ASSESSMENT OF TASK, ACTIVITIES AND WORKING MATERIALS USED IN NON-FORMAL TRAINING OF SOLAR AND SATELLITE SYSTEMS INSTALLATION IN NIGER STATE, NIGERIA

BY

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MTech/SSTE/2018/8765

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APRIL, 2023

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN INDUSTRIAL AND TECHNOLOGY EDUCATION (ELECTRICAL/ELECTRONIC TECHNOLOGY OPTION)

APRIL, 2023

ABSTRACT

The study was designed to assess the tasks, activities and working materials in the non-formal training of craft man in solar and satellite systems installation in Niger State, Nigeria. Descriptive Survey research design was adopted. The study was carried out in Niger State. The population for the study comprised 243 trainees and 99 master trainers. For this study, the entire population of the trainee and the master trainers was used; hence, sampling was not carried out. The research instrument used in this study is a structured questionnaire, and it involve the use of a Likert scale. The instrument was validated by experts in the Department of Industrial and Technology Education, Federal University of Technology, Minna. Cronbach Alpha co-efficient was used to determine the internal consistency of the instrument and it yielded reliability coefficient of 0.99. Data were collected through questionnaire with the help of six research assistants. SPSS was used to analysis the data. Mean and standard deviation was used to answer research questions, while z test was used to test the hypotheses at 0.05 level of significance. From the findings, it revealed that tasks in non-formal training of trainees in Solar system installation in Niger State among others are: deciding on the best locations for solar equipment, setting up scaffolding, planning how to route cables, Installing solar panel mount and installing the solar panel also, activities in non-formal training of trainers in solar system installation in Niger State are to erect scaffolding, ensuring safety during the whole installation process determine where solar panel will be located and to select a very clear area for connection of the panel. The findings from the hypotheses of the study revealed that there is no significant difference between the mean responses of trainers and trainee on tasks in non- formal training of solar system installation with a the mean and standard deviation of trainer are 3.55 and 0.70 while the mean and standard deviation of trainee are 3.39 and 0.73 respectively, since the p-value (0.52) is greater than 0.05. The study concluded that the trainee with poor skills and inadequate material should be empowered with the required skills and tools needed for training. Vocational and crafts centers should be restructured and the number of trainee to be admitted by the crafts masters to be regulated. The study recommends that master trainers should be appropriate in planning tasks in non-formal training of trainees in Solar system installation, The government should provide working materials for trainers and trainee in non-formal training of solar and satellite system installation and the master trainers should coordinate the activities of trainees in non-formal training in satellite system installation among others.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Non-formal learning is often self-directed, meaning that individuals take the initiative to pursue their own learning goals and objectives. This can include acquiring new skills or knowledge related to personal interests, hobbies, or career development. Non-formal learning is characterized by its flexibility, as it can be tailored to fit individual needs and preferences. It is also often less structured than formal education, with fewer requirements and regulations. Informal Learning, which typically take place naturally and spontaneously as part of other activities. These form the three styles of learning recognised and supported by the Organisation for Economic Co-operation and Development (OECD, 2018).

World Bank (2018) defined skilled training as the process of enhancing the capacity of individuals or groups to make choices and to transmit those choices into desired action and outcome. More so, Susan (2014) referred to skilled training as the process of enabling or authorizing an individual to think, behave, take action and control work and decision making in an autonomous way. In the context of this study, training empowerment is the process of equipping an individual with skills such that the individual can make a living out of it. Today, non-formal training is seen as a means of achieving current and lifelong learning.

According to OECD (2018), non-formal training refers to training that occurs outside the formal school system. It includes various structured training which do not either have the level of curriculum, syllabus, accreditation and certification associated with 'formal learning', but have more structure than that associated with 'informal learning', which typically take place naturally and spontaneously as part of other activities.

Non-formal training is beneficial in a number of ways. There are activities that encourage young people to choose their own programme and projects that are important because they offer the youth the flexibility and freedom to explore their emerging interests. When the youth can choose the activities in which they can participate, they have opportunities to develop several skills like decision making skills. Non-formal learning has experiential learning activities that foster the development of skills and knowledge. This helps in building the confidence and abilities among the youth of today. It also helps in development of personal relationships not only among the youth but also among the adults. It helps in developing interpersonal skills among the young people as they learn to interact with peers outside the class and with adults in the community (Stephen, 2015).

Trainee is commonly known as an individual taking part in a trainee program within an organization either after having graduated from higher or technical courses. *Trainee* is a junior employee who is being taught how to do a job, having agreed to work for a fixed period. A trainee is an official employee of the firm that is being trained to the job they were originally hired for. Literally, a trainee is an employee in training. Trainee programs are arranged by private companies and public sector employers where the trainee position has a varied duration depending on the company's program (Hodkinson *et al.*, 2013).

The trainee programs most often consist of a combination of theory and practice and is aimed at having the trainee to learn the company from the ground up. Many trainees are able to take advantage of their contact network from the trainee program and climb the corporate ladder and become key individuals in many companies. Once a trainee had finished his apprenticeship, he would become a journeyman searching for a place to set

up his own shop and make a living. After he set up his own shop, he could then call himself a Trainee master (Okorie, 2014). Trainee are train in various trades such as auto-mechanics, wood work, metal works, electrical installation, electronics work, building technology, and satellite and solar system installation.

Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect (Atoyinbo, 2016). Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system. The other form of training is the satellite installation. In crafts of solar and satellite systems installation, the apprentice is exposed to various technical skilled related to electronics installations under the guidance of their master craftsmen. The length of training varies considerably among vocational trades and masters. It caters for varied individuals; thereby satisfying educational as well as occupational needs of the individuals. It is a matter between two parties and apparently consists of two elements, the reciprocal obligation between the master and his apprentice.

Solar power craftsmen should involve in variety of tasks such assemble solar modules, panels, or support structures, as specified. Install active solar systems, including solar collectors, concentrators, pumps, or fans, Install photovoltaic (PV) systems in accordance with codes and standards using drawings, schematics, and instructions and perform routine photovoltaic (PV) system maintenance on modules, arrays, batteries, power conditioning equipment, safety systems, structural systems, weather sealing, or

balance of systems equipment, select mechanical designs, installation equipment, or installation plans that conform to environmental, architectural, structural, site, and code requirements (Jones, 2017).

The craftsmen also ought to carry out task of test operating voltages to ensure operation within acceptable limits for power conditioning equipment, such as inverters and controllers. Visually inspect and test photovoltaic (PV) modules or systems, Compile or maintain records of system operation, performance, and maintenance, demonstrate system functionality and performance, including start-up, shut-down, normal operation, and emergency or bypass operations and determine materials, equipment, and installation sequences necessary to maximize installation efficiency (Jones, 2017). Satellite system craftsmen should carried out the tasks of delivers television programming to viewers by relaying it from a communications satellite orbiting the Earth directly to the viewer's location (Adams, 2018). The trainee master help to test, install, and repair tv satellite equipment such as communication equipment and navigational equipment. They may be employed in product evaluation and testing, using measuring and diagnostic devices to adjust, test, and repair equipment (Moses, 2017). Craftsmen may also work as sales workers or field representatives for manufacturers, wholesalers, or retailers giving advice on the installation, operation, and maintenance of complex equipment and may write specifications and technical manuals.

Some of the tasks that satellite trainee master ought to carry out include setting up the wall mount; mounting on iron stand; assembling the dish; pointing the dish to the satellite; wire the dish; protect the power cord from being pinched; make sure that all ventilation openings are not covered; do not install close to any source of heat or any apparatus that produce heat; unplug all socket connections during lightning; do not

place any liquid substance on any part of the dish; always unplug the receiver (decoder) from the AC power outlet before cleaning; install the satellite antenna near overhead power lines or circuits and test the system.

Working materials required by these master trainers also include: - satellite; satellite mount; satellite LNB; compass; wrench; hammer; chisel; lag bolts; washes; locking nut; RG6 coaxial cable; high-definition multimedia interface (HDMI) cable; drilling machine; marker; 4 stainless steel fixing; hexagonal screws; ‘F’ connector x 2; digital TV receiver; compression tool and Pocket cable tester. These working tools are very crucial in carry out solar and tv satellite installation. Without them, installing a satellite dish correctly will take more effort than necessary, and won’t be possible in most cases. Apart from, installing satellite dishes, they are helpful for many other uses. Having these tools, would help one install satellite dishes effortlessly. These tools also include some pricey tools like: portable TVs, TV tuners cards, DVB-T boxes, and other tools that aren’t primary to satellite network installers.

Other methods of acquiring skill through trainee period are: limitation, repetition and occupational participation. Through imitation the apprentice gets acquainted with how the master performs the act. Repetition entails performing an operation several times, so as to be able to master the operation. Occupational Participation involves both the imitation of the master and frequent practice. Furthermore, other projects tried out, demonstrations and experiences are used to acquire skills. interest is essential for learning and training in apprenticeship. It is a motivating factor that generates one's potentialities and is based on fundamental emotions and desire. It has always been described as one of the major factors that influence individuals in choice of career (Ochiagha, 2013). Interest promotes the desire of trainee to learn a skill, do a job well

and to take pride in his or her work. The organization of vocational trade areas seems to be predominantly informal. The master trainer seems to be the sole administrator and the entire training is on the job. Moreover, as the nation strides into the technological advancement which aims at improving educational quality and skill training, there is the need to carry out an assessment of task, activities and working materials master trainer in solar and satellite systems installation towards improving nonformal vocational training in Niger State.

1.2 Statement of the Research Problem

The capacity to accomplish something properly and expertly is referred to as skill (Nwokike, 2018). To learn how to install solar power and satellite dishes, solar power and TV satellite technicians must first understand the fundamental components that make up solar power and satellite dishes, as well as the basic actions and preventative measures that must be taken. This hands-on program allows youth to explore with installation in a variety of methods. In the end, this would enable them to manage and organize actual work and resources, as well as come up with new ideas for new products and perform maintenance work. However, given the current rate of inadequate trainer training, non-formal training in solar and satellite installation does not appear to be sufficiently meeting these aims.

Satellites and solar installations undergo rigorous testing and quality control measures during their design, development, and deployment phases to ensure their reliability and durability. In addition, regular maintenance and repairs are performed to address any issues that may arise during their operation. However, it is true that there have been instances where solar and satellite installations have malfunctioned or failed prematurely. These instances are often due to unexpected events such as natural

disasters, collisions with other objects in space, or technical failures. (Stephen, 2015). This could indicate that the training material is insufficient, not labour market-driven, or out of step with the rapidly changing technology landscape. According to Okorie and Ezeji (2012), the operation of the informal sector apprenticeship is unstructured and lacking in theoretical knowledge, and repairs and maintenance work is done by trial and error. Furthermore, the non-formal training approach of demonstration and limitation, as well as the craftsmen's trial-and-error method, are ineffective and may result in further equipment and appliance damage. Thus, the trainer involved in installation and maintenance of Solar power and TV Satellite system seems to lack the requisite technical skills as a result of lack of proper training on emerging technologies (Okorie, 2014). If this trend is not checked, it may throw some self-employed trainers and the trainees out of employment and the apprentices trained in this condition may not find job. Even though, demonstration method is the most common instructional method used in training trainee in the non-formal education system, the problem of this study put in form of a question is: What are the tasks, activities and working materials in the non-formal training of solar and satellite systems technicians in Niger State?

1.3 Aim and Objectives of the Study

The aim of the study is to assess the tasks, activities and workings materials in the non-formal training of craft man in solar and satellite systems installation in Niger State. The objectives are to assess:

i. the task in non- formal training of trainees in solar system installation in Niger State.
ii. the task in non-formal training of trainees in satellite system installation in Niger State.

iii. the activities in non-formal training of trainees in solar system installation in Niger State.

iv. the activities in non-formal training of trainees in satellite system installation in Niger State.

v. the working materials in non-formal training of trainees in Solar system installation in Niger State.

vi. the working materials in non-formal training of trainees in Satellite system installation in Niger State.

1.4 Research Questions

The following research questions were formulated for the study:

1. What are the tasks in non- formal training of trainees in Solar system installation in Niger State?
2. What are the task in non-formal training of trainees in Satellite system installation in Niger State?
3. What are the activities in non-formal training of trainees in solar system installation in Niger State?
4. What are the activities in non- formal training of trainees in satellite system installation in Niger State?
5. What are the working materials in non-formal training of trainees in Solar system installation in Niger State?
6. What are the working materials in non-formal training of trainees in Satellite system installation in Niger State?

1.5 Research Hypotheses

The following null hypotheses was tested at 0.05 level of significance:

Ho_1: There is no significant difference between the mean response of master trainer and Trainee as regard the tasks in non- formal training of solar system installation in Niger State

Ho_2: There is no significant difference between the mean responses of master trainer and Trainee as regards the task in non- formal training of satellite system installation in Niger State.

Ho_3: There is no significant difference between the mean response of master trainer and Trainee as regards the activities carried out in non- formal training of solar system installation in Niger State.

Ho_4: There is no significant difference between the mean response of master trainer and Trainee as regards the activities carried out in non- formal training of satellite system installation in Niger State.

Ho_5: There is no significant difference between the mean response of master trainer and Trainee as regards the materials used in non- formal training of solar system installation in Niger State.

Ho_6: There is no significant difference between the mean response of master trainer and Trainee as regards the materials used in non- formal training of Satellite system installation in Niger State.

1.6 Significance of the Study

The findings of this study would be useful to the various levels of governments (Federal, State and Local) trainees, Society, private and public establishments and vocational trades.

This study, through its findings will provide useful information that will aid objective planning and successful execution of vocational programmes by the governments. The various levels of governments at the federal, states and locals in the country have also embarked on a number of dynamic programmes aimed at making the youths acquire requisite employable skills in various vocational trades.

This study will also be beneficial to trainees if the findings is translated into the establishment of the methods of instruction that could be used to improve informal vocational training and determined to help generate valuable information, which if made known to them and subsequently utilized or added to the wealth of their experiences will enhance their effectiveness in planning, organizing, supervising and imparting methods of instruction to the trainees in different vocational trade areas.

The study will be beneficial to society in an effort to reduce the rate of unemployment among uneducated, primary school dropouts and secondary school leavers. The finding will help to introduced various training programmes that border on vocational education training. Such training programmes include the National Open Apprenticeship Scheme (NOAS), School on Wheel Scheme (SOW), Youth Employment Scheme (YES), and National Poverty Eradication Programme (NAPEP).

The findings of this study will be useful to private and public establishments as various training facilities are required for efficient training that could bring about desired

improvement in non-formal vocational education training. This will give the various private and public establishments an insight on the procurement and distribution of training facilities. Parents and Nigerian Youths, private and public establishment will benefit from the findings of this study on the factors that could be considered in enrolling trainees in order to bring about improvement in informal vocational training in vocational trade areas. The information generated will provide parents with the knowledge of factors influencing decision to enroll.

This study will also bring to focus the importance of vocational trade areas in the economy and the need to encourage the informal vocational training of trainees who can be credited for producing the bulk of manpower for the productive sector of the economy in our society. Therefore, this study through its findings will bring to focus the type of trades in which informal vocational education training is given in Niger State according to their aptitudes, interest and capabilities.

1.7 Scope of the Study

The study focus on the training contents of the trainees in solar and TV satellite installation trade. specifically, is delimited to task, activities and working material used in non-formal training of solar and satellite systems installation in Niger state. The areas covered are essential because these are job responsibility of trainees in non-formal training as this contributes majority to the actualization of effective solar and satellite installation system. The study do not cover the repair and replacement of solar cells if burn, flashing of satellite decoder system for trouble shooting because this role is performed by the repairs and maintenance department. It did not also cover avometer because this tools is used by electrical\electronic engineers to measure current, voltage, resistance, diode and transistors. A proper solar installation can be done without the use

of multimeter by choosing a suitable location, mount the solar panels, install the charge controller, connect the batteries, connect the inverter, test the system and monitor the system.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Behavioural learning theory

Behavioural learning theory is a popular concept that focuses on how students learn. Behaviorism focuses on the idea that all behaviors are learned through interaction with the environment. This learning theory states that behaviors are learned from the environment, and says that innate or inherited factors have very little influence on behavior. Behaviorism is key for educators because it impacts how students react and behave in the classroom, and suggests that teachers can directly influence how their students behave. It also helps teachers understand that a student's home environment and lifestyle can be impacting their behavior, helping them see it objectively and work to assist with improvement (Crawl *et al.*, 1997).

Behaviorists attempt to explain learning in terms of how events in the environment affect behavior. Crawl *et al.* (1997) state that believe and argued that knowledge is based on experience and that a person can acquire knowledge only about things that can be experienced by means of the senses of sight, touch, hearing, smell and taste; then the individual verifies knowledge through observation and experiment. To the researcher a person acquires knowledge by forming various associations among different aspects of the environment that one can experience through one's senses. Behavioural theory is strongly based on the concepts of conditioning. In the classroom, the behavioural learning theory is key in understanding how to motivate and help students. Information is transferred from teachers to learners from a response to the right stimulus. Students are inactive participant in behavioural learning teachers are giving them the information

as an element of stimulus-response. Teachers use behaviorism to show students how they should react and respond to certain stimuli. This needs to be done in a repetitive way, to regularly remind students what behavior a teacher is looking for and there is a need for positive reinforcement.

Positive reinforcement is key in the behavioural learning theory. Without positive reinforcement, students will quickly abandon their responses because they don't appear to be working. For example, if students are supposed to get a sticker every time, they get an A on a test, and then teachers stop giving that positive reinforcement, less students may get A's on their tests, because the behavior isn't connected to a reward for them. Repetition and positive reinforcement go handin-hand with the behavioural learning theory. Teachers often work to strike the right balance of repeating the situation and having the positive reinforcement come to show students why they should continue that behavior and motivation is very crucial in learning (Bandura & Walters, 1963).

Motivation plays an important role in behavioural learning. Positive and negative reinforcement can be motivators for students. For example, a student who receives praise for a good test score is much more likely to learn the answers effectively than a student who receives no praise for a good test score. The student who receives no praise is experiencing negative reinforcement their brain tells them that though they got a good grade, it didn't really matter, so the material of the test becomes unimportant to them. Conversely students who receive positive reinforcement see a direct correlation to continuing excellence, completely based on that response to a positive stimulus (Chomsky, 1959).

Holland (1978) opined that teachers can implement behavioural learning strategy techniques in their classroom in many ways, including:

- Drills. Teachers may practice skills using drill patterns to help students see the repetition and reinforcement that behavioural learning theory uses.
- Question and answer. Teachers can use a question as a stimulus and answer as a response, gradually getting harder with questions to help students.
- Guided practice. Teachers can be directly involved in helping students go through problems to give them the reinforcement and behavior demonstration you want them to follow.
- Regular review. Reviews are important to behavioural learning theory. Going back over material and giving positive reinforcement will help students retain information much better.
- Positive reinforcement. Behaviorist classrooms utilize positive reinforcement regularly. This can be in the form of verbal reinforcement and praise, reward systems, added privileges, and more.

While behaviorism is a great option for many teachers, there are some criticisms of this theory.

Behaviorism is best for certain learning outcomes, like foreign languages and math, but aren't as effective for analytical and comprehensive learning. Other critics of behavioural learning say that the theory doesn't encompass enough of human learning and behavior, and that it's not fully developed. Other theories have come forward that take behaviorism further, implying that there are many additional factors to consider

when evaluating behavior. Behavior theory consider apprentice behavior and its relationship to the learning process (Hull, 1943).

2.1.2 Cognitive learning theory

Cognitive Learning theory is a broad theory that explains thinking and differing mental processes and how they are influenced by internal and external factors in order to produce learning in individuals. When cognitive processes are working normally then acquisition and storage of knowledge works well, but when these cognitive processes are ineffective, learning delays and difficulties can be seen (Schultz & Schultz, 2004). These cognitive processes are: observing, categorizing, and forming generalizations about our environment. A disruption in these natural cognitive processes can cause behavioural problems in individuals and the key to treating these problems lies in changing the disrupted process. For example, a person with an eating disorder genuinely believes that they are extremely overweight. Some of this is due to a cognitive disruption in which their perception of their own weight is skewed. A therapist will try to change their constant pattern of thinking that they are overweight in order to decrease the unhealthy behaviors that are a result of it (Flawell *et al*., 2002). The cognitive learning theory has been developed within the philosophical frameworks of rationalism (Arends, 1997). Cognitive attempt to explain learning in terms of how people think.

