ASSESSING JOB SATISFACTION AND THE NEEDED COMPETENCY IN THE IMPROVEMENT OF ROADSIDE ARC WELDERS IN SULEJA TOWN, NIGER STATE

BY

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CERTIFICATION

I, Suleiman Haruna, Matric No. 2007/1/27571BT an undergraduate student of the Industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other university.

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APPROVAL PAGE

This project has been read and approved as meeting the requirement for the award of B. Tech. degree in Industrial and Technology Education of the department of Industrial and Technology Education, School of Science and Science Education, Federal university of technology, Minna.

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Supervisor Sign - Date

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DEDICATION

This research work is dedicated to Allahu Subhannahu Watta'ala (SAW) and my parents Alhaji Suleiman L. Mohammed and Hajia Aishat Suleiman.

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Abstract

The project is designed to assess the job satisfaction and the needed competency in the improvement of the road side arc welders in Suleja Town, Niger State. Three research questions and 2 null hypotheses were formulated to guide the study. A 46 items questionnaire was developed and used to collect data from the respondents consisting of 10 Arc Welders and 20 costumers selected from Suleja Town, Niger State. Data collected was analysed using mean, standard deviation and t-test statistic. The null hypotheses was tested at 0.05 level of significance. The findings revealed that the Roadside Arc Welders have the needed competency to identify material resources required to satisfy job specifications and determines the correct sizes of materials in accordance with job specifications and can also identify and monitors work area hazards. Based on the findings, it was recommended thatDue to automation of modern technology, training and retraining of the arc welders and craft men on how to improve their practical skills should be made mandatory and also recommended that Seminars and Workshops should also be organized by Governmental and non-governmental agencies for the arc welders and apprentice on potential hazard identification.

CHAPTER I

INTRODUCTION

Background of the study

Technology is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, methods of organization, in order to solve a problem.(Wikipedia2012). The term can either be applied generally or to specific areas: examples which include information technology, medical technology, and construction technology. The human species use of technology began with the conversion of natural resources into simple tools. The prehistoric discovery of the ability to control fire increased the available sources of food and the invention of wheel helped humans in travelling in and controlling their environment and also the invention of telephone and the internet have lessened the physical barriers to communication and allowed human to interact on a global scale. The rise in technology has led to the construction of skyscrapers, airplanes, ships, and computers etc. which have improved the standard of living of everyone on earth.

The buildings, airplanes, ships etc. are constructed from various materials ranging from wood, glass, fiber, metal etc. but metals play a great role in construction, so metal will be the focus of this study. To construct with this material (metal), there is the need of joining them to acquire the desired shape, for example in construction of an overhead tank, there will be a great need for joining of metal, which is known as welding.

Welding can be define as “a fabrication process that join materials, usually metals” this is by melting the part of the materials to be joined and adding some additional molten material, when the material cools, it forms a strong bond or joint. (Cary, Howard & Scott 2005).

Many people have chosen careers in welding or have used welding as an occupation to earn a living, some have secured jobs in various firms and while some work in independent workshops. As such, there are various types of welding, some popular ones includes the following: arc welding, gas welding, friction welding, fusion welding, forge welding, resistance welding, etc. But for the purpose of this study, arc welding will be focus upon.

Arc welding is the most extensively employed method of joining the components of metallic parts. Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at a welding point. (Weman 2003).

Welding is a skill that is acquired either formally or informally, and people go into it as an occupation to earn a living, but for the purpose of this study we will base on those who acquire the arc welding skill informally, those people who acquire this skill informally are referred to as road side arc welders. These people acquire this skill by means of apprenticeship. Apprenticeship is a system of training a new generation of practitioners of a structured competency based set of skills. (Paul 2001).

Sometimes these apprentice have secondary school or technical college background to have basic scientific knowledge of metals, while sometimes they have no educational background, they stay under the master craftsman for at least four to five years before he is allowed to be on his own (i.e. own his own workshop). The capabilities of the apprentice are determined by the competency of his trainer. (Aldrich, Richard 2005). Competency is a set of defined behavior that provides a structural guide enabling the identification, evaluation and development of the behaviors in individual employees. (Craig 1970).

