooperative learning, it is

often because they have adopted a particular technique without a firm understanding of the underlying principles and do not have sufficient support to implement creative, multilevel cooperative learning activities that allow students to participate at different levels, with differentiated goals and varying levels of support. Cooperative learning has been part of the landscape of engineering education for almost 30 years. The conceptual cooperative learning model was introduced to the engineering education community in 1981 and was continually refined and elaborated for engineering educators Smith, Sheppard, Johnson, & Johnson, 2005)..

Many principles have been proposed for cooperative learning. Below is one list of eight such principles.

1. Heterogeneous Grouping. This principle means that the groups in which students do cooperative learning tasks are mixed on one or more of a number of variables including sex, ethnicity, social class, religion, personality, age, language proficiency, and diligence.

2. Collaborative Skills. Collaborative skills, such as giving reasons, are those needed to work with others. Students may lack these skills, the language involved in using the skills, or the inclination to apply the skills. Most books and websites on cooperative learning urge that collaborative skills be explicitly taught one at a time.

3. Group Autonomy. This principle encourages students to look to themselves for resources rather than relying solely on the teacher. When student groups are having difficulty, it is very tempting for teachers to intervene either in a particular group or with the entire class. We may sometimes want to resist this temptation, because as Roger Johnson writes, “Teachers must trust the peer interaction to do of the things they have felt responsible for themselves”.

4. Simultaneous Interaction (Kagan, 1994). In classrooms in which group activities are not used, the normal interaction pattern is that of sequential interaction, in which one person at a time – usually the

teacher – speaks. In contrast, when group activities are used, one student per group is speaking. In a class of 40 divided into groups of four, ten students are speaking simultaneously, i.e., 40 students divided into 4 students per group = 10 students (1 per group) speaking at the same time.

5. Equal Participation (Kagan, 1994). A frequent problem in groups is that one or two group members dominate the group and, for whatever reason, impede the participation of others. Cooperative learning offers many ways of promoting more equal participation among group members.

6. Individual Accountability. When we try to encourage individual accountability in groups, we hope that everyone will try to learn and to share their knowledge and ideas with others.

7. Positive Interdependence. This principle lies at the heart of CL. When positive interdependence exists among members of a group, they feel that what helps one member of the group helps the other members and that what hurts one member of the group hurts the other members. It is this "All for one, one for all" feeling that leads group members to want to help each other, to see that they share a common goal.

8. Cooperation as a Value. This principle means that rather than cooperation being only a way to learn, i.e., the how of learning, cooperation also becomes part of the content to be learned, i.e. what of learning. This flows naturally from the most crucial cooperative learning principle, positive interdependence. Cooperation as a value involves taking the feeling of "All for one, one for all" and expanding it beyond the small classroom group to encompass the whole class, the whole school, on and on, bringing in increasingly greater numbers of people and other beings into students' circle of ones with whom to cooperate.

Cooperative learning, according to the research (see Johnson & Johnson, 1999; Johnson, Johnson, & Stanne, 2000; Slavin, 1995 for reviews), offers many potential benefits beyond enhanced L2 acquisition. These benefits include increased self-esteem, greater liking for school, enhanced inter-

ethnic ties, and improved complex thinking. Furthermore, Cooperative Learning offers one small ray of hope that we can move away from the all-too present unhealthy forms of conflict and competition that plague our world today (Kohn, 1994).However, using Cooperative Learning may be difficult at first. It requires some initial thought, some long term vision, and some persistence to succeed. Often, students may not be familiar with or skilled at working together. Fortunately, the Cooperative Learning allows us to learn from the trial-and-error and effective practices of educators who have come before us. With this assistance, teachers and students can come to enjoy and benefit from cooperation in the classroom and beyond (Sapon-Shevin, 1999).

Students Achievement in Electrical Work Maintenance

Measuring of academic achievement of students is challenging since students performance is products of socio-economic, psychological and environmental factors. For the past 20 years, education in most part of the world is growing as a profitable industry with prime objective of maximizing profit by delivering high quality education that produces well-educated, skilled, mannered students according to needs and requirements of the dynamically growing, market Hijazi, (2006). Many empirical students carried out to explore factors affecting student's performances.

This study focuses on investigating the factors affecting achievement and retention of electrical work maintenance. Naqvi and Hijazi, (2006) conducted a survey, they collected information and responses of students, regarding factors affecting their performance, all of the research reviews support the hypothesis that student's performance depends on different socio-economic, psychology, environmental factors. The findings of research studies focused that student performance is affected by different factors such as learning abilities because new paradigm about learning assumes that all students can and should learn at higher levels but it should not be considered as constraints because

there are other factors like workshops, materials, equipments, circuits, race, gender, sex that can affect student's performance. Some researchers even tried to explain the link between students' achievements economic circumstances and risk of becoming a drop out that proved to be positive.

Ordu (2004) pointed out that the concept of academic achievements at school had a long history in the Nigerian educational system, Niger state in particular .In the academic situation, it has been observed that differences in performance of students vary from one person to another. Some perform excellently well in their academic pursuit while others perform below expectation and exhibit a dismal academic performance in spite of careful instruction and encouragement. Opinions vary as to why some students excel academically while others appear to be at lowest level to the academic ladder. Although, people are aware that even those who are enrolled in the formal educational system appear not to be exposed to the same equal learning opportunities as a result of many variables, which as it where , enhance or hinder performance of students. Psychologists have put forward some test as to why this disparity in academic performance among student exists. Early studies concentrated on intelligent as explanatory variable and this is still assumed the simple most effective predictor of school achievements. Subsequently, a wide variety of research reports have drawn attention to the importance of social factors and early experiences of the child in the home. Environment affects both the development of intelligence and the level of achievement. Almost unnoticed in the research literature is a series of papers, which describe the relationship personality traits and academic attainment. The result have far from clear-cut and consequently have attracted little publicity; but any attempt to understand the complete causal chain associated with school attainment must include the effect of personality on the child's work in the school.

The need for teachers to be motivational in their approaches cannot be overemphasized; hence the teacher is aware that students come to teaching/learning situation with different personality traits.

Having the results of study at the back and his mind it means that the teacher can create a conductive teaching/learning environment to make for a well-adjusted student. The study implies that since personality traits can predict school achievements, it then means that the school administrator can group or classify their students with similar personality traits for an enhanced performance. Weyner (2003) pointed out some factors affecting students' performance in sixth grade modular technology education (MTE). In his exploratory study, he investigated the relationship between achievement in one sixth-grade program and student's individual traits and characteristics. More specific, this research examined relationship between students (a) prior knowledge of the MTE content, (b) verbal ability, (c) quantitative ability (d) intrinsic motivation, and (e) cognitive style with regards to performance on a posttest instrument. IT was hypothesized that performance in MTE would correlate positively with students prior knowledge, cognitive style fifty grade verbal and quantitative ability scores and intrinsic motivation. Furthermore, this study sought to identify characteristics of low-achieving students in electrical maintenance works students, and to develop a regression model for predicting student achievement in electrical maintenance works students programs.