Rationalist's philosophers argued that knowledge is based on reasoning. Crawl *et al*. (1997), state that, a rationalist believe that people learn because of the ability to interpret wants occurring in the environment. Also, those human beings are born with an innate to find meaning in the world and that people perceived is determined as how much by how the mind interprets the stimuli. Cognition is a term used to described all our mental processes; such as perception, memory and judgment (Suthers, 1996). The most important mental process is thinking and cognitive focuses most of their attention

on studying how people think. The cognitive developmental model and the information processing model: the cognitive developmental model focuses on change that occur in how people think and they progress from infancy through childhood and adolescence and ultimately into adulthood. The information processing model uses the way a computer works as a way of understanding how the human mind takes in information (sensory experience), process it (thinks) and produce output (behavior).

Cognitive learning theory related to how a person learns and how learning can be efficient have a long history. Various theories and approaches have been developed in this field and they have had important impact on endeavors for learning. Pedagogues make a classification based on three basic approaches while dealing with learning theories (Huitt, 2012). These are behaviorist approach, cognitive approach and constructivism. It will be a mistake to see these three approaches as alternative to each one or to evaluate them independently while making a classification.

Behavioural, cognitive and constructive ideas and principles overlap in many fields (Ally, 2008). It is difficult to classify these theories in this context. Some theories can be involved in more than one class in different ways. For example; in some resources, Bruner's theory of Discovery Learning is accepted to be cognitive rather than developmental. In some other resources, Bruner is mostly included in developmental or constructivist class. On the other hand, while Albert Bandura is mostly classified as behaviorist, Bandura himself opposes to behaviorism. This difficulty in classification is natural. Because it is impossible to make a statement independent of behaviorist approach while dealing with cognitive approach or to make a statement independent of cognitive approach while handling constructivist approach. In other words, behaviorist approach provided a basis passing to cognitive approach while cognitive approach

provided a basis passing to constructivist approach. According to this, cognitive approach does not deny behaviorism, it claims that cognitive process is seen in behaviorist learning. Moreover, constructivist approach established its principles on the basis of the principles of cognitive approach. According to behaviorist approach, learning depends on stimulus and response to a stimulus, and the resulting behaviour should be observable and measurable. While passing from behaviorist approach to cognitive approach, the question if cognitive process is present or not in acquiring behaviour started to be asked. We cannot say that cognitive psychologists completely exclude the findings of behaviorists. Cognitive processes and activities such as processing information, mental representations, guesses and expectations are accepted to be a basis in the interpretation of learning. What cognitive theorists do in addition to behaviorists' findings is that they claim cognitive processes are also present in the events of an organism's learning.

Tolman claimed that learning was related to complex mental processes, not simple mechanic conditioning processes. He did a lot of classical experiments with mice in order to prove his idea. One of his most well-known studies involves maze running. Moreover, he also put emphasis on the role of reinforcer in mice's learning their ways in complex mazes. These experiments caused the birth of "The Theory" expresses as the learning occuring in situations where there is no certain reward (Suthers, 1996). Hugh Blodgett did the first experiment making use of the paradigm of learning without reinforcer in 1929 and he was the first academician who used the term of latent learning. He announced this concept, which he put forth as a result of the experiments he carried out with mice in 1929, in "university of California publications in psychology" through an article, which he published with the name of "the effect of the introduction of reward upon the maze performance of rats" in the same year. Then,

Tolman also did equaling experiments and developed studies in this field and mentioned Blodgett as the creator of the term “latent learning.” Tolman also stated in his article named “cognitive maps in rats and men” published in “The Psychological Review” that it was again Blodgett who did the first experiment in this field. Tolman called the first learning occurring when trials without a reinforcer were done as “latent learning.” People apply this kind of learning every day while driving car, walking through the same path daily, and they learn the places of various buildings and places. However, learning appears when we need to find out an object or building.

2.1.3 The social learning theory

Social Learning Theory, which is also called observation learning, focuses on how people learn by observing the behavior of others. It provides link between the behavioural and cognitive theory. Learning by observation occurs in four sequential phases: attention, retention, reproduction and motivation. The principle is explained that, learner must first pay attention to the model’s behavior, remember the behavior, practice it and be motivated to perform. Spencer (2006) state that, much of children’s learning occurs by observing parents, teachers, other children and even character on television. He further noted that through observations children acquire basic know – how and need some practice to reefing their skills. Observational learning amount for most human learning. It occurs when learners watch teacher solve a problem and hear him speak. It occurs when children or learners observe how parent cook, clean or repair a broken appliance.

Social learning theory is a theory of learning process and social behavior which proposes that new behaviors can be acquired by observing and imitating others (Albert, 1971). It states that learning is a cognitive process that takes place in a social context and can occur purely through observation or direct instruction, even in the absence of

motor reproduction or direct reinforcement (Bandura, 1963) In addition to the observation of behavior, learning also occurs through the observation of rewards and punishments, a process known as vicarious reinforcement. When a particular behavior is rewarded regularly, it will most likely persist; conversely, if a particular behavior is constantly punished, it will most likely desist (Renzetti *et al*., 2012). The theory expands on traditional behavioural theories, in which behavior is governed solely by reinforcements, by placing emphasis on the important roles of various internal processes in the learning individual (Albert, 1971).

Social Learning Theory integrated behavioural and cognitive theories of learning in order to provide a comprehensive model that could account for the wide range of learning experiences that occur in the real world. As initially outlined by Bandura and Walters in 1963 (Bandura, 1963*)* and further detailed in 1977, key tenets of Social Learning Theory are as follows:

1. Learning is not purely behavioural; rather, it is a *cognitive* process that takes place in a social context.
2. Learning can occur by observing a behavior *and* by observing the consequences of the behavior (vicarious reinforcement).
3. Learning involves observation, extraction of information from those observations, and making decisions about the performance of the behavior (observational learning or modeling). Thus, learning can occur without an observable change in behavior.
4. Reinforcement plays a role in learning but is not entirely responsible for learning.

5. The learner is not a passive recipient of information. Cognition, environment, and behavior all mutually influence each other (reciprocal determinism).

Typical stimulus-response theories rely entirely upon direct experience (of the stimulus) to inform behavior. Bandura opens up the scope of learning mechanisms by introducing observation as a possibility. Albert, (1971) adds to this the ability of modeling a means by which humans "represent actual outcomes symbolically". These models, cognitively mediated, allow future consequences to have as much of an impact as actual consequences would in a typical S-R theory. An important factor in Social Learning Theory is the concept of reciprocal determinism. This notion states that just as an individual's behavior is influenced by the environment, the environment is also influenced by the individual's behavior (Albert, 1971*)*. In other words, a person's behavior, environment, and personal qualities all reciprocally influence each other. For example, a child who plays violent video games will likely influence their peers to play as well, which then encourages the child to play more often.

Social Learning Theory draws heavily on the concept of modeling as described above. Bandura (1963) outlined three types of modeling stimuli:

1. Live models, where a person is demonstrating the desired behavior

2. Verbal instruction, in which an individual describes the desired behavior in detail and instructs the participant in how to engage in the behavior
3. Symbolic, in which modeling occurs by means of the media, including movies, television, Internet, literature, and radio. Stimuli can be either real or fictional characters.

Exactly what information is gleaned from observation is influenced by the type of model, as well as a series of cognitive and behavioural processes, including:

Attention – in order to learn, observers must attend to the modeled behavior. Experimental studies have found that awareness of what is being learned and the mechanisms of reinforcement greatly boosts learning outcomes. Attention is impacted by characteristics of the observer (for instance perceptual abilities, cognitive abilities, arousal, past performance) and characteristics of the behavior or event (for instance relevance, novelty, affective valence, and functional value). In this way, social factors contribute to attention the prestige of different models affects the relevance and functional value of observation and therefore modulates attention (Schaik, 2011).

- Retention – In order to reproduce an observed behavior, observers must be able to remember features of the behavior. Again, this process is influenced by observer characteristics (cognitive capabilities, cognitive rehearsal) and event characteristics (complexity). The cognitive processes underlying retention are described by Bandura as visual and verbal, where verbal descriptions of models are used in more complex scenarios.
- Reproduction By reproduction, Bandura refers not to the propagation of the model but the implementation of it. This requires a degree of cognitive skill, and may in some cases require sensorimotor capabilities. Reproduction can be difficult because in the case of behaviors that are reinforced through self-observation (he cites improvement in sports), it can be difficult to observe behavior well. This can require the input of others to provide selfcorrecting feedback. Newer studies on feedback support this idea by suggesting effective feedback, which would help with observation and correction improves the performance on participants on tasks.
- Motivation – The decision to reproduce (or refrain from reproducing) an observed behavior is dependent on the motivations and expectations of the

observer, including anticipated consequences and internal standards. Bandura's description of motivation is also fundamentally based on environmental and thus social factors, since motivational factors are driven by the functional value of different behaviors in a given environment.

Social Learning Theory has more recently applied alongside and been used to justify the theory of cultural intelligence. The cultural intelligence hypothesis argues that humans possess a set of specific behaviors and skills that allow them to exchange information culturally. This hinges on a model of human learning where social learning is key, and that humans have selected for traits that maximize opportunities for social learning. The theory builds on extant social theory by suggesting that social learning abilities, like Bandura's cognitive processes required for modeling, correlate with other forms of intelligence and learning (Schaik, 2011), Experimental evidence has shown that humans over imitate behavior compared to chimpanzees, lending credence to the idea that we have selected for methods of social learning (Whiten *et al*., 2009). Some academics have suggested that our ability to learn socially and culturally have led to our success as a species (Uddin, 2007).

This theory is related to this study in terms of rationalism (reasoning), how people think. Apprenticeship training involves the ability to think and to be creative. The apprentice develops the skill of thinking and application to perform the crafts or trades. The theories or observational theories are more relevant to the learning of crafts and trades. The theories explain on how learning takes place through observing behavior of the craft master. This is very crucial to apprenticeship training as the apprentice observes the craft master, pay attention to the master behavior, remember the behavior, practice the behavior and is motivated to perform the behavior.

2.1.4 Schema-based learning theory

Schema-based learning is a central theoretical approach in cognitive and educational psychology as well as in artificial intelligence. Schemas allow learners to reason about unfamiliar learning situations and interpret these situations in terms of their generalized knowledge. Concept of schema theory, one of the cognitivist learning theories, was firstly introduced in 1932 through the work of British psychologist Sir Frederic Bartlett (some suggest it was first introduced in 1926 by Jean Piaget) and was further developed mostly in 1970s by American educational psychologist Richard Anderson. Schema theory describes how knowledge is acquired, processed and organized (Bartlett, 1932). The starting assumption of this theory is that "*very act of comprehension involves one's knowledge of the world"*. According to this theory, knowledge is a **network of mental frames** or cognitive constructs called *schema*. Schemata organize knowledge stored in the long-term memory.

The term **schema** is nowadays often used even outside cognitive psychology and refers to a **mental framework** humans use to represent and **organize remembered information**. Schemata ("*the building blocks of cognition*") present our personal simplified view over reality derived from our experience and prior knowledge, they enable us to **recall, modify our behavior**, concentrate attention on key information, or try to **predict most likely outcomes of events**. According to David Rumelhart schemata also expand and **change in time**, due to acquisition of new information, but deeply installed schemata are inert and slow in changing. This could provide an explanation to why some people live with incorrect or inconsistent beliefs rather then changing them. When new information is retrieved, if possible, it will be **assimilated** into existing schema(ta) or related schema(ta) will be **changed** (*accommodated*) in order to integrate the new information. For example: during schooling process a child learns about mammals and develops corresponding

schema. When a child hears that a porpoise is a mammal as well, it first tries to fit it into the mammals schema: it's warm-blooded, air-breathing, is born with hair and gives live birth. Yet it lives in water unlike most mammals and so the mammals schema has to be accommodated to fit in the new information.

Schema theory was partly influenced by **unsuccessful attempts** in the area of artificial intelligence. Teaching a **computer** to **read natural text** or display other human-like behavior was rather unsuccessful since it has shown that it is impossible without quite an amount of information that was not directly included, but was inherently present in humans. Pavlov (1897) shows that this inherent information stored in form of schemata, for example:

- *content schema* - prior knowledge about the topic of the text
- *formal schema* - awareness of the structure of the text, and
- *language schema* - knowledge of the vocabulary and relationships of the words in text

can cause easier or more difficult text comprehension, depending on **how developed** the mentioned schemata are, and weather they are **successfully activated**. According to Skinner (1938) when reading a text, it alone does not carry the meaning a reader attribute to it. The **meaning is formed by the** information and cultural and emotional **context the reader brings** through his schemata more than by the text itself. Text comprehension and retention therefore depend mostly **on the schemata the reader possesses**, among which the content schema should be one of most important, as suggested by Al-Issa (Skinner, 1971)

Criticisms of the theory

Explanations of structures of knowledge have been criticized for being rather **unclear** about what exactly can count as a schema and what does a schema include. The idea of schemata as more complex constructs of memory has also been questioned. Some researchers suggest schemata as such are just networks of interacting simple (*low-level*) units activated at the same time. For example, a classroom schema is formed by simultaneously activated units of a blackboard, desks, chairs and a teacher. On the other hand, schema theory was the starting point or a component for many other cognitivist theories and theorists like Jean Mandler, David Rumelhart (modes of learning) or Marvin Minsky (frame theory) who have further expanded it's concepts, and was also included in works of many other theorists like Sweller's (cognitive load theory) or Ausubell's (assimilation theory).

2.2 Conceptual Framework

A conceptual framework is a formal way of thinking or conceptualizing about a process or system under research study. This study is based on the concept that in order to achieve the goals non-formal education various factors affecting its achievement must be understood and addressed by taking the necessary action. Like any strategy of programme the management is very important for its success. This is true according to Senna (2017) who noted that managing the learning and teaching process is the most important thing and not the method. Learning can only take place in a society that is supportive through understanding, involvement, facilitation of transfer and application of new behaviour and providing linkages between the programme and the components. Economic environment is very important in the realization of NFE. It is more likely that the government will neglect educational needs for other programmes/project which it

deems important like security (Oketch, 2014). The quality of non-formal training process is enhanced by the availability of teaching and learning materials like tools and facilities (Wafula, 2003). This framework therefore demonstrates how these factors affect non-formal training in Nigeria.

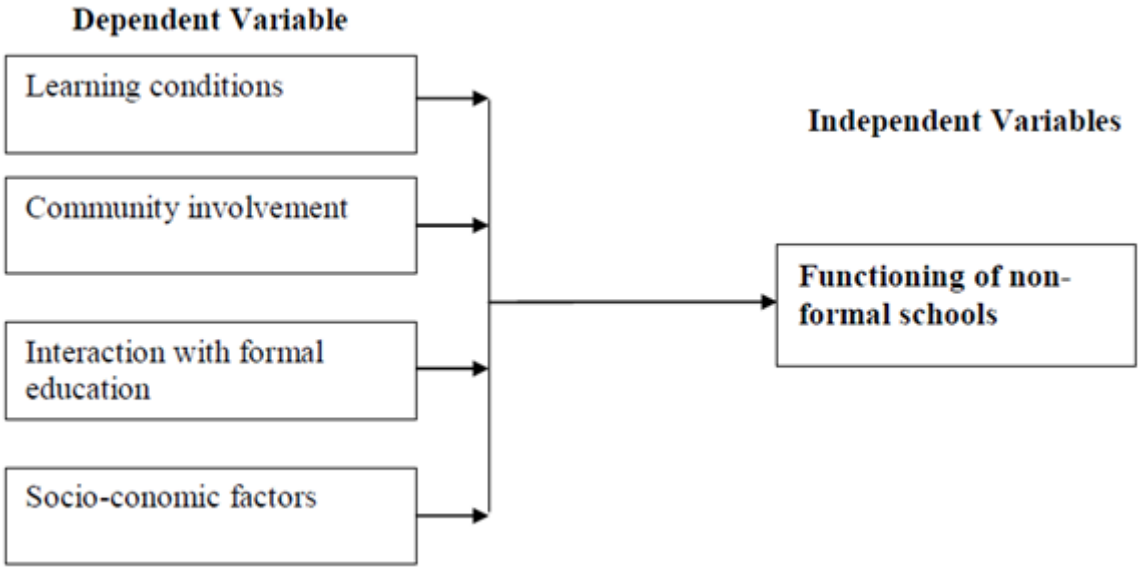

Figure 2.1: Conceptual Framework by the researcher

2.2.1 Non-formal training

Non-formal training is various structured learning situations which do not either have curriculum, syllabus, accreditation and certification associated with 'formal learning', but have more structure than that associated with informal learning, which typically take place naturally and spontaneously as part of other activities. These form the three styles of learning recognised and supported by the OECD (Eaton, 2011). It is difficult to make a clear distinction between formal and informal learning as there is often a crossover between the two (McGivney, 1999). Similarly, Hodkinson *et al*. (2013), conclude after a significant literature analysis on the topics of formal, informal, and non-formal learning, that the terms informal and non-formal appeared interchangeable,

each being primarily defined in opposition to the dominant formal education system, and the largely individualist and acquisitional conceptualisations of learning developed in relation to such educational contexts (Hodkinson *et al*., 2013). Moreover, he states that "It is important not to see informal and formal attributes as somehow separate, waiting to be integrated. This is the dominant view in the literature, and it is mistaken. Thus, the challenge is not to, somehow, combine informal and formal learning, for informal and formal attributes are present and inter-related, whether we will it so or not. The challenge is to recognise and identify them, and understand the implications. For this reason, the concept of non-formal learning, at least when seen as a middle state between formal and informal, is redundant (Eraut, 2014).

Non-formal training is popular on a worldwide scale in both 'western' and 'developing countries'. Non-formal education can form a matrix with formal and non-formal education, as non-formal education can mean any form of systematic learning conducted outside the formal setting. Many courses in relation to non-formal education have been introduced in several universities in western and developing countries. The UNESCO institute of education conducted a seminar on non-formal education in Morocco. The association for development of education in Africa (ADEA) launched many programmes in non-formal education in at least 15 countries of Sub-Saharan Africa. In 2001 World Bank conducted an international seminar on basic education in non-formal programmes. In addition to this the World Bank was advised to extend its services to adult and non-formal education. A report on vocational education, Making Learning Visible: the identification, assessment and recognition of non-formal learning in Europe, defines non-formal learning as semi structured, consisting of planned and explicit approaches to learning introduced into work organisations and elsewhere, not recognised within the formal education and training system (Abubakar, 2010).

We normally consider formal education as the right way of learning and teaching. However, along history the education that takes place out of school has always existed and has always been part of the community. In a certain way, it has even been the forerunner of school itself. Formal education as it is understood nowadays is the one that is confined and controlled by the state or authorities; the one that represents the system where policies, curriculum, programs and conditions define the educational practice. Besides, it is normally graded and it is expected to achieve a certification of degree through the stages of formal education. On the other hand non-formal education is an alternative to formal education mainly when the latter, due to different reasons, is not able to cover the society educational needs. In fact the term non-formal education was issued at the end of the 1960s to refer to the local educational efforts aiming at development in poor and developing countries (Rogers, 2005). However in the last 50 years the idea and practice of non-formal education has been expanded so much that the former discourse is not anymore universally agreed (Romi & Schmida 2009).

A crucial notion about non-formal training is to admit that education practice can take place in and out of school. Rogers states that the term NFE covers both small-scale very localised learning programmes and large-scale national programmes of flexible schoolin (Rogers, 2015). Although the term has been used with different connotations, for instance, adult education, lifelong learning, out-of-school basic education, compensation hours, literacy, etc., the major consensus consists of the idea that non-formal education is not the education received in the schools through a formal system. At least the difference between education in formal contexts and education in more informal settings is clear (Rogers, 2015). What it is still in debate among practitioners and stakeholders is the limitation of the term. Rogers points out the possible range of

non-formal education: Hoppers (2006) distinguishes several types of non-formal training:

- Para-formal education: out-of-school activities but still with a strong connection to the formal system, sometimes even sponsored by the state or authorities.
- Popular education: addressed to the poor communities through a practical and contextualized approach for learning, grounded on critical awareness and social action.
- Personal development: encourage individualized leisure-time activities for the improvement of oneself.
- Supplementary NFE programs: support services especially for children in vulnerable situations such as conflict, poverty, marginalization, displacement, etc.
- Early childhood care and education: home-based or community-based efforts related to pre-schooling (Romi & Schmida, 2009).