The safety reliability and cost effectiveness of welded products required welds to be of adequately quality. Welding is a special process which needs unique controls in order to achieve

the required quality. Such processes are recognized in the quality management system standards International Organization for Standardization (ISO) 9001, which requires them to be treated in a particular way. Ignoring the need for special, competentcontrol of welding can result,in most cases, in catastrophically failure and loss of life. Whilst such occurrences are rare these days, they are not unknown. Most companies that do not adequately ensure competent control of welding may find themselves in cost overruns, delays, contractual problems etc. arising from the need to make repairs to bad welds. The cost penalties can be significant: it has been established that repairing a faulty weld incurs more than 5 to 6 six times the cost of doing it correctly the first time. (Aldrich, Richard 2005).

The importance of competence in welding was recognized a long time ago by the technical committee of Lloyd's register of Shipping (1918) reviewed a report on the application of ship building. The report was generally positive about the introduction of the process and proposals regarding additional regulations were made. These included the following:

1. The committee must be satisfied that the operators engaged are specially trained and are experienced and efficient in the use of welding systems proposed to be employed.
2. Efficient supervisors of approved ability must be provided, and the proportion of supervisors to welders must be submitted for approval.

Later on the 1960s and beyond, specifications dealing with the competence of Non-Destructive Testing (NDT) and welding inspections personnel emerged. Nowadays, controlling welding as a special process with ISO 3834, quality requirement for fusionwelding (which was first published as ISO 3834, and as EN 729, IN 1995) this standard sets specific requirements for competence of people with welding responsibilities and this includes: welders, NDT personnel, welding inspectors and welding coordinators. In other words, it is clear that anyone and everyone who

can have an impact on the final quality of the welds of a product must have the required competence. It is like a chain – a 'welding quality chain'- if only one link is missing or faulty, the chain will break and the kinds of problems highlighted above may occur. This is recognized in ISO 14731(2006) welding coordination – tasks and responsibilities (first published in 1994 as EN 719) which is referred to In ISO 3834. The correct implementations of these two standards ISO 3834 and ISO 14731, is the key to the cost effective manufacture of and reliable welded products, which in turn proves that if the arc welders are competent in carrying out there work, then they will be able to produce reliable products and that will increasetheir job satisfaction and that of their customers.The big question now is how competent are these road side arc welders in providing an effective delivery to their customers? This study is to assess job satisfaction and the needed competency in the improvement of road side arc welders in Suleja town, Niger State.

Statement of the problem

The importance of welding products in the society and in the world of today is indicated by how societies depend extensively upon metals and metal products. Many products would be nonexistent if it were not for welding, as metal cannot be obtained in a useable form from the earth. There is no doubt that modern civilization would not be as advanced as it is today if it were not for the welding and its products in the developing world of today. The welding industry is progressive and is always looking ahead. As it improves, so will civilization improve (Thomas, 1994).

Since technology brought about the means of solving problems, through the invention of medical technology, construction technology, information technology and transportation technology. Materials are used in building equipment and machines to enhance those aspects of technology; metal as a material which play a great role in construction. In constructing with the metals there

is a need for welding (joining metals). From the background of the study, we see that people go into welding as an occupation, whose delivery are determined by their competency and it is also determines how satisfied they are with their job. There is a need to assess the job satisfaction and the competency of roadside arc welders so as to be able to improve their competency to achieve a better job satisfaction by these welders as they satisfy their customers effectively.

Hence, this study seeks to ascertain the improvements and competency needs of arc welders in Suleja Town, Niger State.

Purpose of the study

The main purpose of the study is to assess the Job Satisfaction and theneeded competency in the improvements of Roadside Arc Welders in Suleja Town, Niger state. Specially, the study determines:

1. Competencies needed by an Arc Welder.
2. Improvement in the competency of Arc Welders for effective service delivery.
3. Levels of customer's satisfaction.

Significance of the study

This study will be beneficial to arc welding workshop owners and operators. It will help the owners/operators come up with an effective training that would serve as a guide for implementation of competencies needed by arc welders for improvement of performance levels.

It will help workshop/operators in the procurement, maintenance and utilization of welding materials to improve the competency in welding shops in Suleja Town, Niger state. The result of this study will help parents, guardians, the general public and the competency planners in creating a competency that will be beneficial to the apprentice in the attainment of higher level of arc welding skills.