Students Retention in Electrical Work Maintenance

Momoh-Olle (1997) defined retention of learning as the repeat performance of a learner of the behaviour earlier acquired after an interval of time. Retention is the preservative factor of the mind (Kundu and Totoo, 2007). Whatever touches consciousness leaves trace or impression and is retained in the mind in form of images. Boyle

Davidheiser (1996) in his research paper explores a successful student in electrical work maintenance. He finds that "by applying pair and group work teachers can increase the quality of grammar instruction that can help retention. By being responsible for practicing and integrating, students internalize, even at the elementary level, challenging electrical points".

Clark (1986) observes that students can expect to make impressive gains in areas of cooperative, to use the integrated Education strategies. Among the cooperative gains, it will be accelerated learning, higher levels of retention and recall and higher interest in content. They can prove self-esteem, find pleasure in learning and improve interpersonal relations and teacher student interaction.

According to this Learning Pyramid, retention rates increased with the amount of student involvement. The rates were the highest with teamwork which included (a) discussion groups: 50%, (b) practice by doing: 75%, and (c) teaching others/immediate use of learning: 90%. As a sharp contrast, the retention rate of the traditional ways of individual and passive learning like lecturing (5%), reading (10%), and demonstration (30%) lasted no more than 30 percent. In contrast, the retention rate of the long existing method of lecturing was as low as only five percent (Krivickas, 2005).

Summary of Reviewed Literature

The various literature reviewed so far revealed that cooperative learning theory propounded over decades ago has added dimension to teaching and learning by emphasizing multiplicity of cooperative techniques in order to address student diverse disposition and learning styles. The review has flow show that it has not been widely accepted as a better teaching method, the review revealed the development of technical college education cannot be over emphasized. The review revealed that Technical college give full vocational training intended to prepare students for entry into the various occupations, The review further revealed electrical work maintenance which is still taught with method which is based on the lecture learning theories could be better taught with cooperative learning method because These methods do not provide better achievement and does not promote retention of

learning. While cooperative learning was not found to be more effective than non-cooperative learning with respect to electrical work maintenance students' achievement and retention in this study, the literature suggests there may be additional reasons to use cooperative learning. Certainly, the ability to work with others within a group and to develop interpersonal skills may be justification for using cooperative learning strategies. This study has shown that cooperative learning methods were as effective as non-cooperative methods with regard to achievement and retention, so concerns about the effectiveness of cooperative learning methods in these areas have been addressed.

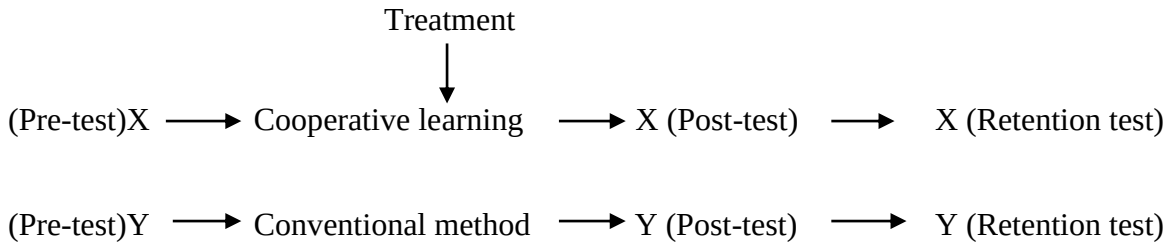
CHAPTER III

METHODOLOGY

This chapter describes research design, area of the study, population, sample, instrument for data collection, validation of the instrument, reliability of the instrument, method of data analysis and decision rule.

Design of the study

The study used the quasi-experimental design. Specifically, the pretest-posttest design with experimental and equivalent control group was used. This implies that non-intact classes', non-randomized groups were used for the study. This design was adopted because it was not possible for the research to randomly sample the subject and design them to group without disrupting the academic programme of the school involved in the study of the design is represented below in the research design



Quasi-experimental design is mostly applied to real life situation in education where random assignment of subject to treatment groups cannot be carried out without extensive disruption of the school programme (Okoro, 2003). Because the study was conducted with intact class in which school time-table was strictly followed. Therefore random assignment of subjects to experimental and control groups was not observed.

was not possible. Besides, true experimental research design would no doubt, disrupt the normal school programme. The design notation is graphically shown below:

Experimental Group: O_1 x O_2, O_3

Control Group: O_1 - O_2, O_3

O_1: represents pre-tests

O_2: represents post-tests

O_3: represents retention tests

X: stands for the treatment using Cooperative Learning Techniques

- : stands for treatment with Conventional Method

Area of the Study

The study was conducted at Government Technical College, Minna and Government Technical College Eyagi- Bida. Also the area posses all the necessary facilities like well equipped workshop and conducive classroom and personnel needed for carrying out the research.

Population

The accessible target population comprised of the student in technical two (TC II) who offers electrical work maintenance in Government Technical College, Minna and Government Technical college Eyagi- Bida. Niger state. The population composed of 96 students in Government Technical

College, Minna and 83 students in Government Technical college Eyagi- Bida in 2011/ 2012 academic year. No sample was made since population is not too large to control.

Sample

The sample for this study comprises of 96 students served as experimental group (student taught electrical work maintenance using the cooperative learning approach) and the other groups made up of 83 students were the control group (student taught electrical work maintenance using conventional method)

Instrument for Data Collection

Instrument used for study was cooperative learning approach and the conventional learning approach use the different lesson plan. The cooperative learning of electrical work maintenance constituted the experimental group while the control group was taught by the convention lecturing approach.

The multiple-choice pre-test, post-test and retention test consisting of twenty (20) items and short essay test of four (4) questions based on NABTEB modular curriculum syllabus for electrical. The researcher developed 16 lesson plans consisting of 8 experimental group lessons plans and 8 control group lessons plans (see appendix B) based on the content area of the study to assess the effectiveness.

The electrical work maintenance achievement test consist of multiple choice item (20 question) and theory questions (4 questions) for pre-test and the same multiple choice item and theory question for post test, achievement and retention test.

Validation of the Instrument

The cooperative learning lesson plans and questions were validated by lecturers in the Department of Industrial and Technology Education from Federal University of Technology Minna, also two Teachers in the Department of Electrical Work Maintenance from Government Technical College Minna and Government Technical College Eyagi- Bida. The validators checked the appropriates of test items and all the corrections and inputs were effected before administration.

Administration of the Instrument

The pre-test was first conducted before the commencement of treatment these exercise provides baseline data that was used to compare subject in both groups, and the lesson plan incorporate learning style which is cooperative learning. These cooperative learning emphasize student's active participation in their learning process.

The experimental group and control group was taught 8 lessons using the prepared lesson plans. Each lesson lasted for 45 minutes and the treatment lasted for eight weeks. At the end of the treatment, a posttest was administered on both group with the electrical work maintenance achievement test and the scores obtained from both groups were compared to determined if there was any significant difference in the performance of the two groups**.**

Retention test was conducted for the two groups (experimental group and control group) after three weeks to actually determine whether the students were able to retain what they were taught in class.