So, with all this variety offered as non-formal education programs, the main question that remains is if formal and non-formal education complement each other or they are opposites one from another. About this concern, it is common to assume formal education as the rigid, non-flexible, static and out-of-date structure whereas non-formal education is seen as an innovative, diverse, contextualized and freer space of education, sometimes even called by the term training. Moreover, UNESCO has promoted as a relevant necessity the fact of considering all education levels in order to achieve major educational goals: Recognizing the importance and interdependence of all education levels and delivery modes, whether formal, non-formal or informal, UNESCO promotes a holistic approach to education to foster balanced development of education systems

that respond to a range of learning needs (UNESCO, 2014). In fact, an active articulation between conventional and nonconventional education is highly suggested: To ensure that lifelong learning becomes a reality for all requirement.

In addition, it is necessary to contemplate the specific characteristics of non-formal education. First, NFE is related with non-structured programs. And the lack of a rigid structure can be both useful and risky. On one hand not having a rigid structure or syllabus forced by an accelerated calendar may give the opportunity of innovative ideas, of an education focused on the learners and in their own rhythm of learning; on the other hand this freedom can be risky in terms of lack of clarity, of organization of topics or of scheduled hours. Furthermore if the NFE discourse is to be useful as a tool of planning, of developing new educational activities, it must be clear about its aims (Rogers, 2015).

Secondly, there is less bureaucracy in the administration processes which might be helpful to facilitate the enrollment but it can also give an opportunity for quitting easily these kinds of programs. Thirdly, it encourages a participatory local environment that might empower communities. In fact in some cases several non-formal programs are part of social and resistance movements. Fourthly, it helps to avoid isolation provoked by geographic and sociocultural characteristics. Fifthly, it opens opportunities and challenges of multicultural, multiage and multilanguage environments. Finally, the well-known teacher-student relation becomes vague in non-formal settings. In fact appellatives such as facilitator, monitor, and coordinator are more common than teacher; and the term learner instead of student. Rogers (2015) Given the diversity of non-formal education practices, Romi and Schmida (2009) proposed a set of categories of variables for classifying non-formal education programs. The first category is the

organizational-administrative level of the program, namely to observe who the supervision authorities are and if there are institutional affiliations. The second category is the analysis of the macro and micro levels is to observe if the program is addressed to the individual or rather to strengthen the education system. The third category is the analysis of the pedagogical approach; for instance the level of flexibility, if it is situated learning or a life-long process. The last category is related to the value orientations of the activities, this is if the program is guided by an ideological or a universal orientation. Such categories seem helpful for a thoughtful understanding of the non-formal education practices.

2.2.2 Apprenticeship system in Nigeria

According to Pratt (2011) the Apprenticeship Perspective involves the learner within an actual, physical context of practice. Apprentices work side by side with an expert in order to learn a specific task (Barab & Hay, 2012). Apprenticeships include: (1) the development of learning contexts that model proficiency, (2) providing coaching and scaffolding as students become immersed in authentic activities, (3) independent practice so that students gain an appreciation of the use of domain-related principles across multiple contexts (Barab & Hay, 2012). Apprenticeship is a teaching method utilized by educators to teach students how to solve problems, understand tasks, perform specific tasks, and deal with difficult situations (Collins *et al.,* 2016). In summary, apprenticeship learning is a method used by teachers to teach students about a specific task. It is utilized in a problematic situation so students know how to react when faced with a similar situation. Students work very closely with an expert at learning a specific skill. Apprenticeship learning is very beneficial to the learner.

Information the student acquires is then applied through practical applications in the field of study.

The notion of an apprentice who learns a craft or occupation while in the service of a skilled practitioner dates back many centuries (Westermann, 1914). In pre-industrial times, apprenticeship was “a system of training in which young men, and much less often young women, entered contracts to work for established craftsmen and merchants for a specific period, generally of some years, in exchange for instruction in a craft or trade (Wallis, 2010). More recently, apprenticeships have evolved in many countries to become programmes of learning that combine part-time formal education with training and experience at the workplace, and result in an externally recognised vocational qualification (Ryan, 2012).

History has it that the system of apprenticeship first developed in the later middle ages and came to be supervised by tailoring guilds and town governments. A master tailor was entitled to employ young people as an inexpensive form of labour in exchange for providing formal training in the tailoring. Most apprentices were males, but female apprentices were found in a number of tailors associated with embroidery, silk-weaving, sewing and cooking. There had been an immense transformation over the years in apprenticeship. Most apprentices do no longer stay with their master tailor/women but come from their own homes. The number has increased so much that many young people are found in the private sector therefore policy makers in both the industrialized and developing countries, as well as international donors, have been showing increased interest in the informal sector. “In some African Countries, the formal sector is experiencing shrinkage due largely to the effects of structural adjustment programmes, restrictions imposed on economic growth by debts and burdens, low knowledge of

science and technology in Africa and the reliance on agro-based exports (Romi & Schmida 2009).

But in Nigeria, information gathered indicated that in the olden days apprenticeship was mostly practiced by families. A father or mother who had skills in sewing, blacksmithing, meat processing passes on those family skills through apprenticeship to other family members. Some skills in the rural communities were not done for money. For example barbering was done free of charge. When apprenticeship started by the involvement of other people apart from family members, interested person had to leave their homes to live with their masters until the time their masters pass them out. At that time, an apprentice would have to work for the master on his/her farms and does any other work in the house. The most common trades practiced at that time were tailoring, blacksmithing, carpentry and masonry. Farming, barbering, catering were not considered as trades that would generate income. It was gathered that the Dagombas who are the most dominant tribe in Tamale Metropolis have three major trades which are metal works, meat processors and drumming. The metal work involves blacksmithing producing of sheets products. Choosing of trades therefore is influenced by cultural norms. Even if you are the most skillful person in metal work, so long as you come from a home that process meat you would not be permitted to practice metal work. But for now apprenticeship is regarded as a source of skills acquisition for school drop outs, illiterates and those who could not pursue their education due to financial problems.

Krupnick (2016) state that apprenticeship is a system for training a new generation of practitioners of a trade or profession with on-the-job training and often some accompanying study (classroom work and reading). Apprenticeships can also enable

practitioners to gain a license to practice in a regulated occupation. Most of their training is done while working for an employer who helps the apprentices learn their trade or profession, in exchange for their continued labour for an agreed period after they have achieved measurable competencies. The period of apprenticeship varied from districts to districts and from craft to craft. He added that in the major towns of Nigeria, there are the vocational improvement centres (VIC) sparingly supported by the Industrial Training Fund (ITF) and government Agency in the states. However, this support has declined in recent times and the ITF has since established its own centres. The state Governments, particularly in the northern states of Nigeria, have established what is known as Basic Apprenticeship Training Centre (BATC) in all the Local Government headquarters. These training centres are under the auspices of the state Governments Ministries of Trade and Industries. They train apprentices in most of the trades, automobile, electrical, mechanical engineering, carpentry, metal work, welding and also trainees are given fundamental training in communication skills. He concluded that, in addition to the learning diplomas, the graduands have the opportunity to sit for the Technical City and Guilds and to go for further studies in technical colleges to obtain National Technical Certificate (NTC). And at the National level, the National Directorate of Employment (NDE) has established Vocational Training centres in various apprenticeship programmes in most trades.

Osuala (2014) notes that the first recorded apprentice training was that of John Holt in the early 1930s. By 1937 a formal school was established in Warri to train twelve trainees. Osuala added that, the major development for firm-sponsored apprenticeship date from the opening of the United Africa Company's first training school at Buruntu in 1954. By 1959 the company operated five schools with 358 apprentice trainees in

seven trades. .Also in 1956, the Shell-BP Petroleum Development Company established a trade school in Port Harcourt with 130 apprentices.

Apprenticeship exists in business, agriculture, technology, medicine and other professional areas. Apprenticeship which is learning through observation and doing is practiced almost in every area of life. Life is full of experiences acquired through a master or mentor who could be a teacher, parent, relatives, or peers. These learning experiences could be conscious or unconscious. Osuala (2014) describes apprenticeship as an organized system of training for providing young people with the manipulative skills and technical knowledge needed for competent performance in skilled occupations. Osuala further viewed apprenticeship to involves an appreciable period of training where the master entrusted the production of certain goods to the apprentice in order to test the level of his skills. The apprentice paid the master for his training by proving regular services on the master's arm throughout the period of apprenticeship. Upon the satisfactory completion of his period of training, the apprentice became fully initiated into the guild and might and continues as a Journey-man or established his own workshop.

Osinem and Nwoji (2017) describes apprenticeship as a kind of vocational training given to a person who learns under an expert by taking time with the trainer to learn a craft from his expertise for a period of time. Osinem and Nwoji (2017) further noted that, a well planned and supervised apprenticeship programme will provide the following benefits.

1. Provide the most efficient way to train all-round craftsmen to meet present and future needs.

2. Assure an adequate supply of skilled workers to fill employment opportunities.
3. Assure the community of competent craftsmen, skilled in relevant aspect of their trades.
4. Give the individual worker a greater sense of social and economic security and fulfillment.
5. Generally raise skill levels in an organisation.

Apprenticeship is the process of acquiring skills, values and, knowledge under a master practitioner/crafts-master to be proficient in the profession, trade, crafts and arts. It is training provided for work or job. Akinduro (2016) outline characteristics feature of apprenticeship:

6. It is a master practitioner and learner oriented
7. It is training for an occupation
8. Involves contract between people
9. Practical training in nature
10. Learning content undefined
11. Duration of training unspecified and lack certification.

2.2.3 Types of apprenticeship

There are basically two types of apprenticeship: non-formal and formal apprenticeship.

i. **Non-formal apprenticeship:** it is a scheme adopts the learner sitting by the master, whereby the apprentice learns the skills of the trade by observing his master performing the job. He added that, the more diversified the jobs his master gets and how well he observes the master perform, the better he is

trained. No theory is taught, the facilities in which the training is done are ill-equipped and no training syllabus used (Ojinnta, 1997).

ii. **Formal apprenticeship:** Formal apprenticeship is a scheme offered by organisations such as manufacturing and service industries and public corporation which have adequate resources in manpower, machines and materials to train people to perform certain skills in their organisations. Osinem and Nwoji (2017), view formal apprenticeship as a learning process which transits from the classroom to real practical situation in the workplace in the industry. Learning experiences acquired in the classroom are transferred to the real work situation. Programmes where formal apprenticeship is practiced are: Internship, Students industrial work experience scheme (SIWES) and on-the-job training scheme.

2.2.4 Non-formal skills acquisition and training in Nigeria

Differences can be drawn between the discoveries on the acquisition of skills and training of the informal sector in different parts of Africa. The level headed discussion encompassing the African versus European models for skills advancement echoes towards on-the-job training. A World Bank (2018) document highlights the importance of increased and better human capital investments through trainee and re-training of the youth on a specific skill of the lifecycle. Currently, due to weak human capital investments early in the lifecycle, many leave schools without the required academic, cognitive, or behavioural skills needed to modernize the Nigerian economy. Favara and Appasamy (2015) states that in Nigerian scene, there are peculiar problems that deters the Nigerian labour market from functioning properly and these problems includes formal and non-formal training and that skills used on-the-job were viewed as more

significant. The effect is that supply of labour increases while it demands falls drastically and at the end of the day, the problem compounds into low wage payments.

The idea of skill acquisition is aimed for battling and decreasing poverty level in Nigeria. Different Government have recurrently attested its assurance to utilize abilities advancement as the main vehicle for helping poor young people to break-out of the poverty trap. The hidden presumption keeps on being that the obtaining of skills bolstered by public financing is the positive response to the issue of joblessness. Skills Acquisition Training is an adult education program which is intended to give different skills on the participants, and address immediate issues, for example, employments, independence and control restiveness among young people (Uranta & Nlerum, 2017). Mike (2014) declares that skill acquirement is the capacity to be prepared on a specific task or capacity. Likewise, Idoko (2014) posit that skill acquirement requires the gathering of various abilities that enhances task execution through the coordination of both theoretical and practical form of knowledge. He specified the rules for the sustenance of expertise acquirement program to include the followings; 1. Provision of training that gives the trainees the chances to obtain skills that are appropriate for readiness in a field of trade for beneficial business. 2. Provision of distinct skills that relate to each trade that makes one an expert in one field rather than the others.

Non-government organisation can play a major role in training and skill acquisition as was discovered from the success story of project YES that the scheme has added to the financial enrichment of the youths by providing them with vocational skill acquisition and counseling services geared towards reorienting their attitudes towards self and societal development (Ohize & Muhammed, 2009).

Acquiring a vocational skill leads to reduction of poverty level among young adults who takes part on skill acquisition programmes (Akpama *et al*., 2011). Also, greater percentage of youth sampled reported high and moderate levels of their capacity building: implying that the vocational skills acquisition and development was a successful scheme (Amadi & Abdullah, 2012). An investigation on skill acquisition and training in alleviation of poverty and unemployment in Kogi State Nigeria revealed that lack of entrepreneurship skills among youth is responsible for high rate of poverty/unemployment in Nigeria. The result also discovered that individuals that benefitted from skill training programme can now afford the basic necessity of life and government should introduce a programme to the status of poverty/unemployment reduction in Nigeria (Adofu & Ocheja, 2013).

Ola-Adebayo (2013), discovered that entrepreneurial education is best received in school settings. This is evident from his study of the determinants of Skill Acquisition and professional knowledge acquired by Nigerian graduates through the current university curriculum. The study also opined that learning by doing is seen as the best approach or method to teach entrepreneurial education. The finding also revealed that gender has nothing to do with observation of the importance of acquiring entrepreneurial skills education within and outside the school system. The research recommends that vocational education training should be mandatory before employment.

In any developing society, the challenges of development depend on the efficient and effectiveness of its educational system. Education is an indispensable element of which no society had ever developed without education. Duntoye (2014) opined that education is the aggregate of all the processes by means of which man developed ability, attitudes

and other forms of behaviours of positive values in the society in which the individual lives. It is geared towards the total development of an individual for productive living. According to Shaaba (2014) education can go on any where human beings exist whether in groups or as individuals whether planned or accidental. This means that education can be acquired through other forms and one of such forms is the non-formal setting or institutions established by the government. Section 6, pg. 19 of the National Policy on Education, states that, adult and non-formal education encourage all forms of functional education given to youths and adults outside the formal school system such as functional literacy, remedial and vocational education. In assertion, Akintayo and Kester (2014) adopted the definition given by the International Council for Education and Development (ICED) that non-formal and organized educational activity outside the established formal system whether operating separately or an important feature of some broader achievers that are intended to serve identifiable learning clienteles and learning objectives. By postulation, if non-formal education programmes are properly planned and implemented through established centres and institutions that are adequately equipped with facilities and resource personnel, it has the capacity to equip and turn out the required manpower skill meant for personal socio-economic sustenance which in turn will enhance national development.

2.2.5 Acquisition of vocational skill through non-formal education

The growth in technology and commerce in any given society depends largely on a functional educational system that recognizes the needs, aspirations and values of the society at a given period of time. Nigeria like other developing nations of the world has been faced with economic problems like unemployment, illiteracy, anti-social vices and poverty. A call for a wholesome national development can only be attained if only when people are adequately employed in productive ventures, no matter the magnitude. For

people to be employed and productive, the government will have to provide enabling environment and sustainable programme through vocational education and training.

Okoro (2006) defined technical and vocational education as that aspect of education that involves the acquisition of practical skill and basic scientific knowledge. While skill acquisition is the process of acquiring or gaining effective and ready knowledge in developing one's aptitude and ability on a particular field. Skill acquisition is one among other policies embarked on in Nigeria with the sole aim of alleviating poverty, youth restiveness, sophisticated crime, rural and urban drifts, unemployment and other social vices. The acquisition of skills by individuals in non-formal institutions is meant to equip individuals with more practical skills and less theoretical knowledge in income generating skills. Mbanusi (2008) noted that when individuals, youths and adults are given adequate training in the area of their interest, will enhance self employment after their training in form of apprenticeship method thereby alleviating their personality as active partners in both community and national development.

Ihebereme (2008) skill acquisition through vocational education and training within the non-formal institutions acts as a rehabilitator, re-orientator, motivator and empowerment to the underprivileged persons (not reached through the formal school system) as it boosts and alleviates socio-economic status of the individual, family members and the entire community. This in turn will affect the socio-economic sphere of the nation. Finally, with skills acquired through vocational and technical training and its appropriate utilization, individuals would be more productive, earn more revenue for family with improved standard of living which is necessary for longevity. With these, individuals could contribute meaningfully to the socio-economic and national development.

A nation's ailing economy can only be improved upon where individuals and other able bodied people not reached through the formal school setting are sufficiently skilled in various economic sectors of the nation. Education, agriculture and industry will enhance individuals, abled bodied persons to self-reliance and sometimes boost the socio-economic development of the nation. Skilled development is fundamental for national development as it harnesses a nation's natural resources and thus promotes economic stability (Bakare, 2017). Nigeria is endowed with natural, mineral and agricultural resources, capable of sustaining the nation where adequately explored and utilized. Furthermore Bakare (2017) revealed that this could be attained through the development of skilled manpower especially by those with potentials desiring to be trained in various trades and occupations, thus subsequently enhance a wholesome national development in the following ways:

- Skill acquisition where adequately utilized will enhance the promotion of entrepreneurship within the nation.
- Creation of employment opportunity as individuals are motivated to establish both small and medium scale businesses which will serve as service machinery to large industries.
- It will drastically reduce unemployment, poverty and other anti-social vices hunting the stability of the nation.
- Improve the living standard of living through innovation as individuals become self-reliant.
- Development of local technological base as the knowledge acquired by the individual could transform into certain small technical knowhow, capable of employing/training artisans.

- Enhance the ability to utilize the available local resources including raw materials for import substitution and/or export drive.
- As a result of the inherent benefit in the economy of the nation, government will be encouraged to provide enabling environment with the necessary labouratories and materials needed for the study of science and other allied capacity oriented values.
- Development of rural societies through the establishment of infrastructural facilities and social amenities thereby reducing rural/urban migration.
- Finally, it would enhance foreign investment, capable of explosion and developing the technological advancement of the nation, all geared towards the wholesome national development of the nation.

2.2.6 Satellite system installation

Television (TV) has become a very important asset in homes. The visual images and sounds that are reproduced on television screens make it more attractive. Television is importantly used to broadcast programmes for entertainments (sports, movies, and music), information (news) and education. A television according to Titlow (2012) is a telecommunication medium for transmitting and receiving moving images that can be monochrome (black and white) or coloured with or without accompanying sound. A standard television set comprises multiple internal electronic circuits including those for receiving and decoding broadcast signals. The extent to which the television serves its users depends on the type of receiving device that receives and decodes the broadcast signals.

A television receiver is an electronic device that receives television signals transmitted from a broadcasting station, amplifies it and applies it to the television screen. At the television receiver, the sound and picture carrier waves are picked up by the receiving

antenna producing currents that are identical in form to those flowing in the transmitting antenna to the receiver by a lead- in- transmission line (Dung, 2015). A television receiver performs the basic function of reception through its aerial system (antenna), selection, detection by converting the radio frequency signals into audio and video signal while the speaker and screen produces transmitted sounds and pictures. The sounds and picture produced are the television programmes. However, access television programme through different means such as, antenna, cables, or satellite dish. There is need to empower electronic master trainers with skills on how to install a satellite dish.

Generally, satellite kits include the satellite dish, mast, receiver, cables, and all necessary mounting hardware. Usually, installation requires the following items: Ladder; Power drill; 3/8-inch drill bit; Phillips screw bit for drill; Level; Compass; Satellite signal meter; Sealant. Satellite dishes are often installed on a roof, a balcony, or the side of a home. Satellite TV is a television programme delivered to users through a satellite and its usage has become so popular that it has become a source of income for many people. Nick (2014) defined satellite as a man-made object launched into space to orbit the earth, moon, sun, or other celestial body. Similarly, Rouse (2008) referred to satellite as a wireless receiver/transmitter that is launched by a rocket and placed in orbit around the earth. The satellite TV system transmits and receives broadcast signals using a specialized antenna called satellite dish. However, a satellite dish as defined by EBay (2013) is a signal receiver from satellite in orbit about the planet. Satellite dish sends and receives microwave signals which it converts into electric signals that can be used by computer, television and other devices (Janssen 2014). Part of the attraction to satellite dish is the great reception that results in exceptional sound and picture quality. Its higher quality digital signal is superior to the cable provider's signal that must be split and compressed to reach their subscribers. In addition, dish network offers 100%

local coverage of ones favourite in addition to other top programmes for a total of over 260 channels ranging from sport packages to premium channels (Bailey, 2013). Television satellite dish has many important component parts. Among the parts of a television satellite dish are: satellite dish pan, low noise block feed horn (LNBF), receiver, decoder.