The study will also help the youths and descendants of the town to gain employment arc welders as it will help them see welding as a lucrative job. It will also help to create awareness to the general public to patronize locally made products thereby increasing the market of the Welders.

Scope of the study

The study is designed to assess the Job Satisfaction and the needed competency of Roadside Arc Welders such as: preparing work area in accordance with job requirement and consult work requirement rom request/work order. The study will not judge the worth of the improvement of the needed competency of other places such as: welding with different positions except that of Suleja Town, Niger State.

Research Question

This study seeks to provide answers to the following question:

1. What are the needed competencies of an arc welder?
2. What are the needed improvements in the competency of Arc Welders for effective service delivery?
3. What are the levels of customer's satisfaction?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

Ho1: There is no significant difference between the mean responses of the customers and the road-side arc welders on the Needed competencies of arc welding.

Ho2: There is no significant difference between the mean responses of the customers and the Road-side Arc Welders on the Needed Improvement in the competency of Arc Welders.

CHAPTER II

REVIEW OF RELATED LITERATURE

The review of related literature for this study is organized under the following sub-headings:

- Historical development of welding
- Arc Welding processes
- Welding as a career
- Job satisfaction of a craftsman
- Safety in welding

Historical development of welding

When you drive your car or look at a light fixture in the street or open your microwave, chances are that there is something in any of those items that has been welded. These products and others have been a part of the process of welding for more years than you can imagine. As thus Welding is a method of repairing or creating metal structures by joining the pieces of metals or plastic through various fusion processes. Generally, heat issued to weld the materials. Welding equipment can utilize open flames, electric arc or laser light. (Jody 2010)

The Bible mentions Tubal Cain, "forged all types of tools from bronze and iron." He may have been one of the first to join metals with the forging process. His flame was an open hearth into which he placed the metals to be heated to the forging temperature. (Of interest, in forge welding the material does not melt. It becomes very soft at temperatures several hundred degrees lower. The most recent innovative joining process, Friction Stir Welding, also does not melt the base metal it just becomes soft and plastic)

Welding actually started a very long time ago during the middle ages, many artifacts have been found that date back to the bronze ages. These have been small boxes that were welded together

with what is called lap joints; no one is exactly sure what these were used for, but this was important to that time. The Egyptians also made a variety of tools by welding pieces of iron together. Perhaps, this is where Maxwell's hammer comes later? Who can say! Then came the rise of the middle ages and many people there were able to use blacksmithing for iron. Different modifications were along the way until welding used today was developed.

There were several significant inventions in the 1800s that influenced welding which includes the following as stated by (Collins, Paul 2005).

- In 1881, French scientist Auguste De Meritens succeeded in fusing lead plates by using the heat generated from an arc.
- The invention of acetylene by an Englishman named Edmund Davy.
- Gas welding and cutting became known and a way to cement pieces of iron together.
- Arc welding was a very popular part of welding after the electric generator b became known.
- Arc and resistance welding become another popular aspect of welding.
- Nikolai N. Barbados receives a patent for welding in 1885 and 1887 from America and Britain.
- C. L. Coffin receives an America patent for arc welding process.

After the 1800s many more patents and inventions were made in order to create more ways of doing welding but one of the greatest needs came much later during world war 1 because this process was needed to create arms. Because of the demands, welding firms became a staple of Europe because the war needed welding machines and electrodes to go with them. During the war people really got the chance to look at how welding worked and it became a very popular way to work. So much that in 1919 the first American welding society was begun and was established by Comfort Avery Adams and the aim of the society was the advancement of welding processes. The aim of the society was the advancement of welding processes. According to miller welds this nonprofit organization came directly out of through a group of men who called themselves the wartime welding committee of the emergency fleet

corporation. CJ Holstag also invented the alternating current in 1919. However, alternating current was first commercially utilized by the welding industry only in the 1930's.

Automatic welding as Invented by P.O. Nobel (1920), automatic welding integrated the use of arc voltage and bare electrode wires. It was used for repairing and molding metals. Several types of electrodes were also developed during this decade.

The New York Navy Yard developed stud welding. Stud welding was increasingly used for the construction industry and also for shipbuilding. It was during this time that the National Tube Company developed a welding process called smothered arc welding. In the sector of shipbuilding, the stud welding process was replaced by the more advanced submerged arc welding.