Method of Data Analysis

The research questions were answered using mean and standard deviation of the best scores while z-test was used to test the hypothesis at 0 .05 level of significance. The choice of z-test becomes necessary since two groups were involved and the pre-test means of both groups were almost equal. The t-critical value was 1.98 of 177df.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This chapter presents and analyses the data collected and arranged according to the hypothesis formulated and research questions for the study.

Research Question 1

What is the Achievement scores of students taught Domestic Industrial Installation using cooperative learning and students taught using conventional method.

Table 1

Mean Scores of Students in Experimental Group Taught Domestic Industrial Installation using Cooperative learning and Conventional Group.

GROUP		PRE-TEST	POST-TEST
TREATMENT GROUP	MEAN	29.35	78.20
	N	96	96
	STANDARD DEVIATION	12.26	11.68
CONTROL GROUP	MEAN	29.03	52.80
	N	83	83
	STANDARD DEVIATION	10.76	9.01

The data presented in Table 1 shows the students in the experimental group have a pre-test mean score of 29.35 and control group have a pre-test mean of 29.03, a post-test mean score of 78.20 and the standard deviation is 12.26 and 11.68 respectively. While the students in the control group have a pre-test mean score of 29.03 and the standard deviation of 10.76, a post test mean 52.80 with the standard deviation of 9.01. This means that the groups were found to be almost equal.

This shows that students in the experimental group taught with cooperative learning method retain what taught better than the students in the control group taught using the conventional method in Domestic Industrial Installation Subject

Research Question 2

What is the Retention scores of students taught Domestic Industrial Installation using cooperative learning and students taught using conventional method.

Table 2

Mean Scores of Students Experimental Group Taught Domestic Industrial Installation using Cooperative learning and Conventional Group.

GROUP		POST-TEST	RETENTION
TREATMENT GROUP	MEAN	78.20	77.40
	N	96	96
	STANDARD DEVIATION	11.68	11.73
CONTROL GROUP	MEAN	52.80	40.20
	N	83	83
	STANDARD DEVIATION	9.01	10.13

The data presented in Table 2 shows the students in the experimental group have a post-test mean score of 78.20, a retention mean score of 77.40 and the standard deviation is 11.68 and 11.73 respectively. While the students in the control group have a post-test mean score of 52.80and the standard deviation of 9.01, a retention mean score of 40.20with the standard deviation of 10.13.

This shows that students in the experimental group taught with cooperative learning method performed better than the students in the control group taught using the conventional method in Domestic Industrial Installation Subject.

Hypothesis 1

There is no statistically significant ($p < .05$) difference between the mean scores of students taught Domestic Industrial Installation using Control Group on pretest and posttest.

Table 3

Significance difference between mean scores of control group with regard to achievement in Domestic Industrial Installation on pretest and posttest

CONTROL	MEAN	STADARD DEVIATION	N	Z- VALUE	
				CALCULATED VALUE	TABLE VALUE
PRE-TEST	29.03	10.76	83	7.44	1.98
POST-TEST	52.80	9.01	83		

Table 3 indicates that the calculated value of z (7.44) was greater than table value (1.98) at 0.05 significance of level. It means that there was significant difference between mean scores on pretest and post of control group with regard to achievement in Domestic Industrial Installation after being treated by conventional method.

Hypothesis 2

There is no statistically significant (p <.05) difference between the mean scores of students taught Domestic Industrial Installation using Cooperative learning on pre-test and post-test.

Table 4

Significance difference between mean scores of experimental group with regard to achievement in Domestic Industrial Installation on pretest and posttest

EXPERIMENT	MEAN	STADARD DEVIATION	N	Z- VALUE	
				CALCULATED VALUE	TABLE VALUE
PRE-TEST	29.35	12.26	96	6.80	1.98
POST-TEST	78.20	11.68	96		

Table 4 indicates that the calculated value of z (6.80) was greater than table value (1.98) at 0.05 significance of level. It means that there was significant difference between mean scores on pretest and post of experimental group with regard to achievement in Domestic Industrial Installation after being treated by cooperative learning method.

Hypothesis 3

There is no statistically significant (p <.05) difference in the mean achievement scores of students taught domestic industrial installation using cooperative learning and students taught with conventional method

Table 5

Summary of the Z-test on the effect of cooperative learning and conventional group for teaching Domestic Industrial Installation Subjects

	MEAN	STADARD DEVIATION	N	DEGREE FREEDOM(DF)	Z CAL*	Z CRITICAL	REMARK
TREATMENT	51.83	11.68	40	100	7.44	1.98	S
CONTROL	35.69	9.01	62				

*S- significant

Table5. Indicates that the calculated value Z-test is 7.44,This value is higher than the critical z value found to be 1.98 of 100df at the significant level of 05. Consequently, the null hypothesis was rejected since the calculated value of Z is greater than the critical Z-value. This implies that there is a statistically significant ($p < .05$) difference in the mean achievement scores of students taught domestic industrial installation with cooperative learning and the conventional method.

Hypothesis 4

There is no statistically significant ($p < .05$) difference between the mean scores of students taught Domestic Industrial Installation using Control Group on posttest and retention test.

Table 6

Significance difference between mean scores of control group with regard to achievement in Domestic Industrial Installation on posttest and retention test

CONTROL	MEAN	STADARD DEVIATION	N	Z- VALUE	
				CALCULATED VALUE	TABLE VALUE
POST-TEST	52.80	9.01	83	6.88	1.98
RETENTION	40.20	10.13	83		

Table 6 indicates that the calculated value of z (6.88) was greater than table value (1.98) at 0.05 significance of level. It means that there was significant difference between mean scores on post-test and retention test of control group with regard to achievement in Domestic Industrial Installation after being treated by conventional method.

Hypothesis 5

There is no statistically significant ($p < .05$) difference between the mean scores of students taught Domestic Industrial Installation using Experimental Group on posttest and retention test.

Table 7

Significance difference between mean scores of experimental group with regard to achievement in Domestic Industrial Installation on posttest and retention test

CONTROL	MEAN	STADARD DEVIATION	N	Z- VALUE	
				CALCULATED VALUE	TABLE VALUE
POST-TEST	78.20	11.68	96	7.44	1.98
RETENTION	77.40	11.73	96		

Table 7 indicates that the calculated value of z (7.44) was greater than table value (1.98) at 0.05 significance of level. It means that there was significant difference between mean scores on pretest and retention test of experimental group with regard to achievement in Domestic Industrial Installation after being treated by conventional method.

Hypothesis 6

There is no statistically significant ($p < .05$) difference in the mean retention scores of students taught domestic industrial installation using cooperative learning and students taught with conventional method

Table 8

Summary of the Z-test on the effect of cooperative learning and conventional group for teaching Domestic Industrial Installation Subjects

GROUP	MEAN	STADARD DEVIATION	N	DEGREE FREEDOM(DF)	Z CAL*	Z CRITICAL	REMRK
TREATMENT	57.05	11.73	40	100	6.88	1.980	S
CONTROL	41.05	10.13	62				

*S- significant

Table 8 indicates that the calculated value Z-test is 6.88. This value is higher than the critical z value found to be 1.98 of 100df at the significant level of 0.05. Consequently, the null hypothesis was rejected since the calculated value of Z is greater than the critical Z-value. This implies that there is a statistically significant ($p < .05$) difference in the mean retention scores of students taught domestic industrial installation with cooperative learning and the conventional method

Summary of Findings

Based on the data collected and the analysis for this study, The following major findings were made with respect to the research questions and hypotheses.