According to Bennett (2014) the components of a satellite dish are satellite dish, low noise block (LNB), VAST decoder box, PRO TV and satellite signal finder, 3 pegs, 10m connecting cable (LNB to decoder box), 1.8m connecting cable (decoder box to TV set), through van wall external-internal TV cable connector. Similarly, Titlow (2012) highlighted the following components of a satellite dish: satellite dish, LNBF, receiver, compass, coaxial cables RG-6 75ohm 75 feet. The satellite dish unlike other receivers needs to be installed before it can be used. Installation of the television satellite dish involves several steps such as: open the pack to check if the components are complete, find a good location to mount the satellite dish, assemble the dish, ground the satellite dish and connect the satellite dish to the receiver and then to the TV (Janssen 2014).

Satellite technology was developed for competing with the local Cable Television (TV) distribution services by providing higher quality satellite signals with more number of channels. In short, DHS refers to the reception of satellite signals on a TV with a personal dish in an individual home. The satellites that are used for this purpose is geostationary satellites. The satellites compress the signals digitally, encrypt them and then are beamed from high powered geostationary satellites. They are received by dishes that are given to the DBS subscribers by DBS providers. Though DHS and DBS present the same services to the subscribers, there are some differences in the technical specifications. While DHS is used for transmitting signals from satellites at a particular

frequency band (the band differs in each country), DBS is used for transmitting signals over a wide range of frequencies (normal frequencies including the KU and KA band). The satellites used for the transmission of the DBS signals are not part of any international planned frequency band. DHS has changed its plans over the past few years so as to include new countries and also modify their mode of transmission from analog to digital. But DBS is more famous for its services in both the analog and digital services which includes both audio and video signals. The dishes used for this service is also very small in size. When it comes to commercial use, DBS is known for its service providing a group of free channels that are allowed for its targeted country (Nick, 2014).

2.2.7 Task of master trainer in satellite system installation

According to Janssen (2014), satellite systems master trainer installs, maintain and repair telecommunications equipment and satellite dishes in offices, hotels, business premises and private houses. They install and maintain the communications links for electrical power companies, terrestrial aerials or satellite dishes for TV or telecommunications companies. Their work involves installing new systems, upgrading existing ones and repairing and realigning equipment. Janssen (2014) stated their main tasks include:

- Deciding on the best location for equipment.
- Planning how to route the cables.
- Installing aerials or satellite dishes.
- Testing the equipment.
- Checking the signal levels received
- Choose your receiver
- Preparing the cable

- Assemble your satellite dish
- Choose your mount
- Mount your satellite dish
- Determine your position
- Elevate your dish
- Connect your dish
- Find the satellite
- Connecting signal outlet sockets.
- Installing the reception equipment.
- Commissioning the installation - getting it working.

Master trainer usually work in pairs. They use vans to transport their equipment, which may include ladders, scaffolding, personal protection equipment, wiring tools and test equipment for signal checking. As skilled workers, they understand the theory behind the practical work they are doing and keep up to date with rapidly changing developments in the field. On complex installations, they may have to follow detailed plans and drawings. A lot of the work is done at heights, so they have to be very competent and safety-conscious, both for themselves and for other people nearby (Janssen 2014).

Master trainer hours tend to vary, but often include weekends and evenings. Emergency call-outs or tight deadlines may mean they have to work outside usual hours. They usually travel from site to site and may complete several installations in one day. There can be opportunities for flexible and part-time working, especially for freelance, contracted or self-employed craftsmen. The work often involves working outside at heights in hot or cold weather. Inside work could be in individual homes, offices or

industrial sites. When they are carrying out planning or administration, they are usually in their own or a shared office. The world of television, radio and telecommunications is continually changing and evolving. As a result, satellite systems master trainer are in increasing demand. They are mostly self-employed individuals that provide installation services (Davies, 2013).

A satellite dish is a dish-shaped type of parabolic antenna designed to receive or transmit information by radio waves to or from a communication satellite. The term most commonly means a dish which receives direct-broadcast satellite television from a direct broadcast satellite in geostationary orbit. The parabolic shape of a dish reflects the signal to the dish's focal point. Mounted on brackets at the dish's focal point is a device called a feedhorn. This feedhorn is essentially the front-end of a waveguide that gathers the signals at or near the focal point and 'conducts' them to a low-noise block down converter or LNB. The LNB converts the signals from electromagnetic or radio waves to electrical signals and shifts the signals from the downlinked C-band and/or K_u-band to the L-band range. Direct broadcast satellite dishes use an LNBF, which integrates the feedhorn with the LNB. A new form of omnidirectional satellite antenna, which does not use a directed parabolic dish and can be used on a mobile platform such as a vehicle was announced by the University of Waterloo in 2004 (Ede *et al.*, 2010).

The theoretical gain (directive gain) of a dish increases as the frequency increases. The actual gain depends on many factors including surface finish, accuracy of shape, feedhorn matching. A typical value for a consumer type 60 cm satellite dish at 11.75 GHz is 37.50 dB. With lower frequencies, C-band for example, dish designers have a wider choice of materials. The large size of dish required for lower frequencies led to the dishes being constructed from metal mesh on a metal framework. At higher

frequencies, mesh type designs are rarer though some designs have used a solid dish with perforations. A common misconception is that the LNBF (low-noise block/feedhorn), the device at the front of the dish, receives the signal directly from the atmosphere. For instance, one BBC News downlink shows a "red signal" being received by the LNBF directly instead of being beamed to the dish, which because of its parabolic shape will collect the signal into a smaller area and deliver it to the LNBF (Feder, 2012). Modern dishes intended for home television use are generally 43 cm (18 in) to 80 cm (31 in) in diameter, and are fixed in one position, for Ku-band reception from one orbital position. Prior to the existence of direct broadcast satellite services, home users would generally have a motorised C-band dish of up to 3 m in diameter for reception of channels from different satellites. Overly small dishes can still cause problems, however, including rain fade and interference from adjacent satellites.

According to Nick (2014), in a single receiver residential installation there is a single coaxial cable running from the receiver set-top box in the building to the LNB on the dish. The DC electric power for the LNB is provided through the same coaxial cable conductors that carry the signal to the receiver. In addition, control signals are also transmitted from the receiver to the LNB through the cable. The receiver uses different power supply voltages (13 / 18 V) to select vertical / horizontal antenna polarization, and an on/off pilot tone (22 kHz) to instruct the LNB to select one of the two frequency bands. In larger installations each band and polarization is given its own cable, so there are 4 cables from the LNB to a 'multiswitch' switching matrix, which allows the connection of multiple receivers to the multiswitch in a star topology using the same signalling method as in a single receiver installation.

A satellite finder may aid in aiming the satellite dish. Professional satellite meters allow better dish alignment and provide received signal parameter values too.A dish that is

mounted on a pole and driven by a stepper motor or a servo can be controlled and rotated to face any satellite position in the sky. There are three competing standards: DiSEqC, USALS, and 36 V positioners. Many receivers support all of these standards (Nick, 2014).

Motor-driven dishes are popular with enthusiasts. Although there is no problem with equipment pricing, only price for space required for installation. And making the installation wind proof for big size dish. Even standard or small size dishes can be used, however enthusiasts tend to prefer the largest possible sizes (at least 120cm) in order to receive signals from remote weak satellite positions. The cheapest sizes for KU band are up to 120cm. Sizes above 120cm have rapid sharp price increase in comparison to ordinary commercial application for end consumer (ordinary viewer). Although pricing is different for countries where there is no freedom for KU band, and end consumer (ordinary viewer) is only allowed to receive channels from C band, which require in most cases sizes 150cm and above.

Titlow, (2012) stated that every standard size dish enables simultaneous reception from multiple different satellite positions without re-positioning the dish, just by adding additional LNB or using Special Duo LNB or Triple or Four Feed Monoblock LNB. However some designs much more effectively optimize simultaneous reception from multiple different satellite positions without re-positioning the dish. The vertical axis operates as an off-axis concave parabolic concave hyperbolic Cassegrain reflector, while the horizontal axis operates as a concave convex Cassegrain. The spot from the main dish wanders across the secondary, which corrects astigmatism by its varying curvature. The elliptic aperture of the primary is designed to fit the deformed illumination by the horns. Due to double spill-over, this makes more sense for a large dish. Titlow, (2012) outline procedures in preparing for installation

- Complete a General Site Survey – Visually survey your location to make sure it is suitable.
- Obtain Dish Pointing Coordinates – Use the on-screen menu system to obtain the exact coordinates (azimuth and elevation) for pointing the dish. Directions for using on-screen menus can be found in your receiver manual.
- Select the Precise Mounting Site – Use the dish pointing coordinates to conduct a precise site survey to determine the exact mounting site.
- Estimate Cable Requirements – Based on your mounting site, you will decide where you want the cable to enter your house, and measure how many feet of cables you need to complete the connection.
- Begin Dish Assembly – Attach the reflector to the support arm so that you can preset the correct elevation.
- Set the Elevation on Dish – This is an important step. Making sure that your elevation setting is correct will help you to more easily obtain the signal later on. Mounting the

  Mast

- Mount the Mast – Step-by-Step mounting instructions for each mounting option.

Titlow, (2012) also stated that completing the Final Installation • Level the Mast – The mast must be level to obtain the signal.

- Complete the Dish Assembly – Place the dish on the mast and connect the RG-6 coaxial cable to the LNB, and attach the LNB to the support arm.

- Route the Cables to the Grounding Block – Attach a grounding block to the house and route the cables from the dish to the grounding block. Also, route grounding wire from the grounding block to the central building ground.
- Run the Cables from Grounding Block into the House – Run the RG-6 cable from the grounding block into the house and to the back of the receiver.
- Make the Final Connections to the Receiver – Connect the RG-6 to the satellite input on the receiver, and make the phone line connection.
- Acquire and Fine-Tune the Satellite Signal – Use the on-screen signal meter to check for a signal. Once the signal is obtained, adjust dish pointing to achieve maximum signal strength for your location.
- Order Satellite Programming – Call the service providers to order satellite programming.

Titlow, (2012) also outline other activities involving in satellite installations include:

- Erect scaffolding
- Ensure safety during the whole installation process
- Set up solar panel mounting system
- Install the solar panel on the mounting structure
- Installation of electrical wiring
- Install solar panel using MC4 connectors
- Connection of solar inverter to the system
- Install inverter in a cooler place for more efficient
- Inverter in the indoors, should be in the garage or utility room

- Solar battery storage save from worrying about the lack % usable energy during cloudy times
- Solar battery storage lower battery storage system cost during installation
- Connection of inverter to consumer unit to generate electricity
- Connection of the output to solar panel to the charge control
- Installation % change over switch between electricity supply and solar supply

2.2.8 Activities of master trainer in satellite system installation

Nick (2014) state that activities of master trainer in satellite systems installation includes repair and replace equipment, communication networks and satellite systems. Work ranges from fitting a new system in a business, to repairing equipment after storm damage on a domestic property.

The activities also include the followings:

- carry out site surveys to prepare plans for jobs and quotes
- plan cabling networks
- install and fix aerials or satellite dishes to wall mounts
- connect signal outlet sockets
- check signal strength levels
- test equipment and fix faults

Satellite TV is a television programme delivered to users through a satellite and its usage has become so popular that it has become a source of income for many people. Nick (2014) defined satellite as a man-made object launched into space to orbit the earth, moon, sun, or other celestial body. Similarly, Rouse (2008) referred to satellite as a wireless receiver/transmitter that is launched by a rocket and placed in orbit around the earth. The satellite TV system transmits and receives broadcast signals using a

specialized antenna called satellite dish. However, a satellite dish as defined by EBay (2013) is a signal receiver from satellite in orbit about the planet. Satellite dish sends and receives microwave signals which it converts into electric signals that can be used by computer, television and other devices (Janssen 2014). Part of the attraction to satellite dish is the great reception that results in exceptional sound and picture quality. Its higher quality digital signal is superior to the cable provider's signal that must be split and compressed to reach their subscribers. In addition, dish network offers 100% local coverage of ones favourite in addition to other top programmes for a total of over 260 channels ranging from sport packages to premium channels (Bailey, 2013). Television satellite dish has many important component parts. Among the parts of a television satellite dish are: satellite dish pan, low noise block feed horn (LNBF), receiver, decoder.

According to Bennett (2014) the components of a satellite dish are satellite dish, low noise block (LNB), VAST decoder box, PRO TV and satellite signal finder, 3 pegs, 10m connecting cable (LNB to decoder box), 1.8m connecting cable (decoder box to TV set), through van wall external-internal TV cable connector. Similarly, Titlow (2012) highlighted the following components of a satellite dish: satellite dish, LNBF, receiver, compass, coaxial cables RG-6 75ohm 75 feet. The satellite dish unlike other receivers needs to be installed before it can be used. Installation of the television satellite dish involves several steps such as: open the pack to check if the components are complete, find a good location to mount the satellite dish, assemble the dish, ground the satellite dish and connect the satellite dish to the receiver and then to the TV.

Bell (2014) stated the following steps of satellite dish installation: unpack the satellite antenna, receiver and parts, determine the appropriate location of the satellite, find the

best location on your property for the satellite antenna with a clear line of sight to the satellite, assemble the satellite antenna, ground the satellite antenna and wire it to the receiver and so on. However, installing Television satellite dish requires necessary precautions to be taken to avoid bridging the terminals or causing short circuit faults such as: making sure that the cloth used for cleaning the receiver is dry, make sure that the power cables are not pinched during connection, avoid over loading of the extension cord.

Bell (2014) identified the following precautionary measures to be taken in installing television satellite dish. They include: Do not use this apparatus near water, clean only with a dry cloth, do not block any ventilation openings, Install in accordance with the manufacturer's instructions, do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat and so on. Installation of the television satellite dish requires skills. Most electronic technicians involved in installation of television satellite dish do not have adequate knowledge and skills required for effective installation of television satellite dishes. The constant production of new models of television satellite dish puts the technicians involved in the installation of the satellite dishes off balance. Training electronic technicians on the necessary steps, as well as precautions involved in installing television satellite dishes will help to improve the quality of reception from the installed television satellite dish. Unfortunately, most electronic technicians struggle to get the updates on the steps and precautions necessary for installing new television satellite. Therefore, this study is designed to find out the skills empowerment needs of electronic technicians for effective installation of television satellite dish.

2.2.9 Working materials used by master trainers in satellite system installation

Satellite system service is a high-powered broadcast service to homes using satellites as the primary form of signal transmission (Kates et al., 2015). Its high transmission power makes possible use of relatively small dish antennas for efficient signal reception and utilization. Commercial satellite TV, as we know it, is a DBS service. Usually, installation requires the following items: Ladder; Power drill; 3/8-inch drill bit; Phillips screw bit for drill; Level; Compass; Satellite signal meter and Sealant (Maigida, 2012).

Below are the guidelines for satellite installations:

1. To work properly, dish must have an unobstructed view of the southern sky. This means it's important to choose a location where the satellite signal won't be blocked by things like buildings or trees.
2. On occasion, you may need to clean snow or debris off the dish or tweak its alignment, so select a location that allows you to reach the dish easily.
3. Don't install the dish near power lines or other service utilities, as this presents a safety hazard.
4. This simply means positioning the dish at the proper angle or tilt so it can receive the satellite signal. The easiest way to find the correct tilt is by using a satellite signal meter. Adjust the tilt of the dish until the meter shows that you're getting a strong signal, then tighten the dish onto the mast using the screws provided in the installation kit.
5. Find a location that is close to your TV and drill a hole through the wall of your house using the 3/8-inch bit. Then, attach one end of the cable to the satellite dish, feed the cable through the hole, and secure the other end of the cable to the receiver. Test the system first to make sure it's working properly. Once you

know it is, close the hole around the cable entry point with a weatherproof sealant to help prevent water damage.

Hand tools: These are small equipments, hold with hands and use to do a particular job. Hand tools used in electrical craft as specified by Miller (2001) includes: Pliers: These are hand tools used principally for holding materials, objects and are some cases for cutting wire and cables. These are: side-cutting pliers, long-nosed pliers and diagonal-cutting nippers. Screw drivers: It consists of hardened and tempered steel or alloy steel blade with a handle of wood or molded insulating material types of screw drivers are: flared tip, parallel-side tip, stub and Phillips.

Hammers: This is used to deliver blows to pins, nails and cold chisels. A hammer consists of steel head mounted on a wood handle. Types are claw, London, Warrington and ball pen hammers. Knives: These are used for stripping cables and coil. Types are: pocket, cobblers and trimming knives. Hack saw: It is a hand tool used for cutting metal. Consists of a blade and a handle. Cold chisels: These are made from a high quality steel throughout and has a special hardened tempered cutting edge used for cutting metals and wood, types includes, flat, chaser and bolster chisels. Tape rule: This is used for measuring length, width and breath of an object or material. There are wooden and steel types. Hand drill: It is used with a bit fitted in the chuck, used for drilling holes in metals. The hand drill is driven by means of an iron bevel wheel and has a side and top handle in addition to the driving handle (Miller (2001).

2.2.10 Solar system installation

Chris, (2016) state that Solar System is the gravitationally bound system of the Sun and the objects that orbit it, either directly or indirectly. Of the objects that orbit the Sun directly, the largest are the eight planets,[d] with the remainder being smaller objects, the

dwarf planets and small Solar System bodies. Of the objects that orbit the Sun indirectly the natural satellites two are larger than the smallest planet, Mercury.

The Solar System formed 4.6 billion years ago from the gravitational collapse of a giant interstellar molecular cloud. The vast majority of the system's mass is in the Sun, with the majority of the remaining mass contained in Jupiter. The four smaller inner planets, Mercury, Venus, Earth and Mars, are terrestrial planets, being primarily composed of rock and metal. The four outer planets are giant planets, being substantially more massive than the terrestrials. The two largest planets, Jupiter and Saturn, are gas giants, being composed mainly of hydrogen and helium; the two outermost planets, Uranus and Neptune, are ice giants, being composed mostly of substances with relatively high melting points compared with hydrogen and helium, called volatiles, such as water, ammonia and methane. All eight planets have almost circular orbits that lie within a nearly flat disc called the ecliptic (Chris, 2016).

The Solar System also contains smaller objects. The asteroid belt, which lies between the orbits of Mars and Jupiter, mostly contains objects composed, like the terrestrial planets, of rock and metal. Beyond Neptune's orbit lie the Kuiper belt and scattered disc, which are populations of transNeptunian objects composed mostly of ices, and beyond them a newly discovered population of sednoids. Within these populations, some objects are large enough to have rounded under their own gravity, though there is considerable debate as to how many there will prove to be. Such objects are categorized as dwarf planets. The only certain dwarf planet is Pluto, with another transNeptunian object, Eris, expected to be, and the asteroid Ceres at least close to being a dwarf planet. In addition to these two regions, various other small-body populations, including comets, centaurs and interplanetary dust clouds, freely travel between regions. Six of

the planets, the six largest possible dwarf planets, and many of the smaller bodies are orbited by natural satellites, usually termed "moons" after the Moon. Each of the outer planets is encircled by planetary rings of dust and other small objects (Chris, 2016).

The solar wind, a stream of charged particles flowing outwards from the Sun, creates a bubblelike region in the interstellar medium known as the heliosphere. The heliopause is the point at which pressure from the solar wind is equal to the opposing pressure of the interstellar medium; it extends out to the edge of the scattered disc. The Oort cloud, which is thought to be the source for long-period comets, may also exist at a distance roughly a thousand times further than the heliosphere. The Solar System is located in the Orion Arm, 26,000 light-years from the center of the Milky Way galaxy.

Solar cell is made of two types of semiconductors which are called P-type and N-type silicon. Because of adding atoms, the P-type silicon loses one electron. The N-type silicon is made by adding atoms so that it gets one more electron. A solar cell is made by a P-type silicon layer and the N-type silicon layer. There are too many electrons in N-type layer, and in P-type layer, there are too many electron-holes. Near the junction of those two layers, the electron moves into the electron-hole from N-type layer, this creates a depletion zone so that the electrons fill the holes. Solar cell is a device which can catch the sun light and transform it to electrical energy directly. The size of a solar cell is about a size of a palm of an adult. The shape is an octagon, and the color is blue-black. Solar cells are built with the solar batteries together very often. The large units are solar modules. The case of many solar cells are built together which are called a solar panel (Chris, 2016).

2.2.11 Task of master trainer in solar system installation

According to Zhao, (2012) states that craftsmen task in solar system installation involve assemble solar modules, panels, or support structures, as specified. Install active solar systems, including solar collectors, concentrators, pumps, or fans. Apply weather sealing to array, building, or support mechanisms. Install photovoltaic (PV) systems in accordance with codes and standards using drawings, schematics, and instructions. Perform routine photovoltaic (PV) system maintenance on modules, arrays, batteries, power conditioning equipment, safety systems, structural systems, weather sealing, or balance of systems equipment.