A new type of welding for seamlessly welding aluminum and magnesium was developed in 1941 by Meredith. This patented process came to be known as Heli arc welding. The gas shielded metal arc welding or GTAW was another significant milestone in the history of welding which was developed in Battelle Memorial Institute in 1948. (Jeffus, Larry 1997)

The CO2 welding process popularized by Lyubavskii and Novoshilov in 1953 became a welding process of choice for welding steels, as it was comparatively economical. Soon, electrode wires of smaller diameter were launched. This made welding of thin materials more convenient.

There were several advancements in the welding industry during the 1960's. Dual shield welding, Inner shield, and Electro slag welding were some of the important welding developments of the decade. Plasma arc welding was also invented by Gage during this time. It was used for metal spraying. The French also developed electron beam welding, which is still used by the aircraft manufacturing industries of the United States.

The 1950s and 1960s were also a significant time for welding because a welding process using CO2 was discovered and a variation of this form of welding that use inert gas became very popular in the 1960s because it produced a different type of arc.(Craig, Ed 1991)

There have been a number of improvements in the welding trade over these years and today the process has added two areas: friction and laser welding, Laser was originally developed in Bell Telephone Laboratories but it is now being used for various kinds of welding work. This is due to the inherent capacity of lasers in rendering precision to all kinds of welding jobs. These two have created a more specialized field and therefore more opportunities for learning and employment. One interesting point about laser welding is that those people use it has found out that it is a tremendous heat source so it can actually weld both metal and non-metallic objects. (Michael 2008)

Arc welding processes

Before discussing the arc welding process, it is essential to list the operational sequence in arc welding. According to V-tec Guides (1998) listed the following operational sequence:

- Consult work requirement from request/work orders
- Identifies and monitors work area hazards
- Identifies material resources required to satisfy job specification
- Obtaining quality materials in compliance with job specifications
- Preparing work area in accordance with job requirement
- Connecting welding machine to power source
- Selects suitable electrode in accordance with work requirement
- Inserting the electrode into the electrode holder
- Cleaning the work surface before welding
- Maintains a constant arc length required for welding
- Use of a uniform travel speed during welding
- Cleaning all welds with a chipping hammer and wire brush

Arc welding is the most extensively employed method of joining the components of metallic parts the source of heat is an electric arc. An electric arc is a continuous stream of electrons flowing through some

sort of medium between two electrodes and accompanied by intense heat generation and radiation, to strike an arc it is necessary to ionize the air gap or specially provided gaseous medium between the electrodes. This requires a certain amount of energy which is determined by the ionization potential needed to release the electrons from their bonds with the atomic nuclei. (ASM International 2003)

Various gases have different ionization potentials. The lower the ionization potential the easier the given gas ionized and the more stable the arc will be though its temperature will be lower. The air or gas in the arc gap is continuously ionized by electrons emitted by the surface of the negative electrode (cathode). These electrons collide with the molecules of the gaseous or vaporous substances in the space between the electrodes and split them into simpler components - positively charged ions and electrons. Two factors influence the emission of electrons from the cathode: high temperature (thermionic emission) and the strength of the electric field (auto electronic emission). (Licoln Electric 2004)

FIVE MOST COMMON ARC WELDING PROCESSES

Process	Known As	Electrodes	Shielding	Operator skill required	Popularity
Shielded metal arc welding	SMAW or stick	Rigid metal	Stick coatings	Low	Diminishing
Gas metal arc welding	GMAW or MIG	Solid wire	CO2 gas	Low	Growing
Flux core arc welding	FCAW or MIG	Hollow wire	Core materials	Low	Growing
Gas tungsten arc welding	GTAW or TIG	Tungsten	argon	High	steady
Submerged arc welding	SAW	Solid wire	argon	high	steady

(Cary, Howard and Scott 2005)

Shielded metal arc welding:

Shielded Metal Arc Welding, also known as manual metal arc welding, stick welding, or electric arc welding, is the most widely used of the various arc welding processes. Welding is performed with the

heat of an electric arc that is maintained between the end of a coated metal electrode and the work piece. The heat produced by the arc melts the base metal, the electrode core rod, and the coating. As the molten metal droplets are transferred across the arc and into the molten weld puddle, they are shielded from the atmosphere by the gases produced from the decomposition of the flux coating. The molten slag floats to the top of the weld puddle where it protects the weld metal from the atmosphere during solidification. (Cary, Howard and Scott 2005)

Other functions of the coating are to provide arc stability and control bead shape. More information on coating functions will be covered in subsequent lessons.