1. Students taught with cooperative learning method scored higher in the post test than those taught with the conventional method. This means that cooperative learning lead to higher performance achievement in domestic industrial installation than lecture method.
2. The students taught with cooperative learning method also score higher in the retention test. This means that cooperative learning led to higher performance in retention of domestic industrial installation than lecture method.
3. The students taught with cooperative learning approach had higher mean scores than those taught by the conventional method in domestic industrial installation achievement and retention test. This implies that the cooperative learning are more effective in enhancing students performance of learning and retention in domestic industrial installation than the lecture method
4. There is a significant difference in the mean scores of students taught domestic industrial installation using cooperative learning and students taught with conventional method

Discussion of findings

The analysis of the results of the achievement and retention test shown on table 1 and table 2 shown that experimental group had higher mean scores than the control group in post test and retention test. The z-test of the post test and retention test scores presents on table 3and 4 confirmed that the difference between the mean scores of students in both groups in the post test and retention was significant. This significant difference is attributed to the treatment. The finding indicate that

cooperative learning has a positive effects on students performance in domestic industrial and installation , this implies that cooperative learning are more effective than the conventional lecture method in enhancing students performance in Domestic Industrial Installation.

Some of the likely reasons why cooperative learning style is superior to the conventional method include the fact that Cooperative learning style fosters student- student interaction in classrooms. The findings of these researchers supported firmly the above (Smith, Johnson, & Johnson, 1999a; Smith, Johnson, & Johnson, 1999b) Thus, it elicits in the student the spirit of helping one another to arrive at their common goal. Interdependence and involvement among students in domestic industrial installation is harnessed through this cooperative learning method- a situation that can be hardly obtained in the normal conventional method.

Cooperative learning method creates accountability awareness among the students and thus encourages collaborative dialogue between students. Students are always excited through this learning process as they get more attention and are closer to their teachers; the learning style also offers all students an opportunity to succeed in their learning. Student retains better what is learnt as students interact freely among themselves when learning or solving problems in domestic industrial installation subjects. It engenders in the teachers to be more committed in their teaching in terms of lesson preparations and provision of teaching aid also equitable use of and provision of instructional materials played an important role in enhancing the superiority of the cooperative learning style against the conventional method, This supported firmly Davison (1990) view's that the teacher's role includes initiating group work, presenting guidelines, forming heterogeneous groups, preparing and introducing new material, interacting with small groups, tying ideas together, making assignments of homework or class work, and evaluating student performance. It is also supported by other researchers like Johnson and Johnson (1999) and Slavin (2000, 2003)

Specifically, the provision of an cooperative learning environment where students can participate actively in class discussion increase the student ability to explore issue and articulate their own ideas. This affirms tochonites (2000), and bonwel and Elson's (2003) view's that cooperative learning facilitates active knowledge construction, develops higher order thinking, skills improve memory and enhance transfer of learning to other situations.

Also, it is well known fact in education that when students work or learn in groups, in order to be an effective participant, will need to think critically in order to make logical contributions moreover, when students learn in groups, the bright ones always help the dull one to understand the subject matter being learnt. This affirms Ngeow (1998) and Lazarus (1999) view that cooperative learning enhances critically thinking skills and hence learning. Moreover, cooperative learning increases a student's self-confidence which in turn lead to higher performance. The variability in the achievement test scores support the views of Parnell (2000) and Patterson (2002) that there is a wide variation in student's abilities.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATION

Summary of the study

Education is the key to any development process, technical vocational education is the master key that can transform the world of work and the economy, alleviate poverty, save the environment and improve the quality of life. It is disheartening that the products of technical vocational education are facing serious problem of unemployment and they cannot be self employed.

Learning outcome of every student major depends on the type of learning methods, teaching strategies and instructional techniques or approaches employed by teacher during instruction. Numerous studies and educational reports have pointed out that the solitary models of the traditional teaching method tend to make student overlay passive and indifferent to what is taught. The traditional whole class lecturing method is found to be one of the major causes of student's low performance in technical courses. This method may also be attributed to the high rate of exam malpractice among student because passive learning allow student have less than 30% retention rate, while co- operative as a sub-set of active learning gives 90% retention rate. It help in communication, interaction and interpersonal skills, team work and leadership skills, self –esteem and high level thinking skills.

This study was concerned with ascertaining the effect of cooperative learning on achievement and retention of electrical work maintenance student in Government Technical College. The study was also concerned with ascertaining whether those taught using cooperative learning might perform better than those using conventional methods, Available literature reviewed showed evidence that this concern is true.

Literature for this study was reviewed in accordance with stated objectives of the study of cooperative learning on achievement and retention of electrical work maintenance student in Government Technical College. The literature provided information related to the concepts of electrical work maintenance and the concept of cooperative learning.

The study adopted a quasi-experimental design. It involved the use of pre-test, post-test and retention Non-equivalent control design. The study answered two research questions and tested six hypotheses. The instrument was made up of domestic industrial installation Multiple Choice Achievement Test developed by the researcher. It consists of 20-multiple-choice items with four options of A. B. C. D. The test items was identified and selected from the content of the school syllabus for the term. The test items were designed by the researcher with the assistance of his supervisor and were based on the review of literature relevant to the study.

The instrument were validated by three experts drawn from the lecturers in the department of industrial and technology education and the H.O.D of electrical department in Technical college minna and the H.O.D of electrical department in Government Technical College Eyagi- Bida. A pretest were first administered to the two group followed by the treatment which last for a term. The post test was given at the end of the treatment, then followed by the retention test. The results obtained from the test scores were compiled and analyzed using the following statistical tools: mean standard deviation and Z-test.

Findings

Based on the data collected and analyzed, the following principal findings were made;

I. Students exposed to cooperative learning have their mean scores higher than the students exposed to conventional methods of learning. There is significant difference in their means this

implies that the cooperative learning methods as an active learning have affected students achievement positively and if cooperative learning method is been put to use, the students are likely going to perform well in internal and external examination.

II. The mean scores of post-test of students taught with conventional method is higher than the scores of retention test, this implies that the students taught domestic industrial installation using conventional method do not have good retention of what they were taught. These have serious negative implication to teaching/learning because students suppose to retain what they are taught even after examination.

III. Students who were taught with the cooperative learning were found to have almost the same post-test and retention scores, this implies that students taught domestic industrial installation using cooperative learning have good retention of what they were taught, this help the students to be able to perform better outside the classroom situations

IV. The learning instructional technique which is cooperative learning was found to have positive effects on student's achievement and retention in electrical work maintenance.

Implications of the study

The following implications arose from this research study. In many classrooms, students work on their own, on individualistic materials and with a minimum of interaction with their classmates. The results of this study threw some light on the utility of cooperative learning style in classrooms. Student' interactions among themselves and with instructional materials have positive effect on their learning.