It also includes: Activate photovoltaic (PV) systems to verify system functionality and conformity to performance expectations. Check electrical installation for proper wiring, polarity, grounding, or integrity of terminations. Determine appropriate sizes, ratings, and locations for all system overcurrent devices, disconnect devices, grounding equipment, and surge suppression equipment. Determine connection interfaces for additional subpanels or for connecting photovoltaic (PV) systems with utility services or other power generation sources. Determine photovoltaic (PV) system designs or configurations based on factors such as customer needs, expectations, and site conditions (Zhao, 2012).

Diagram layouts and locations for photovoltaic (PV) arrays and equipment, including existing building or site features. Examine designs to determine current requirements for all parts of the photovoltaic (PV) system electrical circuit. Identify and resolve any deficiencies in photovoltaic (PV) system installation or materials. Identify electrical, environmental, and safety hazards associated with photovoltaic (PV) installations. Identify installation locations with proper orientation, area, solar access, or structural integrity for photovoltaic (PV) arrays. Identify methods for laying out, orienting, and

mounting modules or arrays to ensure efficient installation, electrical configuration, or system maintenance (Zhao, 2012).

Install module array interconnect wiring, implementing measures to disable arrays during installation. Install required labels on solar system components and hardware. Measure and analyze system performance and operating parameters to assess operating condition of systems or equipment. Program, adjust, or configure inverters and controls for desired set points and operating modes. Select mechanical designs, installation equipment, or installation plans that conform to environmental, architectural, structural, site, and code requirements. Test operating voltages to ensure operation within acceptable limits for power conditioning equipment, such as inverters and controllers. Visually inspect and test photovoltaic (PV) modules or systems. Compile or maintain records of system operation, performance, and maintenance. Demonstrate system functionality and performance, including start-up, shut-down, normal operation, and emergency or bypass operations. Determine materials, equipment, and installation sequences necessary to maximize installation efficiency.

Zhao (2012) identified task in solar installations:

- Deciding on the best location for equipment
- Planning how to route the cables.
- Installing aerials or satellite dishes.
- Testing the equipment.
- Checking the signal levels received
- Choose your receiver
- Preparing the cable
- Assemble your satellite dish

- Choose your mount
- Mount your satellite dish
- Determine your position
- Elevate your dish
- Find the satellite
- Connecting signal outlet sockets.
- Installing the reception equipment.
- Commissioning the installation - getting it working.

2.2.12 Activities of craftsman in solar system installation

Zhao, (2012) stated that Solar AC and DC Power Distribution Cabinet includes AC control cabinet and photovoltaic DC control cabinet. it is mainly used in those huge photovoltaic power plants. It can prevent lightning and over-current, and detect the PV single array string current, voltage, lightning protection state and short circuit state. The professionally design and the carefully choice of components can guarantee a long and stable period of the use of solar AC and DC power distribution cabinet. AC control cabinet is a device which can implement the inverter's output, detect, display and the device protection and so on. The output interface of the inverter AC distribution cabinet can provide it, the output AC circuit breaker can be configured with network (or for AC load use) directly, and the maintenance state of the PV system cannot influence the security of the PV system and grid (or the load), but also protect the maintenance workers.

Bell, (2014) identify the main function of solar AC and DC power distribution cabinet is the switching for the backup inverter in the power plant system, to ensure the power supply system is normal, as well as the measurement of the energy line. Solar

photovoltaic power plants are made by the solar cells square which can transform the solar radiation energy to electrical energy. According to the operation mode, solar photovoltaic power plant can be divided into independent solar power stations and grid-connected solar photovoltaic power plant. Independent solar power station does not couple with the public grid. It mainly uses in those places where are no electricity and some special places. Such as remote and isolated rural and pastoral areas, islands, plateaus and desert for those farmers and fishermen, to ensure that they can watch TV, lighting, listening to the radio and other basic living electricity. It also can be used for communications relay station, coastal and inland buoy, cathodic protection of pipelines, meteorological station, road class and road border posts and other special premises. Independent system consists of solar cell matrix, the system controller, battery, DC / AC inverter and other components.

Grid-connected solar photovoltaic power plant does not connect with the public power grid. It is very important for large-scale commercial stage and the electric power industry components. It is the main trend of the world's solar photovoltaic technology development. Grid system consists of solar cell matrix, the system controller, and network inverter and other components (Zhao, 2012).

Household solar power system consists of solar batteries, solar controller, battery components. It will need to configure inverter if the output power is 220V AC or 110V. The conditions of the household solar photovoltaic power generation system as follows:

Where do people want to use the household solar photovoltaic system and what is the solar radiation situation of the place?

- How much is the power of the load?

- How much is the output power?
- How long should the system work per day? How long should the system supply power when the weather is not good? (Zhao, 2012)

Array Mounting Racks Arrays are most commonly mounted on roofs or on steel poles set in concrete. In certain applications, they may be mounted at ground level or on building walls. Solar modules can also be mounted to serve as part or all of a shade structure such as a patio cover. On roof-mounted systems, the PV array is typically mounted on fixed racks, parallel to the roof for aesthetic reasons and stood off several inches above the roof surface to allow airflow that will keep them as cool as practical.

Adjustability: The tilt of sloped rooftop arrays is usually not changed, since this is inconvenient in many cases and sometimes dangerous. However, many mounting racks are adjustable, allowing resetting of the angle of the PV modules seasonally.

Tracking – Pole-mounted PV arrays can incorporate tracking devices that allow the array to automatically follow the sun. Tracked PV arrays can increase the system's daily energy output by 25 percent to 40 percent. Despite the increased power output, tracking systems usually are not justified by the increased cost and complexity of the system.

General Installation

According to Bell, (2014) proper roof mounting can be labour intensive, depending largely on the type of roof and how the mounting brackets are installed and sealed. It is best to follow the recommendations of the roofing contractor, racking system suppliers and module manufacturers. Module manufacturers will provide details of support requirements for their modules. A good racking supplier will provide code-compliant engineering specifications with their product. As a general rule for bidding purposes,

however, it is typical to have one support bracket for every 100 watts of PV modules. Particular attention must be given to securing the array directly to the structural members of the roof and to weather sealing of roof penetrations. All details regarding attaching the mounting brackets to the roof and sealing around them are best approved and carried out by the roofing contractor so that the roof warranty will not be voided.

Asphalt Composition Roofs

Rouse, (2008) state that asphalt composition roofs, all mounts need to be secured to the roof with stainless steel lag bolts, bolted into the rafters. Mount types include support posts and L-brackets. Support posts are preferred because they are designed to give a good seal on boots. Support posts are best mounted after the roof decking is applied and before the roof material is installed. Support posts and roof jacks may be installed by either the roofing contractor or the crew in charge of laying out the array mounting system. The roofing contractor then flashes around the posts as they install the roof. It is very common to install mounts after the roof is installed, drilling through the asphalt composition roofing to install the bolts. Sealant is then applied around the bolts without flashing.

As well, the top layer of roofing should be carefully lifted back to inject sealant under the roofing. While this is much less labour intensive than when flashed, unless performed by the roofing contractor, this method may void the warranty on the roof.

Metal Roofs

According to Rouse, (2008), there are several types of standing seam metal roof products, including vertical seam, horizontal seam and delta seam products. Currently, special clamps, referred to as S-5 clamps, are available to attach arrays without any penetrations to vertical and horizontal seam roofs and certain other standing seam roof

profiles. These clamps make installation of the solar array a relatively easy matter compared to any other roof type. In contrast, clamps for delta seam metal roofs are not available. For these roofs, it is necessary to cut into the roofing, install boots around the mounting posts, and then seal the penetration. This being undesirable and labour intensive, it is best to clearly specify in advance a vertical or horizontal seam metal roof or other roof type compatible with S-5 clamps. Other Roof Types – While it is possible to install a PV array on shake, tile and slate roofs, these roof types pose certain problems. Contact the racking system supplier for information on products and installation methods for these roof types. Work directly with the roofing contractor before ordering the racking system.

Grounding Equipment

Titlow (2012), states that grounding equipment provides a well-defined, low-resistance path from your system to the ground to protect your system from current surges from lightning strikes or equipment malfunctions. Grounding also stabilizes voltages and provides a common reference point. The grounding harness is usually located on the roof. Check with the AHJ – Grounding can be a particularly problematic issue. Be sure to check with the Authority Having Jurisdiction (AHJ) – typically the building department's electrical inspector – concerning local code requirements. Equipment Grounding – Equipment grounding provides protection from shock caused by a ground fault. A ground fault occurs when a current-carrying conductor comes into contact with the frame or chassis of an appliance or electrical box. All system components and any exposed metal, including equipment boxes, receptacles, appliance frames and PV mounting equipment, should be grounded.

Combiner Box Wires from individual PV modules or strings are run to the combiner box, typically located on the roof. These wires may be single conductor pigtails with

connectors that are prewired onto the PV modules. The output of the combiner box is one larger two wire conductor in conduit. A combiner box typically includes a safety fuse or breaker for each string and may include a surge protector (NBTE, 2011).

Surge Protection Surge protectors help to protect your system from power surges that may occur if the PV system or nearby power lines are struck by lightning. A power surge is an increase in voltage significantly above the design voltage (NBTE, 2012).

Inverter

- Inverters take care of four basic tasks of power conditioning:
- • Converting the DC power coming from the PV modules or battery bank to AC power
- • Ensuring that the frequency of the AC cycles is 60 cycles per second
- • Reducing voltage fluctuations

Surge Capacity

The starting surge of equipment such as motors is not a consideration in sizing grid-connected inverters. When starting, a motor may draw as much as seven times its rated wattage. For grid connected systems, this start-up surge is automatically drawn from the grid. Frequency and Voltage Regulation – Better quality inverters will produce near constant output voltage and frequency. Efficiency – Modern inverters commonly used in residential and small commercial systems have peak efficiencies of 92 percent to 94 percent, as rated by their manufacturers. Actual field conditions usually result in overall efficiencies of about 88 percent to 92 percent. Inverters for battery-based systems have slightly lower efficiencies (Ngwoke, 2016).

Integral Safety Disconnects

Titlow (2012), identify the AC disconnect in most inverter models may not meet requirements of the electric utility (see section “Disconnects”). Therefore, a separate exterior AC disconnect may be required even if one is included in the inverter. All inverters that are UL listed for grid-connection include both DC disconnects (PV input) and AC disconnects (inverter output). In better inverters, the inverter section can be removed separately from the DC and AC disconnects, facilitating repair. Maximum Power Point Tracking (MPPT) – Modern non-battery-based inverters include maximum power point tracking. MPPT automatically adjusts system voltage such that the PV array operates at its maximum power point. For battery-based systems, this feature has recently been incorporated into better charge controllers.

Inverter-Chargers

According to Miller (2001), battery-based systems, inverters are available with a factory integrated charge controller, referred to as inverter-chargers. Be sure to select an inverter-charger that is rated for grid connection, however. In the event of a grid power outage, use of an inverter-charger that is not set up for grid-connection would result in overcharging and damaging the batteries, known as “cooking the batteries.”

Automatic Load Shedding

For battery-based systems, the inverter can automatically shed any unnecessary loads in the event of a utility power outage. Solar loads, i.e. the loads that will be kept powered up during the outage, are connected to a separate electrical sub-panel. A battery-based system must be designed to power these critical loads (Miller, 2001),

Warranty

Titlow, (2012) states that inverters typically carry warranties of 5 years, although the industry is moving toward a 10-year warranty. The transformer and solid state

components of an inverter are both susceptible to overheating and damage from power spikes, reducing its life. Transformerless inverters, long available in Europe, are beginning to move into the U.S. market. To Consider When Researching Inverters – Many references on sizing and selecting inverters have been developed for off-grid systems, but may not clearly state that they are specific to off-grid systems. Sizing and selecting grid-connected inverters entails different considerations and is easier, since the system does not have to provide 100 percent of the energy requirements. In particular, peak energy demand and surge capacity do not need to be considered for grid-connected systems. Disconnects Automatic and manual safety disconnects protect the wiring and components from power surges and other equipment malfunctions.

Ogwa (2015) Identified activities of solar include the followings

- Set up Scaffolding
- Confirm that all the components are complete.
- Determine the location of the panel
- Select a very clear area for connection of the panel
- Fix the panel
- Run the cable
- Mount Installation
- Install the Solar Panels
- Do Electrical Wiring
- Connect the System to Solar Inverter
- Connect Solar Inverter and Solar Battery
- Connect Solar Inverter to the Grid
- Start Solar Inverter

- Test run the System
- Troubleshoot and Fix Issues
- Perform Tests
- Follow up with to ensure that the solar system is works properly.

2.2.13 Working materials of master trainer in solar system installation

According to Yabo (2013), Solar panels are installed on roofs. Solar panels can be installed easily by the home owner or one can also call a professional to install the solar panels. The materials that are required for solar panel installation are: roof anchors that are made up of aluminium or steel; a unique key lock system between the roof anchors and the mounting frame; mounting frame; bolts are used to screw it tightly; you will also need a clamp to fix the solar panels to the mounting frame; solar panels. First of all you have to find the suitable place where you would like to install the solar panels. The position of the roof anchors has to be properly measured and marked. Once you fix the roof anchors to the roof, you will attach the mounting frame. After this you will install the photovoltaic panels in rows or columns. It depends upon the availability of the roof space. The panels need to be wired to each other properly to get the complete electrical system.

Working materials are indispensable to the crafts master. The crafts masters set out workshop objectives and decide how to achieve the objectives. Machines, equipments, tools, material resources human resources, finance and time are adequately planned for optimum benefit. Workshop planning becomes more tasking bearing that resources are scarce and limited. Planning is a mental activity involving setting of objectives and carefully deciding on how to achieve the objectives. It involves deciding on what to do and how to do it. Yabo (2013) conceptualized planning to involve working out broad

out line, things needed to be done and the method of doing them to accomplish organizational goals. Yabo also viewed planning as a process of mapping out in advance a pattern of action to be implemented, determining what to be done, identification of requirements and careful formulation of lines of actions to achieve goals. Informal electrical/electronics crafts practice facilities include hand tools, measuring instruments, components, machines and building. Ezeji (2003), described facilities in industrial arts to includes: machines, tools, instruments, floor space, time, auxiliary buildings and the instructor. Facilities planning involve specific activities as to determining the workshop objectives, careful selection of tools and equipment, and harnessing human and material resources to achieve goals.

Workshop organization: A workshop is a building or room containing tools and machines for carrying out practicals (Miller, 2011). Miller, further stated that it is a place for carrying out test, experiments, construction, design, repairs and maintenance. The arrangements and layout of the shop demand unusual foresight and planning due to complexity of activities to be carried out. Pollard (2016), noted that, the effective organization and management is vital in implementing plans for learning. Yabo (2013), viewed organization as deliberately coordinated efforts of group of individuals for imparting knowledge, skills and attitudes to achieve predetermined goals.

Organization involves arranging and coordinating of resources in best order to achieve set objectives. This involves arrangements, coordinating and controlling of tools, equipment, machines to achieve workshop goals. The shop organization demand adequately space passage to allow free flow of materials and personnel. The shop should be set up to provide suitable effective workspace for couple of activities. Factors to be considered in planning electrical and electronics shop as identified by Miller

(2001) includes: shop size and shape, natural and artificial light, electric power outlets/supply, storage facilities and location.

Yabo (2013) identified some working materials use in satellite installation include:

- Satellite
- Satellite mount
- Satellite LNB
- Compass
- Wrench
- Hammer
- Chisel
- Lag bolts
- Washes
- Locking nut
- RG6 coaxial cable
- HDMI cable
- Drill
- Yain (1.3cm) drill bits
- Marker
- 4 Atanless steel fixing
- Hexagonal screws
- ‘F’ connector x 2
- Digital TV recover
- Compression tool
- Pocket cable tester

Solar Battery

For some problems, such as unstable grid energy, over-charging or discharging and irregular full recharging, is for the solar battery important to meet those demands. And for nowadays, lead-acid batteries are the main batteries which are used in solar photovoltaic system. Lead-acid batteries: these solar batteries are mainly used in the car, but it is a good choice for solar photovoltaic system. It is a starting battery; it can produce a short burst of high power to start the engine of the system. There are also some deep-cycle batteries. Lead-acid batteries are used very widely, but all of lead acid batteries are used for starting or prociding deep cycle power. There is an obviously difference, that is how much power it delivered and how long it needs to deliver. (Kathie, 2015)

Battery Pack

According to Yabo (2013), the main function of a solar battery pack is to store solar energy by the square under the light and be ready to supply the electricity energy to the load at anytime. Here are the basic requirements for solar power batteries:

1. Low self-discharge rate
2. Long service life
3. Deep discharge capacity should be strong
4. High charging efficiency
5. Low-maintenance rate or maintenance is free
6. Wild range of operating temperature

7. Low price

For currently, the most battery packs used with solar photovoltaic system together are leadacid batteries and nickel-cadmium batteries. Generally, it is used in stationary or industrial sealed leadacid batteries, more than 200Ah lead-acid batteries are used more, and the rated voltage of each battery is 2VDC. Generally, it is used small sealed maintenance-free lead-acid battery if the need is less than 200Ah lead-acid battery, and the rated voltage is 12VDC for each battery (Zachary, 2015).

Charge Controller

Yabo (2013) states that the charge controller can prevent battery over-charge and over-discharge automatically. Due to the cycle times of charge, discharge and the depth of discharging is the main factor to determine the usage of battery life. Therefore, a charge controller is an essential equipment. The charge controller can be used to supply power for DC device which is with solar panels. The charge controller can supply a regulated DC output and store the excess energy in a battery, and it can also prevent over or under charging by monitoring the battery voltage.

Inverter

Miller, (2001) identify the device can transform direct current into alternating current. Since solar cells and batteries are DC power supplier so that an inverter is necessary when it is an AC load. According to operating mode, the inverter can be divided into stand-alone inverters and grid inverters. As a stand-alone inverter, it is used in an independently operated solar power generation system for supplying a separate load. Grid inverters are used in network operation solar power generation systems. The inverter can be divided into square wave inverter and sine wave inverter according to the type of output waveform. The circuit of square wave inverter is simple, cost of

production is low, but the harmonic component is large. It is generally used for the system which is a few hundred watts or less and low requirements on the harmonic. However, the cost of sine wave inverter is high, but it can be applied to a variety of loads. The inverter can be connected with a charging output controller to drive AC loads. Here are some protection functions of an inverter:

1. Overload protection
2. Short circuit protection
3. Reversal protection
4. Undervoltage protection
5. Overvoltage protection
6. Overheating protection.

Solar AC and DC power distribution cabinet

According to Yabo (2013), Solar AC and DC Power Distribution Cabinet includes AC control cabinet and photovoltaic DC control cabinet. it is mainly used in those huge photovoltaic power plants. It can prevent lightning and over-current, and detect the PV single array string current, voltage, lightning protection state and short circuit state. The professionally design and the carefully choice of components can guarantee a long and stable period of the use of solar AC and DC power distribution cabinet. AC control cabinet is a device which can implement the inverter's output, detect, display and the device protection and so on. The output interface of the inverter AC distribution cabinet can provide it, the output AC circuit breaker can be configured with network (or for AC load use) directly, and the maintenance state of the PV system can not influence the security of the PV system and grid (or the load), but also protect the maintenance workers. The main function of solar AC and DC power distribution cabinet is the

switching for the backup inverter in the power plant system, to ensure the power supply system is normal, as well as the measurement of the energy
line.

The lightning protection system

Yabo (2013) states that a new power generation system in the field of energy generation, solar photovoltaic power generation system has been widely used. Because of the particularity of solar photovoltaic power generation system, such as the installed location and environment of the solar photovoltaic system, the components of the system will be caused damage by the lightning. Therefore, the protection for the systems according to the actual situation of the systems can make sure the system run safer and more efficient. The solar photovoltaic power generation equipment external lightning protection system is to prevent the thunder cause damage to solar cells directly. External lightning protection system consists of three parts: the air terminal, ground deflectors and ground network. Solar power system must have a relatively external lightning protection measures to ensure that the exposed outdoors solar panels are not directly damaged by lightning.

Yabo (2013) identified working materials in solar installation

- Tape measure
- Extension ladder
- Chalk line
- Ink marker
- Hammer
- Roofing bar
- Shingle ripper

- Utility knife
- Impact driver
- Ratchet set
- Caulk gun
- Level
- Linemen pliers
- Crimping tools
- Wire crippler
- hack saw
- Conduit bender
- Multimeter.