Equipment & Operation - One reason for the wide acceptance of the SMAW process is the simplicity of the necessary equipment. The equipment consists of the following items as stated by (Cary, Howard and Scott 2005)

.1. Welding power source

2. Electrode holder

3. Ground clamp

4. Welding cables and connectors

5. Accessory equipment (chipping hammer, wire brush)

6. Protective equipment (helmet, gloves, etc.)

Welding Power Sources - Shielded metal arc welding may utilize either alternating current (AC) or direct current (DC), but in either case, the power source selected must be of the constant current type. This type of power source will deliver a relatively constant amperage or welding current regardless of arc length variations by the operator. The amperage determines the amount of heat at the arc and since it will remain relatively constant, the weld beads produced will be uniform in size and shape. Whether to use an AC, DC, or AC/DC power source depends on the type of welding to be done and the electrodes used. The following factors should be considered:

Electrode Selection - Using a DC power source allows the use of a greater range of electrode types. While most of the electrodes are designed to be used on AC or DC, some will work properly only on DC.

Metal Thickness - DC power sources may be used for welding both heavy sections and light gauge work. Sheet metal is more easily welded with DC because it is easier to strike and maintain the DC arc at low currents.

Distance from Work - If the distance from the work to the power source is great, AC is the best choice since the voltage drop through the cables is lower than with DC. Even though welding cables are made of copper or aluminum (both good conductors), the resistance in the cables becomes greater as the cable length increases. In other words, a voltage reading taken between the electrode and the work will be somewhat lower than a reading taken at the output terminals of the power source. This is known as voltage drop.

Welding Position - Because DC may be operated at lower welding currents, it is more suitable for overhead and vertical welding than AC. AC can successfully be used for out-of-position work if proper electrodes are selected.

Arc Blow - When welding with DC, magnetic fields are set up throughout the weldment. In weldments that have varying thickness and protrusions, this magnetic field can affect the arc by making it stray or fluctuate in direction. This condition is especially troublesome when welding in corners. AC seldom causes this problem because of the rapidly reversing magnetic field produced. Combination power sources that produce both AC and DC are available and provide the versatility necessary to select the proper welding current for the application. When using a DC power source, the question of whether to use electrode negative or positive polarity arises. Some electrodes operate on both DC straight and reverse polarity, and others on DC negative or DC positive polarity only. Direct current flows in one direction in an electrical circuit and the direction of current flow and the composition of the electrode coating will have a definite effect on the welding arc and weld bead.

Electrode Holder - The electrode holder connects to the welding cable and conducts the welding current to the electrode. The insulated handle is used to guide the electrode over the weld joint and feed the electrode over the weld joint and feed the electrode into the weld puddle as it is consumed. Electrode holders are available in different sizes and are rated on their current carrying capacity.

Ground Clamp - The ground clamp is used to connect the ground cable to the work piece. It may be connected directly to the work or to the table or fixture upon which the work is positioned. Being a part of the welding circuit, the ground clamp must be capable of carrying the welding current without overheating due to electrical resistance.

Welding Cables - The electrode cable and the ground cable are important parts of the welding circuit. They must be very flexible and have a tough heat-resistant insulation. Connections at the electrode holder, the ground clamp, and at the power source lugs must be soldered or well crimped to assure low electrical resistance. The cross-sectional area of the cable must be sufficient size to carry the welding current with a minimum of voltage drop. Increasing the cable length necessitates increasing the cable diameter to lessen resistance and voltage drop.

Coated Electrodes - Various types of coated electrodes are used in shielded metal arc welding. Electrodes used for welding mild or carbon steels are quite different than those used for welding the low alloys and stainless steels.