The findings of this study have implication for electrical work maintenance teachers, curriculum developers, students' educational administrator and examination bodies. Having found that

cooperative learning have positive effects on students learning in electrical work maintenance, it implies that electrical work maintenance should adopt approach by incorporating cooperative learning in their teaching method, the approach could considerably improve the students' communication and logical thinking skills, interpersonal relationships and self-concepts, it will also improve their manipulative or kinesthetic skill and visual-spatial skills considerably and at the same time cater for the diverse learning styles of student in each classroom.

The implications of the finding of this study to curriculum developers is that they should develop appropriate curriculum that will make provision for the teacher to adopt various activities that will appeal to each students' learning styles to enable them learn effectively. Students should be able to identify their strongest, weakest and natural talent and should be able use that as basis for career decisions. From the findings of the study, examination bodies should be able to develop appropriate assessment instrument that will enable them to assess student performance assessment instrument that will enable them to assess student performance or abilities. The implication for educational administrators is that they will greatly appreciate the need for the provision of adequate learning facilities like workshop, tools and consumable materials and instructional materials such as visuals aids, models and charts which will greatly enhance students learning.

Conclusion

The study investigated the effect of cooperative learning on achievement and retention of electrical work maintenance students. The purpose of the study was to compare the effect of cooperative learning and the conventional teaching method on the mean achievement of students and their retention. Two null hypotheses were formulated. The pre-treatment test, the post-treatment and

the retention test were tools used for data collection. The hypotheses were tested using the Z-test technique. The major finding of study is:

There is a significant difference in the mean achievement scores of students taught domestic industrial installation using cooperative learning and those that use the conventional teaching method. This implies that the cooperative learning is more effective than the conventional method of teaching domestic industrial installation. Implications for the study were made after the limitations of the study were enunciated.

Recommendations

On the basis of the findings and its implications of this study the following recommendations were made:

I. Teachers should encourage students to learn and work in groups as this will enable them to improve their academic performance and thereby give room for better performance in both internal and external examination

II. Teachers should encourage cooperative learning for their instructional delivery because it will allow them to identify their areas of strengths and weakness and hence regulate their rate of learning without being compelled

III. Government Technical College Principals and the different agencies should provide fund to procure the materials needed and re-equip electrical workshop to enable teachers to effectively adopt cooperative learning which will make the teaching of electrical works maintenance more practical than it is presently.

IV. Supervisors and principals should discourage the use of conventional methods of learning most especially in teaching electrical work maintenance.

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Appendix B

COOPERATIVE LEARNING TECHNIQUES AND ACTUAL TREATMENT THAT WAS GIVEN TO THE STUDENT

Cooperative method Lesson Plan 1

TOPIC:	ILLUMINATION TERMS TIME:
CLASS:	T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).
AVERAGE AGE :	16-19 YRS
TIME:	40 MINUTES
PERFORMANCE OBJECTIVE:	At the end of the lesson, the student should be able to 1. Define illumination. 2. Define the different illumination terms.
ENTRY BEHAVIOUR:	It is expected that students have properly mastered the previous lesson
INSTRUCTION MATERIAL:	Electric lamp/bulb , Cardboard sheets displaying various drawing for the illumination terms

INSTRUCTIONAL PROCEDURE:

(See Chart)

C. D	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIAL
CD 1 General Instruction	-Teacher states objectives of the lesson as : Illumination terms. -Tells students the definition of illumination - Give the illumination terms -Define each illumination terms	Students listen and take down the task	Chalk Bulb
CD 2 Grouping	-Teacher separates the class into group of 4 -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their different groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	Illumination models.
CD 3 Supervi sion	-The teacher goes around the groups, clearing Doubts and urging all members to be involved in thesolution of task	-Each group now carries out the specified task	
CD 4 Presenta tion by groups	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5	-The teacher controls here during the discussion.		

General Discussion.	-She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: List the various illumination terms and define	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the main illumination terms The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 2

TOPIC: COSINE LAW, INVERSE SQUARE LAW, BRIGHTNESS GLARE, AND PHOTOMETRY

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. State the different laws
2. Differentiate between the different laws

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson which is illumination terms.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CD	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIALS
CD 1 General Instruction	-Teacher states objectives of the lesson as : Cosine law, inverse square law, brightness glare and photometry. -He explain further that: STEP 1: Cosine law(also known as Lambert's cosine law). The law states that the illuminate(E) is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. STEP 2: Inverse square law. It states that the illumination of a surface is inversely proportional to the square of the distance of the surface from the source. E a I/r^2. STEP 3: Brightness glare: This is an instrument for the evaluation of glare from light sources STEP 4: Photometry: This is a science of the measurement of light, in the terms of the perceived brightness to the human eyes. It can be also defined as the measure of light in a given area. It is the measurement of light's brightness or luminous intensity.	Students listen and take down the note	Chalk

CD 2 Grouping	-Teacher separates the class into group of 10 -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their different groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	
CD 3 Supervision	-The teacher goes around the groups, clearing doubts and members to be involved in the solution of task	-Each group now carries out the specified task	
CD 4 Presentation by groups	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5 General Disc	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	

CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 3

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CD	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIALS
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1: Spacing ratio is mark per area ratio M/A. STEP 2: Spacing and height ratio is given by the ratio: horizontal distance btw two lamps / Mounting height of lamps. This ratio depends on the nature of the polar curve of a lamp when used along a reflector. -The teacher ask the student to solve a mathematical question with the above formula	Students listen and take down the task	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their different groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	
CD 3	-The teacher goes around the groups, clearing doubts and members to be involved in the solution of task	-Each group now carries out the specified	

Supervision		task	
CD 4 Presentation groups	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5 General Discu	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 4

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIALS
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1: Spacing ratio is mark per M/A. STEP 2: Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamp / Mounting height of lamps. This ratio depends on the nature of the polar curve when used along a reflector. -The teacher ask the student to solve a mathematic cal question with the above formula	Students listen and take down the task	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	
CD 3	-The teacher goes around the groups, clearing doubts and urging all members to be involved in	-Each group now carries specified task	

Supervision	the solution of task		
CD 4 Presentation by g	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5 General Discussi	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 5

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIAL
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1: Spacing ratio is mark per M/A. STEP 2:Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamps / Mounting height of lamps. This ratio depends on the nature of the polar curve when used along a reflector. -The teacher ask the student to solve a mathematical question with the above formula	Students listen and take down th	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their groups -Students in each group select a group leader -Group leaders pick their tasks ra -Each group retires to their working places	
CD 3 Supervision	-The teacher goes around the groups, clearing doubts and urging all members to be involved in the solution of task	-Each group now carries out the specified task	

CD 4 Presentation by g	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5 General Discussi	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives q		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 6

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIALS
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1:Spacing ratio is mark per area ratio M/A. STEP 2:Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamps Mounting height of lamps. This ratio depends on the nature of the polar curve when used along a reflector. -The teacher ask the student to solve a mathematica with the above formula	Students listen and take down the task	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their different groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	
CD 3 Supervision	-The teacher goes around the groups, clearing doubts and urging all members to be involved in the solution of task	-Each group now carries specified task	

CD 4 Presentation by g	-The teachers only moderates the presentation	-Each group representative comes and presents how they to solve the task.	
CD5 General Discussi	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 7

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIAL
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1:Spacing ratio is mark per area ratio M/A. STEP 2:Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamps Mounting height of lamps. This ratio depends on the nature of the polar curve when used along a reflector. -The teacher ask the student to solve a mathematica with the above formula	Students listen and take down th	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their groups -Students in each group select a group leader -Group leaders pick their tasks ra -Each group retires to their working places	
CD 3 Supervision	-The teacher goes around the groups, clearing doubts and urging all members to be involved in the solution of task	-Each group now carries out the specified task	

CD 4 Presentation by g	-The teachers only moderates the presentation	-Each group representative comes and presents how they were able to solve the task.	
CD5 General Discussi	-The teacher controls here during the discussion. -She summarizes all that the groups did and receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Cooperative method Lesson Plan 8

TOPIC: SPACING AND MONITORING HEIGHT RATIO

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Express in ratio spacing and height ratio.