2.3 Review of Related Empirical Studies

Ogbuanya *et al.* (2020) assess the apprenticeship system and labour supply of electrical installation artisans in Enugu State. The paper focused on apprenticeship system and labour supply. study was carried out in Enugu State of Nigeria which involved 234 apprentices of electrical installation. A structured questionnaire was used for data collection. The instrument was face-validation by three experts and pilot tested on 15 apprentices in Anambra to determine its reliability. Cronbach Alpha reliability method was used to establish the internal consistency of the instrument and it yielded the overall reliability coefficients of 0.87. After the data collection, mean, standard deviation and t-test were used to answer the research questions and null hypotheses that guided the study. The study found that 14 modalities were needed for the admittance of apprentices, 10 attraction packages were found for facilitating enrolment into apprenticeship system, 11 motivation indices were found for apprentices in electrical installation, there was no significant difference between the mean responses of early

apprentices and late apprentices on the attraction of apprentices' enrolment into apprenticeship system, and on motivation indices and instructional modalities. The study related to the present study in the area of apprenticeship and electrical installation. Though it was carried out in Enugu State, South Estate of Nigeria.

Onoh, (2019) investigate electrical installation and maintenance skill needs of Technical college graduates for job creation and self-reliance in Enugu state. This study determines the electrical installation and maintenance skill needs of technical college graduates for job creation and self-reliance in Enugu State. The population for the study comprised of 33 graduates in rural and 64 graduates in urban cities of Enugu state. Due to manageable size of the population, there was no sampling. Two research questions were raised and answered using mean and standard deviation while hypotheses formulated were tested using t-test at .05 level of significance. The study adopted descriptive (survey) research design while data was collected using a structured questionnaire developed by the researcher. The instrument was validated by three experts; the reliability of the instrument was established using Cronbach Alpha which gave a high co-efficient result of 0.78. Some of the findings include: electrical installation and maintenance work skills like Planning the layout and installation of wiring, testing of electrical work for safety, Competence with tools, effectives use of materials, inspection of electrical installation, interpretation of wiring drawing and the likes are highly needed for job creation. The study recommends that government should fund the technical colleges so as to empower graduates for job creation and self-reliance. The study relates to the present study in the area of electrical installation skills needs, though it focused on technical college graduates.

Elias, (2014) conducted a research on the factors affecting the existence of non-formal education in Kenya with focus on Kibera slum. The study establishes the state of

learning conditions, forms and patterns of community participation in the management of NFE culture, socio-economic factors and the level and forms of participation by the learners on non-formal education in Kenya. The study adopted a survey research design in which all the 9,854 learners and 280 teachers in the non-formal education centres in Kibera slum were targeted. The study used stratified random sampling method to select 336 pupils from the three locations of Kibera slum. Purposive sampling was used to select 8 headteachers, 8 teachers, one District Education Officer, one County Education Officer 3 chiefs and 3 community members from the sampled centers. The researcher also interviewed the key informants. Data was collected both quantitatively and qualitatively using observation guides, questionnaires and interview schedules. The researcher self-administered the research instruments. Data was analysed using both descriptive statistics and content analysis. The study established that the community comprised of community members, parents, NGOs, churches and to a small extent the government. The participation by the community was in forms of building classrooms, buying of school furniture and land for establishment and learning materials. The study further established that most of the schools have classrooms and learners are provided with meals. The study recommends that school administrators should establish schools in forms and patterns of community participation in the management of NFE culture. The study is related to the present study on non-formal education but differs in study area.

Uthman (2017) conducted a study on improving the preparation of master craftsmen and teachers of the non-formal and formal apprenticeship programme. Sample of the study consisted of 487 teachers and master craftsmen. Structured interview were used as a method of data collections. Frequency percentage and mean statistic were used to analyze the data collected. Findings from the study revealed that the effectiveness and

efficiency of apprenticeship to contribute to economic and technological advancement depends largely on the techniques of training employed by the crafts masters. Government involvement in the apprenticeship programme by way of appropriate legislation and policies to regulates crafts practices. The need for training environment to replicate the working environment and the participation of vocational education experts in the structuring of the apprenticeship leaning content. The apprenticeship programme lack adequate evaluation and articulate learning content. The study recommends that the teachers should be professionals in their areas so as to have positive impact on the students in their programme of study. The study is related to the present study on non-formal and formal apprenticeship programme but differs on Solar and Satellite installation and also differs in study area.

Oduma (2015), conducted a study on improving the apprenticeship system for skill acquisition. Its study examining tools and equipment needed for effective job creation and poverty reduction: sample of the study were 38 master craftsmen and 32 technology teachers. Structured questionnaire was used as a method of data collection. The mean and standard deviation statistic were used to analyse the data collected. Findings from the study revealed that, the Federal, state and local governments should set up Apprenticeship Development Board (ADB) to coordinate apprenticeship programme in the country. Apprenticeship should be registered, time of graduation specified and trade test or examination be infused into the training and the trade test administered and coordinated by the ADB. Apprentices with poor education already practicing should be enforced to enroll in evening schools. Vocational and crafts centers including mechanic villages should be restructured under the apprenticeship board and the number of apprentices to be admitted by the crafts masters to be regulated. The study recommends that large emphasis should be placed on the

psychomotor skills in the apprenticeship training and observed the need to establish a meaningful balance within the three domains, Cognitive, psychomotor and affective domains for apprenticeship programme to be effective. The study is related to the present study on apprenticeship programme but differs in solar and satellite installations.

Uthman and Chado (2019) conducted a study on non-formal apprenticeship training programme in Nigeria: The way forward. Sample of the study was 52 technology teachers. Structured questionnaire was used as a method of data collection. Mean and standard deviation statistic were used to analyze the data collected. Finding from the study revealed that informal apprenticeship training has been left in the hands of private individuals and firms and a working cooperation should be worked out between crafts guilds and formal technical colleges. The colleges should assist to remedy the lack of theoretical content in the training by giving periodic lectures to the craftsmen. And members of the guilds should provide effective practical job experiences to the technical college students. The study recommends that guilds should be established and conducted in every technical trade by National Board for Technical Education (NBTE). It was also recommended that curriculum and evaluation models should be developed and to issue certificates of competence and practice. The study is related to the present study on apprenticeship programme but differs in solar and satellite installations also differs in study area.

Alhasan (2011), conducted a survey study on improving the apprenticeship programme to enhance technology education. Sample of the study comprised 248 master craftsmen and technology teachers. Structured questionnaire was used as a method of data collection. Percentage and mean statistic were used to analyse the data collected.

Findings from the study revealed that governments pay very little or no attention to apprenticeship programme which accounts for a large number of skilled men in the work force. Certificates issued by the crafts masters are not recognized by the government for the purpose of employment. He recommended the establishment of Apprenticeship education centre in towns where apprenticeship is largely practiced. Such centres should use existing buildings of primary schools, secondary schools, technical colleges or higher institutions. The training should best be conducted as evening programmes. All trades should have professional association. These trades organization should be registered by government and used as a focal point for the training programme. The arm of government responsible for employment labour and productivity should be a supervising ministry for training and to conduct trade test for the members. The study recommends that curriculum for the various trades should have scientific, technical trade, business and civic and may be planned on modular basis. The study is related to the present study on apprenticeship programme but differs in solar and satellite installations also differs in study area.

Adeyemi (2014) conducted a study on apprenticeship system: a panacea for sustainable technology education. The sample size of the study was 254 technology teachers and master craftsmen. Structured questionnaire was used as a method of data collection. Frequency count, percentage and mean statistic were used to analyse the data collected. Findings from the study revealed that craftsmen should be encouraged to form cooperative society which will serve as a forum for educating members, disseminating of information and assisting members financially. Government should organize training programmes for master craftsmen to expose them to some rudiments of science and develop their creativity. Proven trainers should be given recognition by accreditation of their certificates by the government. The study recommends that

government should assist tradesmen with loans to improve their crafts practices. The study is related to the present study on apprenticeship programme but differs in solar and satellite installations.

2.4 Summary of Reviewed Literature

The behavioural learning theory is a popular concept that focuses on how students learn. It states that behaviors are learned from the environment, and says that innate or inherited factors have very little influence on behavior. Behaviorism is key for educators because it impacts how students react and behave in the classroom. It suggests that teachers can directly influence how their students behave. It also helps teachers understand that a student's home environment and lifestyle can be impacting their behavior. The cognitive learning theory has been developed within the philosophical framework of rationalism. Cognitive attempt to explain learning in terms of how people think. Social Learning Theory focuses on how people learn by observing the behavior of others. Observational learning amount for most human learning. It occurs when learners watch teacher solve a problem and hear him speak. Humanist Learning is an approach to education based on the work of humanistic psychologists. In the 1970s the term "humanistic education" became less popular after conservative groups equated it with "Secular Humanism" and attacked the writings of Harold Lyon as being anti-Christian. All of these approaches seek to engage the "whole person": the intellect, feeling life, social capacities, and artistic and practical skills.

Non-formal training is various structured learning situations which do not have curriculum, syllabus, accreditation and certification associated with 'formal learning' These form the three styles of learning recognised and supported by the OECD. Many courses in relation to non- formal education have been introduced in several universities

in western and developing countries. Non-formal learning is popular on a worldwide scale in both 'western' and 'developing countries' and can be seen as a middle state between formal and informal learning. Television is used to broadcast programmes for entertainments, information (news, news, and education) A television is a telecommunication medium for transmitting and receiving moving images. Access television programme through different means such as, antenna, cables, or satellite dish.

There is need to empower electronic craftsman with skills on how to install a satellite dish. Satellite systems craftsman install, maintain and repair telecommunications equipment and satellite dishes. They install and maintain the communications links for electrical power companies, terrestrial aerials or satellite dishes for TV or telecommunications companies. Their work involves installing new systems, upgrading existing ones and repairing and realigning equipment. They use vans to transport their equipment, which may include ladders, scaffolding, personal protection equipment, wiring tools and test equipment for signal checking. The following were identified as a precautionary measures to be taken in installing television satellite dish. Most electronic technicians do not have adequate knowledge and skills required for effective installation of television satellite dishes. Training electronic technicians on the necessary steps will help to improve the quality of reception from the installed television satellite Dish. The constant production of new models of satellite dishes puts the technicians involved in the installation of the satellite dishes off balance. Crafts masters set out workshop objectives and decide how to achieve the objectives. Machines, equipment’s, tools, material resources, human resources, finance and time are adequately planned for optimum benefit. Planning is a mental activity involving setting of objectives and deciding on how to achieved objectives.

From the review of the empirical studies, it was discovered that lack of assessing worker's training needs prior to training program and lack of adequate tools / equipment and high cost of training were high among the major factors militating against craft skills training. It was gathered that most of the studies carried out on non-formal training of apprenticeship in different fields did not analyse the tasks, activities and workings materials in the non-formal training of craft man in solar and satellite systems installation in Niger State. This gap will be filled in this study. Furthermore, even though the rapid development in solar and satellite systems installation has been noted, reviewed literature indicated no investigation was carried out in analysing the tasks, activities and workings materials in the non-formal training of craft man in solar and satellite systems installation and particularly in Niger State. These gap in knowledge necessitated the present study.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

A descriptive Survey research method was adopted. This research design is dimmed appropriate for this study because it was used to collect information from all parameters that is needed to solve the research problems stated in chapter one. According to Osuala (2014), descriptive survey research studies both large and small population by selecting and studying samples chosen from the populations to discover the relative incidence, distribution, and interrelations of dependable and independable variables. In view of the above assertion the survey research enables the researcher to draw from population a sample that would be representative of the entire population and provide a basis for generalization.

3.2 Area of the Study

This research work center on solar and satellite system installation master trainers and trainee in Niger State. The reasons for choosing the state were due to the urban nature of the towns and most of the people living in the area used solar and satellite and this makes the presence of technicians high in these areas. Data collected was restricted to trainee and the master trainee which specifically deals with solar and TV satellite systems.

Niger State is situated in the north-central geopolitical zone of Nigeria with Minna as its capital city. Niger State between Longitude 6° 32’ 51.94” and Latitude 9 ° 331 and 9 ° 40 North and 6 ° 351 East. It is in the North Central Zone and occupies an area of approximately 29,484 square area in the present political zoning system. Other major towns in the State include Suleja, Bida, Mokwa, New Bussa and Kontagora see Appendix c (page 136). Established in 1976, Niger State was created out of the defunct North-Western States. It is the largest State in Nigeria with a vast land mass of 86,000km2; approximately 8.6 million hectares constituting about 9.3% of the total land

area of the country. Therefore, effort towards improving the non-formal training of craft man in solar and satellite systems installation in Niger State will have a significant impact of populace of the state.

3.3 Population of the Study

The population for the study comprises of trainees and master trainers in the six metropolitan city in Niger State. The total population of the study is eight hundred and ninety three (893) in Niger State, in which the trainees is five hundred and thirty six (536) while the master trainers is three hundred and fifty seven (357) in the six metropolitan city in Niger State (Niger State Technician Association of Nigeria, 2020).

3.4 Sample and Sampling Techniques

A simple random sampling technique was used for the study. Simple random sampling is a statistical sampling technique that involves selecting a random sample of individuals from a population in such a way that every individual has an equal chance of being selected. This technique is commonly used in research to obtain a representative sample of a larger population (Alchemer, 2017). 54 trainees and 20 master trainers in Minna, 61 trainees and 25 master trainers in Suleja, 31 trainees and 15 master trainer in Bida, 27 trainees and 13 master trainer in Mokwa, 44 trainees and 14 master trainers in Kontagora and 26 trainees and 9 master trainer in New Bussa, making a total population of 243 trainees and 99 master trainers. The total sampled size is three hundred and forty two (342) as shown in Table 3.1.

Table 3.1: Distribution of Sampled Size of Trainees and master trainers in Solar and Satellite Systems Installation

Metropolis	No. of trainees	No. of master trainers	Total
Minna	54	20	74
Suleja	61	25	86
Bida	31	15	46
Mokwa	27	13	40
Kontagora	44	14	58
New Bussa	26	9	35
Total	**243**	**99**	**342**

Source: Niger State Technician Association of Nigeria, (2020)

3.5 Instruments for Data Collection

The research instrument used in this study is a structured questionnaire, and it involve the use of a Likert scale. A Likert scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research. The questionnaire was designed to ask questions related to tasks, activities and workings materials in the non-formal training of trainers in solar and satellite systems installation. A 105-item questionnaire on statements relating to tasks, activities and workings materials in solar and satellite systems installation were prepared. The questionnaire consist of two parts or sections. “Section A” was concerned with education level and others, while “Section B” was structured questionnaire formulated based on the research questions stated in chapter one. The researcher use a rating scale of five-point interval in the instrument with 5 standing for strongly agree (SA), 4 for agree (A),3 for agree Undecided (U), 2 for Disagree (D) and 1 for Strongly Disagree (SD).

Table 3.2: Mean Rating Scale

Scale of Questionnaire	Rating
Strongly Agree (SA)	4.50 - 5.00
Agree (A)	3.50 - 4.49
Undecided (U)	2.50 - 3.49
Disagree (D)	1.50 - 2.49
Strongly Disagree (SD)	0.50 – 1.49

The questionnaire will require the respondents to indicate the most appropriate option by ticking (✓).

3.6 Validation of the Instruments

The instruments were given to Industrial and Technological Education experts from the department of Industrial Technology Education, Federal University of Technology, Minna who scrutinize them and offer suggestions. Some of the corrections are; change the trainers to master trainers, the rating from four point to five point rating scale and to differentiate between task in solar system and activities carried out by the solar system. Corrections were made based on their suggestions, the instruments were deemed to have content validity and it was therefore appropriate to used.

3.7 Reliability of the Instrument

After validation of the instruments, a pilot study was carried out in Abuja using 10 trainees and 10 master craftmen out of the study area. After administration of the instrument, the data was collected and computed. Cronbach Alpha was used to test the reliability of the instrument. Research question one which deals on the tasks in

non-formal training of trainees in Solar system installation contains nineteen (19) items have a reliability index of 0.998. Research question two which deals on the task in non-formal training of trainees in Satellite system installation contains sixteen (16) items have a reliability index of 0.999. Research question three which deals on the activities in non-formal training of trainers in solar system installation contains nineteen (19) items have a reliability index of 0.997. Research question four which deals on the task in non-formal training of trainee in Satellite system installation in Niger State contains fourteen (14) items have a reliability index of 0.996. Research question five which deals on the activities in non- formal training of trainee in satellite system installation in Niger State contains eighteen (18) items have a reliability index of 0.999. Research question six which deals on the working materials in non-formal training of trainee in Satellite system installation in Niger State contains twenty (20) items have a reliability index of 0.999. The total reliability for the 106 items of all questionnaire was also carried out using Cronbach alpha which a result of reliability index of 0.998 was generated and therefore acceptable due to Uwe (2007) who recommends that reliability index value that falls within the range of 0.68 to 0.85 is reliable while any value that falls below is not reliable. The result shows the overall reliability of the instrument, indicate that the instrument had a high reliability, the items in the questionnaire was internally consistent in measuring what is intended to be measured for the study.

3.8 Method of Data Collection

The questionnaire was administered by six research assistant each from the metropolitan area, the research was carried out within the duration of 12 weeks (3 months). The research assistant were brief on their task before embarking on the process. Permission was asked from the train master in each of the study area.

Copies of the questionnaire for every area in the study were enveloped and accompanied with letters for permission obtained from the Department of Industrial and Technology Education, School of Science and Technology Education, Federal University of Technology, Minna, Niger state.

3.9 Method of Data Analysis

Data collected for this study was computed. Mean and standard deviation was used to answer the research questions while Z-test statistics was used to test the hypotheses at 0.05 level of significance. Z-tests are commonly used in hypothesis testing, particularly in quality control, market research, and other applications where a known or hypothesized population mean is available. They are also used in comparing two means, where the sample sizes are large and the populations have normal distributions with known variances. Decision on the research questions was based on the resulting mean scores. A five point likert rating scale of strongly Agreed (SA), Agreed (A), undecided (U), disagreed (D) and strongly disagreed (SD), with SA=5 points, A=4 points, U=3 points, D=2 points, SD=1 points was used for research questions one to six. Standard deviation with a critical value of 1.96 was used to decide on the closeness of the respondents to the mean of their responses. Any item with a mean of 3.00 and above will be consider agreed while item with a mean below 3.00 will be considered disagreed. Z-test analysis was used to test the hypotheses at 0.05 level of significance. P value less than 0.05, hypothesis will be rejected while p value greater than 0.05, hypothesis will be accepted.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Research Question One

What are the tasks in non-formal training of trainees in Solar system installation in Niger State?

Analysis for research question one is presented in Table 4.1.

Table 4.1: Mean and standard deviation of respondents on tasks in non-formal training of trainees in Solar System Installation

S/N	ITEMS	$\bar{X}_1$ n_1=99	$\bar{X}_2$ n_2=243	$\bar{X}_T$ N=342	SD	Decision
1	Deciding on the best locations for solar equipment	3.00	3.29	3.15	0.56	A
2	Set up scaffolding	2.88	3.98	3.43	0.57	A
3	Planning how to route cables	2.97	3.02	3.00	0.62	A
4	Install solar panel mount	2.87	3.93	3.40	0.69	A
5	Install the solar panel	3.00	3.60	3.30	0.69	A
6	Route cables	3.03	3.63	3.33	0.68	A
7	Install solar inviter	3.94	2.70	3.32	0.63	A
8	Bond solar inverter and solar battery	3.00	3.54	3.27	0.64	A
9	Connect solar inverter to grid	3.35	2.80	3.08	0.64	A
10	Mounting of charge controller	3.60	3.00	3.30	0.51	A
11	Connect the inverter to the consumer unit	3.02	3.40	3.21	0.78	A
12	Start and test solar panels	3.04	2.15	2.60	0.78	D
13	Start solar inverter	2.39	2.72	2.56	0.63	D
14	Installing change over switch	2.62	3.65	3.14	0.68	A
15	Installation Testing	3.62	3.15	3.39	0.60	A
16	Polarity test	2.65	2.56	2.61	0.66	D
17	Continuity test	3.63	3.15	3.39	0.56	A
18	Earthing test	3.65	2.15	2.90	0.78	D
19	Follow up to ensure that the solar system is working properly	3.35	2.70	3.03	0.63	A

Source: Author's fieldwork (2021)

Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.1 shows the responses of respondents on tasks in the non-formal training of trainees in Solar system installation in Niger State. The result revealed that items 1-

11,14,15,17,19 agreed with the mean range from 3.00-3.43 while item 12,13,16 and 18 disagreed with the mean range from 2.60-2.90 on the tasks in the non-formal training of trainees in Solar system installation in Niger State based on the decision. The result also revealed that the standard deviations (SD) of all items are within the ranges from 0.51 to 0.78, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the tasks in the non-formal training of trainees in Solar system installation in Niger State. This indicated most of the respondents agreed on the tasks in the non-formal training of trainees in Solar system installation in Niger State.