Gas tungsten arc welding

The Gas Tungsten Arc Welding (GTAW) process is sometimes referred to as TIG, or Heliarc. TIG is short for Tungsten Inert Gas Welding, and the term Heliarc was used because helium was the first gas used for the process. The aircraft industry developed the GTAW process for welding magnesium during the late 1930's and the early 1940's. During that time, helium was the primary shielding gas used, along with DCEP welding current. These caused many problems that limited application of GTAW welding process. But improve the process effectiveness and reduced its cost. Before the development of the GTAW

process, welding aluminum and magnesium was difficult. The weld produced was porous and corrosion−prone. (Minnick, William 1996)

Gas tungsten arc welding is a welding process performed using the heat of an arc established between a non-consumable tungsten electrode and the work piece. The electrode, the arc, and the area surrounding the molten weld puddle are protected from the atmosphere by an inert gas shield. The electrode is not consumed in the weld puddle as in shielded metal arc welding. If a filler metal is necessary, it is added to the leading the molten puddle. Gas tungsten arc welding produces exceptionally clean welds no slag is produced, the chance inclusions in the weld metal is and the finished weld requires virtually no cleaning. Argon and Helium, the primary shielding gases employed, are inert gases. Inert gases do not chemically combine with other elements and therefore, are used to exclude the reactive gases, such as oxygen and nitrogen, from forming compounds that could be detrimental to the weld metal. Gas tungsten arc welding may be used for welding almost all metals — mild steel, low alloys, stainless steel, copper and copper alloys, aluminum and aluminum alloys, nickel and nickel alloys, magnesium and magnesium alloys, titanium, and others. This process is most extensively used for welding aluminum and stainless steel alloys where weld integrity is of the utmost importance. Another use is for the root pass (initial pass) in pipe welding, which requires a weld of the highest quality. Full penetration without an excessively high inside bead is important in the root pass, and due to the ease of current control of this process, it lends itself to control of back-bead size. For high quality welds, it is usually necessary to provide an inert shielding gas inside the pipe to prevent oxidation of the inside weld bead. (Nadzam, Jeff 1997)

Gas tungsten arc welding lends itself to both manual and automatic operation. In manual operation, the welder holds the torch in one hand and directs the arc into the weld joint. The filler metal is fed manually into the leading edge of the puddle. In automatic applications, the torch may be automatically

moved over a stationary work piece or the torch may be stationary with the work moved or rotated in relation to the torch. Filler metal, if required, is also fed automatically.

Equipment and Operation - Gas tungsten arc welding may be accomplished with relatively simple equipment, or it may require some highly sophisticated components. Choice of equipment depends upon the type of metal being joined, the position of the weld being made, and the quality of the weld metal necessary for the application. The basic equipment consists of the following. As stipulated by (Minnick, William1996)

1. The power source
2. Electrode holder (torch)
3. Shielding gas
4. Tungsten electrode
5. Water supply when necessary
6. Ground cable
7. Protective equipment

Power Sources - Both AC and DC power sources are used in gas tungsten arc welding. They are the constant current type with a drooping volt-ampere curve. This type of power source produces very slight changes in the arc current when the arc length (voltage) is varied. The choice between an AC or DC welder depends on the type and thickness of the metal to be welded.

AC/DC Constant Current Power Sources - Designed for gas tungsten arc welding, are available, and can be used for welding practically all metals. The gas tungsten arc welding process is usually chosen because of the high quality welds it can produce. The metals that are commonly welded with this process, such as stainless steel, aluminum and some of the more exotic metals, cost many times the price of mild steel; and therefore, the power sources designed for this process have many desirable features to insure high quality welds. Among these are:

1. Remote current control, which allows the operator to control welding amperage with a hand control on the torch, or a foot control at the welding station.

2. Automatic soft-start, which prevents a high current surge when the arc is initiated.

3. Shielding gas and cooling water solenoid valves, which automatically control flow before, during and for an adjustable length of time after the weld is completed.

4. Spot-weld timers, which automatically control all elements during each spot-weld cycle. Other options and accessories are also available. Power sources for automatic welding with complete programmable output are also available. Such units are used extensively for the automatic welding of pipe in position. The welding current is automatically varied as the torch travels around the pipe. Some units provide a pulsed welding current where the amperage is automatically varied between a low and high several times per second. This produces welds with good penetration and improved weld bead shape.