ENTRY BEHAVIOUR: Correction of assignment given in the previous class.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	MATERIALS
CD 1 General Instruction	-Teacher states objectives of the lesson as : Spacing and monitoring height ratio STEP 1:Spacing ratio is mark per area ratio M/A. STEP 2:Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamps Mounting height of lamps. This ratio depends on the nature of the polar curve when used along a reflector. -The teacher ask the student to solve a mathematica with the above formula	Students listen and take down the task	Chalk
CD 2 Grouping	-Teacher separates the class into group of 10 as usual -He assigns working places or corners to groups and - Presents the group with models for their work.	-Student identify with their groups -Students in each group select a group leader -Group leaders pick their tasks randomly -Each group retires to their working places	
CD 3 Supervision	-The teacher goes around the groups, clearing doubts and urging all members to be involved in thesolution of task	-Each group now carries specified task	

CD 4 Presentation by g	-The teachers only moderates the presentation	-Each group representative comes and presents how they to solve the task.	
CD5 General Discussi	-The teacher controls here during the discussion. -She summarizes all that the groups did and Receives questions.		
CD 6 Evaluation	The teacher gives the following questions QUESTION: state the different laws Differentiate between the different laws	-The groups copy the assignment given as home work	
CD 7 Summary	The teacher reminds them of the various laws. The teacher encourages and praises the groups and their leaders for their cooperative spirit		

Appendix D

Lecture method Lesson Plan 1

TOPIC:	ILLUMINATION TERMS.
CLASS:	T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).
AVERAGE AGE :	16-19 YRS
DATE:	
TIME:	40 MINUTES
PERFORMANCE OBJECTIVE:	At the end of the lesson, the student should be able to 1. Define illumination. 2. Define the different illumination terms.
ENTRY BEHAVIOUR:	It is expected that students have properly mastered the previous lesson
INSTRUCTION MATERIAL:	Electric lamp/bulb.
INSTRUCTIONAL PROCEDURE:	(See Chart)

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 ILLUMINATION T	Step 1 : Define Illumination as the amount of light per unit area delivered to a surface and accounting for the spectral sensitivity of human eyes	Students listen and take down th	
CD 2 ILLUMINATION T	STEP 2:Define illumination terms which are:- 1. Candela:- it is the unit for luminous 2. intensity of a source. 3. Luminous flux:- (F or O). It is the light 4. energy radiated out per seconds from the l form of luminous light waves 5. Lumen-hour:- It is the quantity of light 6. delivered in one hour by a flux of one 7. lumen 8. Luminous intensity(I) or Candle power:- 9. It is a solid angular flux density of a 10. source in a specific direction 11. Reduction factor:-It can be defined as a reduction factor. 12. I luminance:-It is the ability of a luminous 13. flux to fall on a surface. 14. Luminance:- It is given as E=SLcosθ. 15. dw=LScos~~O.dw~~		

	16. Luminous Existence of a surface:- Is 17. defined as luminous flux per unit area in all M=DO/DA.(im/M^2)/lux 18. Transmittance(T) of an illuminated Diffused Surface:- It is defined as the ratio of the total flux transmitted by it to the total flux incident 19. Reflection Ratio:- It is given by The luminous flux reflected from a small area of the surface to the total flux incident upon it.		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	The lesson will be evaluated by means of oral question asked by the teacher		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms		

Lecture method Lesson Plan 2

TOPIC: COSINE LAW, INVERSE SQUARE LAW, BRIGHTNESS GLARE, AND PHOTOMETRY

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE: 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. State the different laws
2. Differentiate between the different laws

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELOPMENT	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 COSINE LAW, II SQUARE BRIGHTNESS AND PHOTOMET	Step 1 : Cosine law(also known as Lambert's cosine law). The law states that the illuminate(E) is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux.	Students listen and take down th	
CD 2 COSINE LAW, II SQUARE BRIGHTNESS AND PHOTOMET	STEP 2: Inverse square law.It states that the illumination of a surface is inversely proportional to of the distance of the surface from the source. E a I/r^2. STEP 3:Brightness glare: This is an instrument for the evaluation of glare from light sources STEP 4:Photometry: This is a science of the measurement of light, in the terms of the perceived brightness to the human eyes. It can be also defined as the measure of light in a given area. It is the measurement of light's brightness or luminous intensity.		

CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	The lesson will be evaluated by means of oral question asked by the teacher		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms and gave the class an assignment. State Cosine and Inverse square law		

Lecture method Lesson Plan 3

TOPIC: ILLUMINATION CALCULATION

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE : 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE OBJECTIVE: At the end of the lesson, the student should be able to

1. Define illumination.
2. Define the different illumination terms.
3. The student should be able to solve some mathematical problems conveniently.

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

INSTRUCTION MATERIAL: Electric lamp/bulb.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 ILLUMINATION CALCULATION	Step 1 : Inverse square law. E a I/r^2.	Students listen and take down th	
CD 2 ILLUMINATION CALCULATION	STEP 2:Lambert's Cosine law.		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	The lesson will be evaluated by means of oral question asked by the teacher		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms and gave the class an assignment: The average luminous output of an 80W fluorescent lamp is 1.5m in length and 3.5cm diameter is 3300 lumen. Calculate its average brightness. If the auxiliary gear associated with the lamp consumes a load equivalent to 25% of the lamp calculate the cost		

	of running a twin unit for 2500hrs at 30 paise per KWh.		

Lecture method Lesson Plan 4

TOPIC:	SPACING AND MONITORING HEIGHT RATIO.
CLASS:	T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).
AVERAGE AGE :	16-19 YRS
DATE:	
TIME:	40 MINUTES
PERFORMANCE OBJECTIVE:	At the end of the lesson, the student should be able to 1. Express in ratio spacing and height ratio.
ENTRY BEHAVIOUR:	It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 SPACING MONITORING RATIO	Step 1 : Spacing ratio is mark per area ratio M/A.	Students listen and take down th	
CD 2 SPACING MONITORING RATIO	STEP 2: Spacing and height ratio is given by the ratio.:- horizontal distance btw two lamps Mounting height of lamps		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	The Teacher will ask a student to write the spacing height ratio on the board		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms.		