4.2 Research Question Two

What are the task in non-formal training of trainees in Satellite system installation in Niger State?

Analysis of research question two is presented in Table 4.2.

Table 4.2: Mean and standard deviation of respondents in non-formal training of trainees in Satellite system installation

S/N	ITEM	$\bar{X}_1$ n_1=99	$\bar{X}_2$ n_2=243	$\bar{X}_T$ N=342	SD	Decision
1	Setting up the wall mount	2.96	3.02	3.00	0.55	A
2	Mounting on iron stand	2.98	3.03	3.01	0.57	A
3	Assembling on the dish	3.00	3.03	3.02	0.54	A
4	Pointing the dish to the satellite	2.98	3.03	3.01	0.65	A
5	Wire the dish	3.01	3.02	3.01	0.61	A
6	Protect the power cord from being pinched	3.01	3.03	3.02	0.60	A
7	Make sure that all ventilation openings are not covered	3.32	3.64	3.48	0.63	A
8	Do not install close to any source of heat or any apparatus that produce heat	2.04	2.00	2.02	0.64	D
9	Unplug all socket connections during lightning	3.04	3.35	3.20	0.64	A
10	Do not place any liquid substance on any part of the dish	3.32	3.54	3.43	0.39	A
11	Always unplug the receiver (decoder) from the AC power outlet before cleaning	3.21	3.02	3.12	0.69	A
12	Install the satellite antenna near overhead power lines or circuits	3.01	3.04	3.03	0.71	A
13	Test the system	2.98	3.03	3.02	0.72	A

Source: Author's fieldwork (2021)

Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.2 shows the responses of respondents on task in non-formal training of trainees in Satellite system installation in Niger State. The result revealed that items 1-7 and 9-13 agreed with the mean range from 3.00-3.48 while only item 8 disagreed with the mean of 2.02 on the tasks in the non-formal training of trainees in satellite system installation in Niger State based on the decision. The standard deviations (SD) of all items are within the ranges from 0.51 to 0.78, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the tasks in the non-formal training of trainees in satellite system installation in Niger State. This indicated most of the respondents agreed on the tasks in the non-formal training of trainees in satellite system installation in Niger State.

4.3 Research Question Three

What are the activities in non-formal training of trainers in solar system installation in Niger State?

Analysis of research question three is presented in Table 4.3.

Table 4.3 Mean and standard deviation of respondents on the activities in non-formal training of trainers in solar system installation

S/N	ITEMS	$\bar{X}_1$ n_1=99	$\bar{X}_2$ n_2=243	$\bar{X}_T$ N=342	SD	Decision
1	Erect Scaffolding	3.35	3.22	3.29	0.55	A
2	Ensure safety during the whole installation process	3.23	3.41	3.32	0.57	A
3	Determine where panel solar will be located	2.96	3.22	3.09	0.63	A
4	Select a very clear area for connection of the panel	3.81	3.55	3.68	0.70	A
5	Install the solar panel on the mounting structure	3.84	3.12	3.98	0.70	A
6	Identification of cables	3.70	3.13	3.92	1.06	A
7	Installation of electrical wiring	3.34	3.26	3.30	0.71	A
8	Connection of solar inverter	3.12	3.33	3.23	0.59	A
9	Install near the main panel	2.73	3.41	3.07	0.58	A
10	Connection of solar inverter to the battery	3.04	3.01	3.03	0.45	A
11	Earthing of the system	3.11	3.28	3.20	0.42	A
12	Switch the power on and test	3.05	3.41	3.23	0.55	A
13	Ground the system	2.53	3.58	3.06	0.57	A
14	Separation of load for solar system installation testing	3.26	3.00	3.13	0.63	A
15	Connection of the output to solar panel	3.81	3.05	3.43	0.70	A
16	Installation of change over	2.84	3.98	3.41	0.70	A

Source: Author's fieldwork (2021)

Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.3 shows the responses of respondents on activities in non-formal training of trainers in solar system installation in Niger State. The result revealed that all the items with the mean range from 3.03-3.98 agreed on the activities in non-formal training of

trainers in solar system installation in Niger State based on the decision. The standard deviations (SD) of all items are within the ranges from 0.42 to 1.60, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the activities in non-formal training of trainers in solar system installation in Niger State. This indicated most of the respondents agreed on the activities in non-formal training of trainers in solar system installation in Niger State.

4.4 Research Question four

What are the activities in non- formal training of trainees in satellite system installation in Niger State?

Analysis of research question four is presented in Table 4.4.

Table 4.4 Mean and standard deviation of respondents on the activities in non- formal training of trainees in satellite system installation

S/N	ITEMS	$\bar{X}_1$ n_1=99	$\bar{X}_2$ n_2=243	$\bar{X}_T$ N=342	SD	Decision
1	Select a flat spot on or around the home	3.01	2.98	3.00	0.66	A
2	Check for any obstructions blocking the dish view of the sky	3.14	3.04	3.09	0.69	A
3	Create the pilot holes using a drill but same size as the mounting bolts	3.01	3.03	3.02	0.63	A
4	Attach the antenna bracket to the low noise block (LNB) arm	3.08	3.00	3.04	0.63	A
5	Chip the antenna adjustment panel over the plate's prongs	3.06	2.99	3.03	0.69	A
6	Fir the U-shaped rod inside the adjustment panel	3.04	3.00	3.02	0.67	A
7	Bolt the antenna bracket to back of the satellite dish	3.77	3.00	3.89	0.73	A
8	Install the LNB on the end of the LNB arm	3.18	3.32	3.25	0.94	A
9	Select a satellite to connect to	3.03	3.00	3.02	0.85	A
10	Mount the dish vertically to adjust its elevation	3.04	3.00	3.02	0.80	A
11	Adjust the dish's polarization until signal is clear	3.04	3.90	3.97	0.61	A

12	Drill a hole in the roof if needed	3.91	3.05	3.98	0.64	A
13	Routing the cables	3.01	3.00	3.01	0.64	A
14	Connect an High Definition Multimedia Interface cable to the receiver and TV	3.77	3.00	3.89	0.73	A
15	Test equipment's and connections identity and correct problems	3.48	3.00	3.24	0.94	A

Source: Author's fieldwork (2021)

Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.4 shows the responses of respondents on the activities in non-formal training of trainees in satellite system installation in Niger State. The result revealed that all the items with the mean range from 3.00-3.98 agreed on the activities in non-formal training of trainees in satellite system installation in Niger State based on the decision. The standard deviations (SD) of all items are within the ranges from 0.63 to 0.94, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the activities in non- formal training of trainees in satellite system installation in Niger State. This result revealed that most of the respondents agreed on the activities in non-formal training of trainees in satellite system installation in Niger State.

4.5 Research Question Five

What are the working materials in non-formal training of trainees in Solar system installation in Niger State?

Analysis of research question five is presented in Table 4.5

Table 4.5 Mean and standard deviation of respondents on the working materials in non-formal training of trainees in Solar system installation

S/N	ITEMS	X_1 n_2=99	X_2 n_2=243	X_T N=342	SD	Decision
1	Tape measure	3.05	3.14	3.10	0.66	A
2	Extension ladder	3.04	3.07	3.06	0.69	A
3	Chalk line	3.01	3.18	3.10	0.63	A
4	Ink marker	3.01	3.06	3.04	0.63	A
5	Hammer	3.06	3.04	3.05	0.69	A
6	Roofing bar	2.04	2.77	2.41	0.67	D
7	Shingle ripper	2.77	2.18	2.48	0.73	D
8	Utility knife	2.18	2.23	2.21	0.94	D
9	Impact driver	2.23	2.77	2.50	0.85	D
10	Ratchet set	2.77	3.15	2.96	0.73	A
11	Caulk gun	3.15	3.14	3.15	0.66	A
12	Level	3.14	3.07	3.11	0.69	A
13	Linemen pliers	3.07	3.18	3.13	0.63	A
14	Crimping tools	3.18	3.06	3.12	0.63	A
15	Wire crippler	3.06	2.77	2.92	0.69	D
16	Screw drivers	2.77	2.18	2.48	0.73	D
17	hack saw	2.18	2.23	2.21	0.94	D
18	Conduit bender	3.23	3.07	3.15	0.85	A
19	Multimeter	3.07	3.15	3.11	0.63	A

Source: Author's fieldwork (2021)

Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.5 shows the responses of respondents on the working materials in non-formal training of trainees in Solar system installation in Niger State. The result revealed that items 1-5, 10-14 and 18-19 with the mean range from 3.04-3.15 agreed while item 6-9

and 15-17 with the mean range of 2.21-2.92 disagreed on the working materials in non-formal training of trainees in Solar system installation in Niger State based on the decision. The standard deviations (SD) of all items are within the ranges from 0.63 to 0.94, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the working materials in non-formal training of trainees in Solar system installation in Niger State. This indicated most of the respondents agreed on the working materials in non-formal training of trainees in Solar system installation in Niger State.

4.6 Research Question Six

What are the working materials in non-formal training of trainees in Satellite system installation in Niger State?

Analysis of research question six is presented in Table 4.6.

Table 4.6 Mean and standard deviation of respondents on the working materials in non-formal training of trainees in Satellite system installation

S/N	ITEMS	X_1 n_2=99	X_2 n_2=243	X_T N=342	SD	Decision
1	Satellite	3.18	3.08	3.13	0.63	A
2	Satellite mount	3.96	3.01	3.49	0.69	A
3	Satellite LNB	3.04	3.01	3.03	0.67	A
4	Compass	3.11	3.06	3.09	0.73	A
5	Wrench	3.06	2.96	3.01	0.94	A
6	Hammer	3.01	2.77	2.89	0.85	D
7	Chisel	3.06	2.18	2.62	0.73	D
8	Lag bolts	2.14	2.23	2.19	0.66	D
9	Washes	2.07	2.28	2.18	0.69	D
10	Locking nuts	2.08	3.05	2.57	0.63	A
11	RG6 coaxial cable	2.23	2.18	2.21	0.63	D
12	High-Definition Multimedia Interface (HDI) cable	3.06	3.01	3.04	0.69	A
13	Drilling machine	3.11	3.18	3.15	0.63	A

14	Marker	3.06	3.00	3.03	0.69	A
15	4 stainless steel fixing	3.01	3.5	3.26	0.67	A
16	Hexagonal screws	2.77	2.17	2.47	0.73	D
17	'F' connector x 2.	2.18	2.22	2.20	0.94	D
18	Digital TV receiver	2.23	2.03	2.13	0.85	D
19	Compression tool	2.17	2.32	2.25	0.73	D
20	Pocket cable tester	3.11	3.05	3.08	0.66	A

Source: Author's fieldwork (2021)
Key: $\bar{X}_1$ = Mean response of Trainers, $\bar{X}_2$ = Mean response of Trainees, n_1 = No of Trainer, n_2 = No of trainees, $\bar{X}_T$ = Average mean response

Table 4.6 shows the responses of respondents on the working materials in non-formal training of trainees in Satellite system installation in Niger State. The result revealed that items 1-5, 10, 12-15 and 20 with the mean range from 3.01 - 3.49 agreed while item 6 - 9, 11, and 16-19 with the mean range from 2.19-2.89 disagreed on the working materials in non-formal training of trainees in Satellite system installation in Niger State based on the decision. The standard deviation values for the 20 items ranges from 0.63 - 0.94, each of these values was less than 1.96 which indicated that respondents were not too far from the mean and from one another in their responses on the working

materials in non-formal training of trainees in Satellite system installation in Niger State. This result revealed that most of the respondents agreed on the working materials in non-formal training of trainees in Satellite system installation in Niger State.

4.7 Hypothesis One

There is no significant difference between the mean response of master trainers and Trainees as regard the tasks in non- formal training of solar system installation in Niger State

Analysis of hypothesis one is presented in Table 4.7.

Table 4.7: Z-test analysis of tasks in non-formal training of solar system installation in Niger State

Variables	N	Mean	SD	Z	p-value
Trainers	99	3.55	0.70		
				0.77	0.52
Trainees	243	3.39	0.73		

Table 4.7 shows the comparison of z-test of the mean rating of the responses of the respondents as regard the tasks in non- formal training of solar system installation. The results revealed that the mean and standard deviation of trainer are 3.55 and 0.70 while the mean and standard deviation of trainee are 3.39 and 0.73 respectively. Since the p-value (0.52) is greater than 0.05, the result revealed that there is no significant difference between the mean responses of trainers and trainee on tasks in non- formal training of solar system installation. Therefore, the null hypothesis was accepted.

4.8 Hypothesis Two

There is no significant difference between the mean responses of master trainers and Trainees as regards the task in non- formal training of satellite system installation in Niger State.

Analysis of hypothesis two is presented in Table 4.8.

Table 4.8: Z-test analysis of task in non- formal training of satellite system installation in Niger State

Variables	N	Mean	SD	Z	p-value
Trainers	99	3.71	0.75	0.83	0.69
Trainees	243	3.49	0.68		

Table 4.8 shows the comparison of z-test of the mean rating of the responses of the respondents as regards to the task in non- formal training of satellite system installation in Niger State. The results revealed that the mean and standard deviation of trainer are 3.71 and 0.75 while the mean and standard deviation of trainee are 3.49 and 0.68 respectively. Since the p-value (0.69) is greater than 0.05, hence there was no significant difference between the mean response of trainer and trainee regarding the task in non- formal training of satellite system installation in Niger State. Therefore, the null hypothesis was accepted.

4.9 Hypothesis Three

There is no significant difference between the mean response of master trainers and trainees as regards the activities carried out in non- formal training of solar system installation in Niger State.

Analysis of hypothesis three is presented in Table 4.9.

Table 4.9: Z-test analysis of the activities carried out in non- formal training of solar system installation in Niger State

Variables	N	Mean	SD	Z	p-value
Trainers	99	3.53	0.68	0.24	0.61
Trainees	243	3.23	0.54		

Table 4.9 shows the comparison of z-test of the mean rating of the responses of trainer and trainee as regards to the activities carried out in non- formal training of solar system installation. The results revealed that the mean and standard deviation of trainer are 3.53 and 0.68 while the mean and standard of trainee are 3.23 and 0.54 respectively. Since p-

value (0.61) is greater than a value (0.05), the result shows that there was no significant difference between the mean response of trainer and trainee regarding the activities carried out in non-formal training of solar system installation. Therefore, the null hypothesis was accepted.

4.10 Hypothesis Four

There is no significant difference between the mean response of master trainers and trainees as regards the activities carried out in non-formal training of satellite system installation in Niger State.

Analysis of hypothesis four is presented in Table 4.10.

Table 10: Z-test analysis of the activities carried out in non- formal training of satellite system installation in Niger State

Variables	N	Mean	SD	Z	p-value
Trainers	99	3.21	0.67	0.43	0.74
Trainees	243	3.41	0.46		

Table 4.10 shows the comparison of z-test of the mean rating of the responses of trainer and trainee as regards the activities carried out in non- formal training of satellite system installation in Niger State. The results revealed that the mean and standard deviation of trainer are 3.21 and 0.67 while the mean and standard of trainee are 3.41 and 0.46 respectively. Since p-value (0.74) is greater than alpha value (0.05), on this basis, there was no significant difference between the mean response of trainer and trainee regarding the activities carried out in non- formal training of satellite system installation in Niger State. Therefore, the null hypothesis was accepted.

4.11 Hypothesis five

There is no significant difference between the mean response of master trainers and Trainees as regards the materials used in non- formal training of solar system installation in Niger State.

Analysis of hypothesis five is presented in Table 4.11.

Table 4.11: Z-test analysis of working materials used in non- formal training of solar system installation in Niger State

Variables	**N**	**Mean**	**SD**	**Z**	**p-value**
Trainers	99	3.27	0.46	0.81	0.31
Trainees	243	3.64	0.52		

Table 4.11 shows the comparison of z-test of the mean rating of the responses of trainer and trainee as regards to the working materials used in non- formal training of solar system installation in Niger State. The results revealed that the mean and standard deviation of trainer are 3.27 and 0.46 while the mean and standard of trainee are 3.64 and 0.52 respectively. Since p-value (0.31) is greater than a value (0.05), on this basis, the result shows there was no significant difference between the mean responses of trainer and trainee regarding the working materials used in non- formal training of solar system installation in Niger State. Therefore, the null hypothesis was accepted.

4.12 Hypothesis Six

There is no significant difference between the mean response of master trainers and trainees as regards the materials used in non- formal training of Satellite system installation in Niger State.

Analysis of hypothesis six is presented in Table 4.12

Table 4.12: Z-test analysis of working materials used in non- formal training of satellite system installation in Niger State

Variables	**N**	**Mean**	**SD**	**Z**	**p-value**
Trainers	99	3.62	0.34	0.41	0.32

Trainees	243	3.48	0.27

Table 4.12 shows the comparison of z-test of the mean rating of the responses of trainer and trainee as regards to the working materials used in non- formal training of satellite system installation in Niger State. The results revealed that the mean and standard deviation of trainer are 3.62 and 0.34 while the mean and standard of trainee are 3.48 and 0.27 respectively. Since p-value (0.32) is greater than alpha value (0.05), on this basis, this shows that there is no significant difference between the mean responses of trainer and trainee regarding the working materials used in non- formal training of satellite system installation in Niger State. Therefore, the null hypothesis was accepted.

4.13 Findings of the Study

The following findings emerged from the study based on the analyzed data:

1. Tasks in non-formal training of trainees in Solar system installation in Niger State among others are; deciding on the best locations for solar equipment, setting up scaffolding , planning how to route cables, Installing solar panel mount and installing the solar panel
2. The task in non-formal training of trainees in Satellite system installation in Niger State among others are; setting up the wall mount, mounting on iron stand, assembling on the dish, pointing the dish to the satellite and wire the dish
3. The activities in non-formal training of trainees in solar system installation in Niger State are; to erect scaffolding, ensuring safety during the whole installation process determine where solar panel will be located and to select a very clear area for connection of the panel

4. The activities in non-formal training of trainees in satellite system installation in Niger State are; to select a flat spot on or around the home and check for any obstructions blocking the dish view of the sky
5. The working materials in non-formal training of trainees in Solar system installation in Niger State among others are; tape measure, extension ladder, chalk line, ink marker and hammer
6. The working materials in non-formal training of trainees in Satellite system installation in Niger State among others are; satellite, satellite mount, satellite LNB, Compass and wrench
7. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees on tasks in non- formal training of solar system installation in Niger State.
8. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees on tasks in non- formal training of satellite system installation in Niger State.
9. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees regarding working materials on non-formal training of solar system installation
10. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees regarding the activities carried out in non- formal training of satellite system installation in Niger State
11. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees regarding the activities carried out in non- formal training of satellite system installation in Niger State.

12. z-test analysis revealed that there was no significant difference between the mean responses of trainers and trainees regarding the activities carried out in non- formal training of satellite system installation in Niger State.

4.14 Discussion of Findings

The findings on research question one revealed that tasks in non-formal training of trainees in Solar system installation in Niger State among others are deciding on the best locations for solar equipment, setting up scaffolding, planning how to route cables, installing solar panel mount, install solar inviter, bond solar inverter and solar battery connect solar inverter to grid, mounting of charge controller and installing the solar panel. This is inline with Zhao, (2012) who states that craftsmen task in solar system installation involve assemble solar modules, panels, or support structures, as specified. Install active solar systems, including solar collectors, concentrators, pumps, or fans. Apply weather sealing to array, building, or support mechanisms. Install photovoltaic (PV) systems in accordance with codes and standards using drawings, schematics, and instructions. Perform routine photovoltaic (PV) system maintenance on modules, arrays, batteries, power conditioning equipment, safety systems, structural systems, weather sealing, or balance of systems equipment. It also includes: Activate photovoltaic (PV) systems to verify system functionality and conformity to performance expectations. Check electrical installation for proper wiring, polarity, grounding, or integrity of terminations. Determine appropriate sizes, ratings, and locations for all system overcurrent devices, disconnect devices, grounding equipment, and surge suppression equipment. Determine connection interfaces for additional subpanels or for connecting photovoltaic (PV) systems with utility services or other power generation sources. Determine photovoltaic (PV) system designs or configurations based on factors such as customer needs, expectations, and site conditions.