Lecture method Lesson Plan 5

TOPIC: DIFFERENT TYPES OF LAMP.

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE: 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE

OBJECTIVE: At the end of the lesson, the student should be able to

1. List the types of lamps
2. Explain the different Types of lamps:

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELC	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 DIFFERENT TYPES OF LAMP.	Step 1 : There are different Types of lamps: Which includes:- 1. Incandescent lamps. 2. fluorescent lamps 3. Mercury vapour lamps 4.sodium vapour lamps	Students listen and take down th	
CD 2 DIFFERENT TYPES OF LAMP.	STEP 2: -Incandescent lamps:- They have instantaneous start and becomes momentarily off. The colour of their light is very near the natural light. -Fluorescent lamps:- They have a reaction time of one seconds or a little more at the start. They go off and restart when the supply is restored. -Mercury vapour lamps:-They take five or six minutes for starting. They go off and cannot be after the recovery of the voltage till the pressure falls to normal-sodium vapour lamps:- They have a starting time of five to six minutes, They go off and cannot be restarted after the recovery of the voltage till the pressure falls to normal. The colour of their light is yellowish		

	and produce colour distortion		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	Mention the different types of lamps		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms and gave assignment: Give the colour of different types of lamps		

Lecture method Lesson Plan 6

TOPIC: DIFFERENT TYPES OF LAMP.

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE: 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE

OBJECTIVE: At the end of the lesson, the student should be able to

1. List the types of lamps
2. Explain the different Types of lamps:

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 DIFFERENT TYP LAMP.	Step 1 : There are different Types of lamps: Which includes:- 1. Incandescent lamps. 2. fluorescent lamps 3. Mercury vapour lamps 4.sodium vapour lamps	Students listen and take down th	
CD 2 DIFFERENT TYPES OF LAMP.	STEP 2: -Incandescent lamps:- They have instantaneous start and becomes momentarily off. The colour of their light is very near the natural light. -Fluorescent lamps:- They have a reaction time of one seconds or a little more at the start. They go off and restart when the supply is restored. -Mercury vapour lamps:-They take five or six minutes for starting. They go off and cannot be restarted after the recovery of the voltage till the pressure falls to normal-sodium vapour lamps:- They have a starting time of five to six minutes, They go off and cannot be restarted after the recovery of the voltage till the pressure falls to normal. The colour of their light is yellowish		

	and produce colour distortion		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	Mention the different types of lamps		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms and gave assignment: Give the colour of different types of lamps		

Lecture method Lesson Plan 7

TOPIC: DIFFERENT TYPES OF LAMP.

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE: 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE

OBJECTIVE: At the end of the lesson, the student should be able to

1. List the types of lamps
2. Explain the different Types of lamps:

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 DIFFERENT TYP LAMP.	Step 1 : There are different Types of lamps: Which includes:- 1. Incandescent lamps. 2. fluorescent lamps 3. Mercury vapour lamps 4.sodium vapour lamps	Students listen and take down th	
CD 2 DIFFERENT TYP LAMP.	STEP 2: -Incandescent lamps:- They have instantaneous start and becomes momentarily off. The colour of their light is very near the natural light. -Fluorescent lamps:- They have a reaction time of one seconds or a little more at the start. They go off and restart when the supply is restored. -Mercury vapour lamps:-They take five or six minutes for starting. They go off and cannot be after the recovery of the voltage till the pressure falls to normal-sodium vapour lamps:- They have a starting time of five to six minutes, They go off and cannot be restarted after the recovery of the voltage till the pressure falls to normal. The colour of their light is		

	and produce colour distortion		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	Mention the different types of lamps		
CD5 Summary	-The teacher summaries by reminding the students Of the various illumination terms and gave assignment: Give the colour of different types of lamps		

Lecture method Lesson Plan 8

TOPIC: DIFFERENT TYPES OF LAMP.

CLASS: T.C.2 ELECTRICAL MAINTENANCE WORK (ENM).

AVERAGE AGE: 16-19 YRS

DATE:

TIME: 40 MINUTES

PERFORMANCE

OBJECTIVE: At the end of the lesson, the student should be able to

1. List the types of lamps
2. Explain the different Types of lamps:

ENTRY BEHAVIOUR: It is expected that students have properly mastered the previous lesson

.

INSTRUCTIONAL PROCEDURE:

(See Chart)

CONTENT DEVELO	TEACHERS ACTIVITIES	STUDENTS ACTIVITIES	STRATEGIES
CD 1 DIFFERENT TYP LAMP.	Step 1 : There are different Types of lamps: Which includes:- 1. Incandescent lamps. 2. fluorescent lamps 3. Mercury vapour lamps 4.sodium vapour lamps	Students listen and take down th	

CD 2 DIFFERENT TYP LAMP.	STEP 2: -Incandescent lamps:- They have instantaneous start and becomes momentarily off. The colour of their light is very near the natural light. -Fluorescent lamps:- They have a reaction time Of one seconds or a little more at the start. They go off and restart when the supply is restored. -Mercury vapour lamps:-They take five or six minutes for starting. They go off and cannot be after the recovery of the voltage till the pressure falls to normal-sodium vapour lamps:- They have a starting time of five to six minutes, They go off and cannot be restarted after the recovery of the voltage till the pressure falls to normal. The colour of their light is yellowish and produce colour distortion		
CD 3 Recapitulation	-The teacher reviews the main points of the lesson and allows the students to ask questions.	The students listen and ask questions	
CD 4 Evaluation	Mention the different types of lamps		
CD5	-The teacher summaries by reminding the students		

Summary	Of the various illumination terms and gave assignment: Give the colour of different types of lamps		

Appendix E

PRE-TEST ITEM AND POST-TEST ITEMS

TIME ALLOWED: 45 MINUTES

INSTRUCTION: Choose the most appropriate for the following question

1. One of these is not a principal term in connection with illumination

(a)Candela

(b) Solid Angle

(c) Lumen-hour

(d) Reduction factor

2. The ratio of the total luminous flux transmitted by it to the total flux incident on it defines which of the following:

(a) Luminous intensity

(b) lumen-hour

(c) luminous Existence

(d)Transmittance

3. The unit of luminous flux is

(a)Im/m^2

(b) cd/m^2

(c) lumen

(d) candela

4. _____ states that the illumination of a surface is inversely proportional to the square of the distance of the surface from the source

(a)Lambert's cosine law

(b) Photometry law

(c) Brightness glare

(d) Inverse square law

5. A material that does not conduct electric current is called_____

(a) conductor

(b) Inductor

(c) Insulator

(d) Converter

6. Brightness glare is an instrument of evaluation of _____from a Light source.

(a) glare

(b) photometer

(c) luminous intensity

(d) Lumen-hour

7. A small light source with intensity uniform in all distance is mounted at a height of 10metres above a horizontal surface. two points A and B both lie on the surface with point A directly beneath the source, how far is B from A if the illumination at B is only 1/10 as great as at A?

(a)19.1m

(b) 13.3m

(c) 9.2m

(d) 22.4m

8. The formula for spacing and mounting height ratio is given as

(a)$\frac{\text{vertical distance between two lamps}}{\text{Mounting height of lamps}}$

(b)$\frac{\text{vertical distance between two lamps}}{\text{Climbing height of lamps}}$

(c)$\frac{\text{Horizontal distance between two lamps}}{\text{Mounting height of lamps}}$

(c)$\frac{\text{Horizontal distance between two lamps}}{\text{climbing height of lamps}}$

9. Candela is the unit of what?

(a) Flux

(b) luminous intensity

(c) illumination

(d) Luminas

10. _____does not have separate choke

(a)sodium vapour lamp

(b) fluorescent lamp

(c) mecury vapour lamp

(d) all of the above

11. The colour of sodium vapour discharged lamp is _____

(a)red

(b) pink

(c) yellow

(d) bluish green

12. A small light source with intensity uniform in all distance is mounted at a height of 10metres above a horizontal surface.

(a) 19.1m

(b) 13.3m

(c) 9.2m

(d) 22.4m

13. _____is the measurement of light's brightness or luminous intensity.

(a)photometry

(b) illumination

(c) candela

(d) brightness glare

14. The law with the formula $E_2=E_1 \cos 0$ is

(a)specific output law

(b) Lambert's cosine law

(c) Specific consumption law

(d) Inverse square law

15. An incandescent lamp can be used

(a) In any position

(b) On both AC & DC supply

(c) for street lightening

(d) all of the above

16. Glass, paper, wood are examples of _____

(a)conductor

(b) Inductor

(c) insulator

(d) converter

17. The ability of a material not to respond to electric flow is referred to as

(a)insulation

(b) insulating

(c) insulator

(d) insulation

18. The symbol of luminous existence of a surface is represented by

(a) W

(b) L

(c) M

(d) S

19. The average working life of a fluorescent is about ____ hours

(a)1000

(b) 4000

(c) 3000

(d) 5000

20. Total flux required in any lightening scheme depends inversely on ……

(a) Illumination

(b) surface area

(c) utilization factor

(d) space/height ratio.

THEORY

ANSWER ALL QUESTION

1a. Define illumination

b. Give five principal illumination terms and explain two

2a. What is Brightness glare?

b. list ten (10) insulating materials

Appendix F

MARKING SCHEME FOR THE PRE TEST AND POST TEST

OBJECTIVE SECTION

1. B
2. C
3. C
4. D
5. B
6. A
7. A
8. D
9. C
10. B
11. D
12. A
13. C
14. A
15. C
16. A
17. B
18. B
19. C

THEORY SECTION

1. a. Illumination is the amount of light per unit area delivered to a surface and accounting for the spectral sensitivity of the human eyes

(5mrks)

OR

Illumination can be defined as the fall of light on an object at the immediate environment/surrounding.

b. Candela

Luminous intensity

Lunen-hour

Lumen-hour

Reduction factor

Luminance

Transmittance

Reflection Ratio

Specific Consumption

2. a. Brightness glare is an instrument for the evaluation of glare from light sources

b. Glass, wood, brick, poured concrete, rubber, sinoflex, timber, ceramics, leather, dry wool (cotton), nylon(polythene), plastics

Appendix G

RESULT OF THE CONTROL AND EXPERIMENT GROUPS

Experimental Result in Government Technical College Minna, Niger state

EXPERIMENTAL GROUP			
S/N	PRE TEST	POST TEST	RETENTN
1	28	60	68
2	16	47	55
3	33	52	60
4	30	46	54
5	43	48	56
6	37	47	55
7	19	51	59
8	49	53	61
9	53	63	71
10	26	39	47
11	36	39	47
12	24	67	72
13	46	50	55
14	37	39	44
15	23	37	42
16	22	69	74
17	14	49	54
18	24	41	46
19	49	70	75
20	25	65	70
21	16	44	49
22	30	46	51
23	17	71	76
24	31	42	47
25	57	62	67
26	19	46	51
27	18	40	45
28	26	79	84
29	36	52	55
30	26	47	50
31	19	41	44

32	20	43	46
33	51	82	85
34	18	44	47
35	32	41	44
36	18	65	68
37	28	50	53
38	48	50	53
39	22	54	57
40	8	42	45
41	19	51	59
42	49	53	61
43	53	63	71
44	26	39	47
45	36	39	47
46	24	67	72
47	46	50	55
48	37	39	44
49	23	37	42
50	22	69	74
51	14	49	54
52	24	41	46
53	49	70	75
54	25	65	70
55	16	44	49
56	30	46	51
57	17	71	76
58	31	42	47
59	22	69	74
60	14	49	54
61	24	41	46
62	49	70	75
64	25	65	70
65	16	44	49
66	30	46	51
67	17	71	76
68	31	42	47
68	57	62	67
70	19	46	51
71	18	40	45
72	26	79	84
73	36	52	55

74	26	47	50
75	19	41	44
76	20	43	46
77	51	82	85
78	18	44	47
79	32	41	44
80	18	65	68
81	28	50	53
82	48	50	53
84	22	54	57
85	8	42	45
86	19	51	59
87	49	53	61
88	53	63	71
89	26	39	47
90	36	39	47
91	24	67	72
92	16	44	49
93	30	46	51
94	17	71	76
95	31	42	47
96	57	62	67

Results for Control Group in Government Technical College, Eyagi-Bida.

CONTROL GROUP			
S/N	PRE TEST	POST TEST	RET
1	35	24	29
2	28	25	30
3	15	25	30
4	10	25	30
5	26	25	30
6	10	25	30
7	28	25	30
8	52	26	31
9	37	27	32
10	16	27	32
11	40	27	32
12	35	27	32
13	48	28	33
14	43	28	33
15	23	29	34
16	30	29	34
17	15	29	34
18	34	30	35
19	10	30	35
20	27	30	35
21	31	31	36
22	20	31	36
23	16	31	36
24	18	31	36
25	22	32	37
26	20	32	37
27	18	33	38
28	28	33	38
29	21	33	38
30	14	33	38
31	18	33	38
32	32	34	39
33	22	34	39
34	19	34	39
35	39	35	40

36	26	35	40
37	37	36	41
38	28	37	42
39	23	37	42
40	18	37	42
41	32	37	42
42	24	39	44
43	26	39	44
44	36	39	44
45	37	39	44
46	24	39	47
47	27	40	48
48	26	41	49
49	24	41	49
50	28	41	49
51	32	41	49
52	30	43	51
53	32	45	53
54	34	47	55
55	35	47	55
56	39	49	57
57	40	50	58
58	43	53	61
59	47	53	61
60	48	57	65
61	49	57	65
62	55	63	71
63	40	27	32
64	35	27	32
65	48	28	33
66	43	28	33
67	23	29	34
68	30	29	34
69	15	29	34
70	34	30	35
71	10	30	35
72	27	30	35
73	31	31	36
74	20	31	36
75	16	31	36
76	18	31	36

77	22	32	37
78	20	32	37
79	18	33	38
80	28	33	38
81	21	33	38
82	14	33	38
S83	18	33	38