The findings on hypothesis one revealed that there was no significant difference between the mean responses of trainers and trainees on tasks in non- formal training of solar system installation in Niger State. The findings on hypothesis one which says that there is no significant difference between the mean response of master trainer and trainee as regard the tasks in non-formal training of solar system installation in Niger State revealed that there was no significant difference between the mean response of master trainer and trainee as regard the tasks in non- formal training of solar system installation in Niger State. This implies that the tasks in non-formal training of solar system installation in Niger State does not have influence on the master trainer and trainee. This findings is in support of Ogbuanya *et al.* (2020) assessed the apprenticeship system and labour supply of electrical installation artisans in Enugu State, it revealed that there was no significant difference between the mean responses of early apprentices and late apprentices on the attraction of apprentices' enrolment into apprenticeship system, and on motivation indices and instructional modalities. The study related to the present study in the area of apprenticeship and electrical installation. Though it was carried out in Enugu State, South Estate of Nigeria.

The findings on research question two revealed that the task in non-formal training of trainees in Satellite system installation in Niger State among them are setting up the wall mount, mounting on iron stand, assembling on the dish, pointing the dish to the satellite, make sure that all ventilation openings are not covered, unplug all socket connections during lightning, do not place any liquid substance on any part of the dish and wire the dish. The findings of the study corroborate with Titlow, (2012) state that every standard size dish enables simultaneous reception from multiple different satellite positions without re-positioning the dish, just by adding additional LNB or using Special Duo LNB or Triple or Four Feed Monoblock LNB. However some designs

much more effectively optimize simultaneous reception from multiple different satellite positions without re-positioning the dish. The vertical axis operates as an off-axis concave parabolic concave hyperbolic Cassegrain reflector, while the horizontal axis operates as a concave convex Cassegrain. The spot from the main dish wanders across the secondary, which corrects astigmatism by its varying curvature. The elliptic aperture of the primary is designed to fit the deformed illumination by the horns. Due to double spill-over, this makes more sense for a large dish.

The findings on hypothesis two revealed that there was no significant difference between the mean responses of trainer and trainee as regards the task in non-formal training of satellite system installation in Niger State. The findings on hypothesis two is inline with Onoh, (2019), he investigated electrical installation and maintenance skill needs of Technical college graduates for job creation and self-reliance in Enugu state. Some of the findings include: electrical installation and maintenance work skills like Planing the layout and installation of wiring, testing of electrical work for safety, Competence with tools, effectives use of materials, inspection of electrical installation, interpretation of wiring drawing and the likes are highly needed for job creation.

The findings on research question three also revealed that the activities in non-formal training of trainers in solar system installation in Niger State are to erect scaffolding, identification of cables, installation of electrical wiring, connection of solar inverter, install near the main panel, connection of solar inverter to the battery, earthing of the system, ensuring safety during the whole installation process determine where panel solar will be located and to select a very clear area for connection of the panel. The findings of the study also agreed with Bell, (2014) that identify the main function of

solar AC and DC power distribution cabinet is the switching for the backup inverter in the power plant system, to ensure the power supply system is normal, as well as the measurement of the energy line. Solar photovoltaic power plants are made by the solar cells square which can transform the solar radiation energy to electrical energy. According to the operation mode, solar photovoltaic power plant can be divided into independent solar power stations and grid-connected solar photovoltaic power plant. Independent solar power station does not couple with the public grid. It mainly uses in those places where are no electricity and some special places. Such as remote and isolated rural and pastoral areas, islands, plateaus and desert for those farmers and fishermen, to ensure that they can watch TV, lighting, listening to the radio and other basic living electricity. It also can be used for communications relay station, coastal and inland buoy, cathodic protection of pipelines, meteorological station, road class and road border posts and other special premises. Independent system consists of solar cell matrix, the system controller, battery, DC / AC inverter and other components.

The findings on hypothesis three revealed that there was no significant difference between the mean response of trainer and trainee regarding the activities carried out in non- formal training of solar system installation in Niger State. The findings on hypothesis three is in support of Alhasan (2011), conducted a survey study on improving the apprenticeship programme to enhance technology education. Findings from the study revealed that governments pay very little or no attention to apprenticeship programme which accounts for a large number of skilled men in the work force. Certificates issued by the crafts masters are not recognized by the government for the purpose of employment.

The findings on research question four also revealed that the activities in non- formal training of trainees in satellite system installation in Niger State are to select a flat spot on or around the home, Create the pilot holes using a drill but same size as the mounting bolts, attach the antenna bracket to the low noise block (LNB) arm, chip the antenna adjustment panel over the plate's prongs and check for any obstructions blocking the dish view of the sky. This also corroborate with Nick, (2014) state that activities of master trainer in satellite systems installation includes repair and replace equipment, communication networks and satellite systems. Work ranges from fitting a new system in a business, to repairing equipment after storm damage on a domestic property. The activities also is to carry out site surveys to prepare plans for jobs and quotes, plan cabling networks, install and fix aerials or satellite dishes to wall mounts, connect signal outlet sockets, check signal strength levels and test equipment and fix faults.

The findings on hypothesis four revealed that there was no significant difference between the mean response of master trainer and Trainee as regards the activities carried out in non-formal training of satellite system installation in Niger State. The findings of the study is inline with Uthman (2017) conducted a study on improving the preparation of master craftsmen and teachers of the non-formal and formal apprenticeship programme. Findings from the study revealed that the effectiveness and efficiency of apprenticeship to contribute to economic and technological advancement depends largely on the techniques of training employed by the crafts masters. Government involvement in the apprenticeship programme by way of appropriate legislation and policies to regulates crafts practices. The need for training environment to replicate the working environment and the participation of vocational education experts in the structuring of the apprenticeship leaning content.

The findings on research question five also revealed that the working materials in non-formal training of trainees in Solar system installation in Niger State among them are tape measure, extension ladder, chalk line, ink marker and hammer. This is inline with Yabo (2013), Solar panels are installed on roofs. Solar panels can be installed easily by the home owner or one can also call a professional to install the solar panels. The materials that are required for solar panel installation are: roof anchors that are made up of aluminium or steel; a unique key lock system between the roof anchors and the mounting frame; mounting frame; bolts are used to screw it tightly; you will also need a clamp to fix the solar panels to the mounting frame; solar panels. First of all you have to find the suitable place where you would like to install the solar panels. The position of the roof anchors has to be properly measured and marked. Once you fix the roof anchors to the roof, you will attach the mounting frame. After this you will install the photovoltaic panels in rows or columns. It depends upon the availability of the roof space. The panels need to be wired to each other properly to get the complete electrical system.

The findings on hypothesis five revealed that there was no significant difference between the mean response of master trainer and Trainee as regards the materials used in non- formal training of solar system installation in Niger State. The findings is inline with Oduma (2015), conducted a study on improving the apprenticeship system for skill acquisition. Its study examining tools and equipment needed for effective job creation and poverty reduction. Findings from the study revealed that, the federal, state and local governments should set up Apprenticeship Development Board (ADB) to coordinate apprenticeship programme in the country. Apprentices with poor education already practicing should be enforced to enroll in evening schools. Vocational and crafts centers

including mechanic villages should be restructured under the apprenticeship board and the number of apprentices to be admitted by the crafts masters to be regulated.

The findings on research question six also revealed that the working materials in non-formal training of trainees in Satellite system installation in Niger State among them are satellite, satellite mount, satellite LNB, compass, wrench, hammer, chisel, lag bolts, washes and wrench. This finding agree with Miller (2001) that the working materials of satellite system includes: Pliers: These are hand tools used principally for holding materials, objects and are some cases for cutting wire and cables. These are: side-cutting pliers, long-nosed pliers and diagonal-cutting nippers. Screw drivers: It consists of hardened and tempered steel or alloy steel blade with a handle of wood or molded insulating material types of screw drivers are: flared tip, parallel-side tip, stub and Phillips. Hammers: This is used to deliver blows to pins, nails and cold chisels. A hammer consists of steel head mounted on a wood handle. Types are claw, London, Warrington and ball pen hammers. Knives: These are used for stripping cables and coil. Types are: pocket, cobblers and trimming knives. Hack saw: It is a hand tool used for cutting metal. Consists of a blade and a handle. Cold chisels: These are made from a high quality steel throughout and has a special hardened tempered cutting edge used for cutting metals and wood, types includes, flat, chaser and bolster chisels. Tape rule: This is used for measuring length, width and breath of an object or material. There are wooden and steel types. Hand drill: It is used with a bit fitted in the chuck, used for drilling holes in metals.

The findings on hypothesis six revealed that there was no significant difference between the mean response of Trainer and Trainee as regards the materials used in non- formal training of Satellite system installation in Niger State. The findings corroborate with

Uthman and Chado (2019), they conducted a study on non-formal apprenticeship training programme in Nigeria: The way forward. Finding from the study revealed that informal apprenticeship training has been left in the hands of private individuals and firms and a working cooperation should be worked out between crafts guilds and formal technical colleges. The colleges should assist to remedy the lack of theoretical content in the training by giving periodic lectures to the craftsmen. The members of the guilds should provide effective practical job experiences to the technical college students. Guilds should be established and conducted in every technical trade by National Board for Technical Education (NBTE).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study assessed the tasks, activities and workings materials in the non-formal training of craft man in solar and satellite systems installation in Niger State. Among the specific objectives of the study is to assess the task in non- formal training of trainees in solar system installation in Niger State, the task in non-formal training of trainees in satellite system installation in Niger State and the activities in non-formal training of trainees in solar system installation in Niger State. The findings of the study revealed that there was no significant difference of master trainers and trainees on tasks in non-formal training of solar system installation in Niger State, there was no significant difference between the trainer and trainee as regards the task in non-formal training of satellite system installation in Niger State, there was no significant difference between the trainer and trainee regarding the activities carried out in non- formal training of solar system installation in Niger State and there was no significant difference between the master trainer and trainee as regards the activities carried out in non-formal training of satellite system installation in Niger State. The study concluded that the need for training of trainee in the working environment and the participation of master trainers in the structuring of the apprenticeship learning is to learn and comprehend easily. The trainee with poor skills and inadequate material should be empowered with the required skills and tools needed for training. Vocational and crafts centers should be restructured and the number of trainee to be admitted by the crafts masters to be regulated.

5.2 Recommendations

Based on the findings of the study the following recommendations were made;

1. There should be regular training and retraining of master trainers and trainees of solar and satellite system installations. This could take the form of workshops, seminars, shoot time training programmes, both within and outside the country in order for the trade to make an appreciable in terms of technology development.
2. Retraining of supervisors should be provided by the establishment for optimum technicality and practical in the area of latest working materials for easier installation.
3. Performance evaluation of master trainers and trainees in solar and satellite system installation should regularly be carried out to checkmate their strength and weakness. This can be achieved through effective supervision and regular inspection on completed work order by the work based supervisor.
4. Work based supervisors should organize in-house training on area where master trainers and trainees performance rate is low for improve productivity.

5.3 Contribution to Knowledge

The study contribute to knowledge by establishing basis as regard to task in non- formal training of trainees in solar system installation. The study also contributed to task in non-formal training of trainees in satellite system installation. The study contribute to the activities in non-formal training of trainees in solar and satellite system installation in Niger State. The study established the working materials in non-formal training of trainees in Solar and satellite system installation.

5.4 Suggestions for Further Studies

From the findings of the study the following are suggested for further Studies

1. Assessment of job skills need among electrical technologist and engineers in National Agency for Engineering Infrastructure institutes.
2. Electrical Installation and Engineering practices for improving productivity in Nigerian Polytechnics
3. Re-training needs of electrical engineering technicians for enhancing performance in Nigerian Polytechnics.

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APPENDIX A

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

ASSESSMENT OF TASKS, ACTIVITIES AND WORKING MATERIALS USED IN NON-FORMAL TRAINING OF SOLAR AND SATELLITE SYSTEMS INSTALLATION IN NIGER STATE.

A research work is proposed to be done on the above topic in pursuit of M.Tech Degree in Industrial and Technology Education. The aim of this survey is to obtain useful information needed for the success of the research. All information obtained would be treated with utmost confidentiality and respect for this research work only.

Joseph Ibrahim Joshua Kuta

MTech/SSTE/2018/8765

SECTION A: GENERAL INFORMATION (SOLAR SYSTEM INSTALLATION)

Please read the following statements and check (√) appropriately.

i. Status: Respondents (a) Master Trainer (b) Trainee

ii. Type of workshop. (a) Open Space (b Bricks constructed shop (c) Wooden constructed shop

SECTION B: TRAINING CRAFT APPRENTICES

Strongly Agree	-	SA
Agree	-	A
Undecided	-	U
Disagree	-	D
Strongly Disagree	-	SD

Section 1: What are the tasks in non- formal training of trainees in Solar system installation?

Task in Solar

	Task involved in Solar system installation include:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Deciding on the best locations for solar equipment					
2	Set up scaffolding					
3	Planning how to route cables					
4	Install solar panel mount					
5	Install the solar panel					
6	Route cables					
7	Install solar inviter					
8	Bond solar inverter and solar battery					
9	Connect solar inverter to grid					
10	Mounting of charge controller					
11	Connect the inverter to the consumer unit					
12	Start and test solar panels					
13	Start solar inverter					
14	Installing change over switch					
15	Installation Testing					
16	Polarity test					
17	Continuity test					
18	Earthing test					
19	Follow up to ensure that the solar system is working properly					

Section 2: What is the task in non-formal training of trainees in Satellite system installation?

Activities in Solar

	Activities involved in Solar System installation include:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Erect Scaffolding					
2	Ensure safety during the whole installation process					
3	Determine where panel solar will be located					
4	Select a very clear area for connection of the panel					

5	Install the solar panel on the mounting structure					
6	Identification of cables					
7	Installation of electrical wiring					
8	Connection of solar inverter					
9	Install near the main panel					
10	Connection of solar inverter to the battery					
11	Earthing of the system					
	Installation testing					
	Polarity test					
	Continuity test					
	Earthing test					
12	Switch the power on and test					
13	Ground the system					
14	Separation of load for solar system installation testing					
15	Connection of the output to solar panel					
16	Installation of change over					

Section 3: What are the activities in non-formal training of trainers in solar system installation?

Working materials in Solar

	Working materials involved in Solar System installation include:	**Strongly Agree**	**Agree**	**Undecided**	**Disagree**	**Strongly Disagree**
1	Tape measure					
2	Extension ladder					
3	Chalk line					
4	Ink marker					
5	Hammer					
6	Roofing bar					
7	Shingle ripper					
8	Utility knife					
9	Impact driver					

10	Ratchet set					
11	Caulk gun					
12	Level					
13	Linemen pliers					
14	Crimping tools					
15	Wire crippler					
16	Screw drivers					
17	hack saw					
18	Conduit bender					
19	Multimeter.					

ASSESSMENT OF TASKS, ACTIVITIES AND WORKING MATERIALS USED IN NON-FORMAL TRAINING OF SOLAR AND SATELLITE SYSTEMS INSTALLATION IN NIGER STATE.

A research work is proposed to be done on the above topic in pursuit of MTech Degree in Industrial and Technology Education. The aim of this survey is to obtain useful information needed for the success of the research. All information obtained would be treated with utmost confidentiality and respect for this research work only.

Joseph Ibrahim Joshua Kuta

M.Tech/SSTE/2018/8765

SECTION A: GENERAL INFORMATION (SATELLITE SYSTEM INSTALLATION)

Please read the following statements and check (√) appropriately.

iii. Status: Respondents (a) Master Trainer (b) Trainee

iv. Type of workshop. (a) Open Space (b Bricks constructed shop (c) Wooden constructed shop

SECTION B: TRAINING CRAFT APPRENTICES

Strongly Agree	-	SA
Agree	-	A
Disagree	-	D
Strongly Disagree	-	SD

Section 1: What are the task in non-formal training of trainee in Satellite system installation in Niger State?

	Task involved in satellite dish installation include:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Setting up the wall mount					
2	Mounting on iron stand					
3	Assembling the dish					
4	Pointing the dish to the satellite					
5	Wire the dish					
6	Protect the power cord from being pinched					
7	Make sure that all ventilation openings are not covered					
8	Do not install close to any source of heat or any apparatus that produce heat.					
9	Unplug all socket connections during lightning					
10	Do not place any liquid substance on any part of the dish					
11	Always unplug the receiver (decoder) from the AC power outlet before cleaning.					
13	install the satellite antenna near overhead power lines or circuits.					
14	Test the system					

Section 2: What are the activities in non- formal training of trainee in satellite system installation in Niger State?

	Activities involved in satellite dish installation include:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Select a flat spot on or around the home					
2	Check for any obstructions blocking the dish view of the sky					
3	Create the pilot holes using a drill but the same size as the mounting bolts					
4	Attach the antenna bracket to the low noise block (LNB) arm.					

5	Chip the antenna adjustment panel over the plate's prongs					
6	Fit the U-shaped rod inside the adjustment panel.					
7	Bolt the antenna bracket to back of the satellite dish					
8	Install the LNB on the end of the LNB arm					
9	Select a satellite to connect to					
10	Mount the dish vertically to adjust its elevation					
11	Adjust the dish's polarization untill signal is clear					
12	Drill a hole in the roof if needed					
13	Routing the cables					
14	Connect an High Definition Multimedia Interface cable to the receiver and TV					
15	Test equipment's and connections identity and correct problems					
16	Display the point dish screen					
17	Exist the installation summary screen					
18	Display the point dish signal screen					

Section 3: What are the working materials in non-formal training of trainee in Satellite system installation in Niger State?

	Working materials involved in satellite dish installation include:	**Strongly Agree**	**Agree**	**Undecided**	**Disagree**	**Strongly Disagree**
1	Satellite.					
2	Satellite mount.					
3	Satellite LNB.					
4	Compass.					
5	Wrench.					
6	Hammer.					
7	Chisel					
8	Lag bolts.					
9	Washes.					
10	Locking nut.					
11	RG6 coaxial cable.					
12	High Definition Multimedia Interface (HDMI) cable.					
13	Drilling machine					
14	Marker.					
15	4 stainless steel fixing.					
16	Hexagonal screws					
17	'F' connector x 2.					
18	Digital TV receiver					
19	Compression tool.					
20	Pocket cable tester.					

APPENDIX B

SPSS Cronbach's Alpha Reliability Statistical Test Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.998	.974	106

APPENDIX C

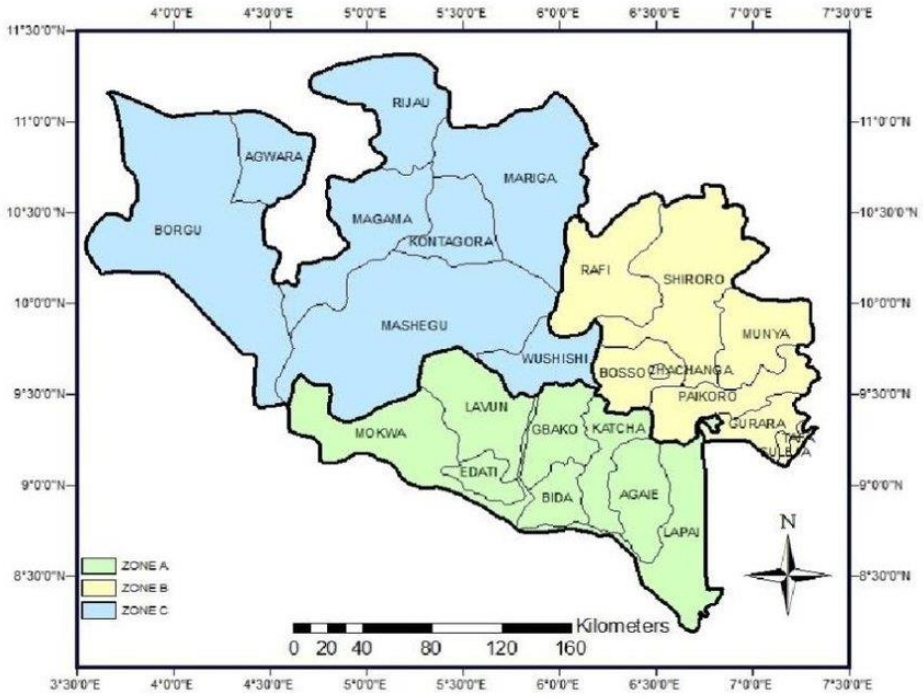

Figure 3.1: Map of the study area
Source: Niger State Geographic System Information (2019)