Torches - The torch is actually an electrode holder that supplies welding current to the tungsten electrode, and an inert gas shield to the arc zone. The electrode is held in a collet-like clamping device that allows adjustment so that the proper length of electrode pro- trudes beyond the shielding gas cup. Manual torches are designed to accept electrodes of 3 inch or 7 inch lengths. Torches may be either air or water-cooled. The air-cooled types actually are cooled to a degree by the shielding gas that is fed to the torch head through a compos- ite cable. The gas actually surrounds the copper welding cable, affording some degree of cooling. Water-cooled torches are usually used for applications where the welding current exceeds 200 amperes. The water inlet hose is connected to the torch head. Circulating around the torch head, the water leaves the torch via the current-in hose and cable assembly. Cooling the welding cable in this manner allows the use of a smaller diameter cable that is more flexible and lighter in weight. The gas nozzles are made of ceramic materials and are available in various sizes and shapes. In some heavy duty, high current applications, metal water-cooled nozzles are used. A switch on the torch is used to energize the electrode with welding current and start the shielding gas flow. High

frequency current and water flow are also initiated by this switch if the power source is so equipped. In many installations, these functions are initiated by a foot control that also is capable of controlling the welding current. This method gives the operator full control of the arc. The usual welding method is to start the arc at a low current, gradually increase the current until a molten pool is achieved, and welding begins. At the end of the weld, current is slowly decreases and the arc extinguished, preventing the crater that forms at the end of the weld when the arc is broken abruptly. (Walker and Polanin 2004)

Shielding Gases - Argon and helium are the major shielding gases used in gas tungsten arc welding. In some applications, mixtures of the two gases prove advantageous. To a lesser extent, hydrogen is mixed with argon or helium for special applications. Argon and helium are colorless, odorless, tasteless and nontoxic gases. Both are inert gases, which mean that they do not readily combine with other elements. They will not burn nor support combustion. Commercial grades used for welding are 99.99% pure. Argon is .38% heavier than air and about 10 times heavier than helium. Both gases ionize when present in an electric arc. This means that the gas atoms lose some of their electrons that have a negative charge. These unbalanced gas atoms, properly called positive ions, now have a positive charge and are attracted to the negative pole in the arc. When the arc is positive and the work is negative, these positive ions impinge upon the work and remove surface oxides or scale in the weld area. (Little, Kevin 2005)

Argon is most commonly used of the shielding gases. Excellent arc starting and ease of use make it most desirable for manual welding. Argon produces a better cleaning action when welding aluminum and magnesium with alternating current. The arc produced is relatively narrow. Argon is more suitable for welding thinner material. At equal amperage, helium produces a higher arc voltage than argon. Since welding heat is the product of volts times amperes, helium produces more available heat at the arc. This makes it more suitable for welding heavy sections of metal that have high heat conductivity or for automatic welding operations where higher welding speeds are required. Argon-helium gas mixtures are used in applications where higher heat input and the desirable characteristics of argon are required.

Argon, being a relatively heavy gas, blankets the weld area at lower flow rates. Argon is preferred for many applications because it costs less than helium. Helium, being approximately 10 times lighter than argon, requires flow rates of 2 to 3 times that of argon to satisfactorily shield the arc. (Bernard 2010)

Electrodes - Electrodes for gas tungsten arc welding are available in diameters from .010" to 1/4" in diameter and standard lengths range from 3" to 24". The most commonly used sizes, however, are the .040", 1/16", 3/32", and 1/8" diameters. The shape of the tip of the electrode is an important factor in gas tungsten arc welding. When welding with DCEN, the tip must be ground to a point. The included angle at which the tip is ground varies with the application, the electrode diameter, and the welding current. Narrow joints require a relatively small included angle. When welding very thin material at low currents, a needlelike point ground onto the smallest available electrode may be necessary to stabilize the arc. Properly ground electrodes will assure easy arc starting, good arc stability, and proper bead width.(Paton welding journal 2006)

When welding with AC, grinding the electrode tip is not necessary. When proper welding current is used, the electrode will form a hemispherical end. If the proper welding current is exceeded, the end will become bulbous in shape and possibly melt off to contaminate the weld metal.

The American Welding Society (1986) has published Specification AWS A5.12-80 for tungsten arc welding electrodes that classify the electrodes on the basis of their chemical composition, size and finish.

Briefly, the types specified are listed below:

1) Pure Tungsten, Color Code: Green, Used for less critical applications. The cost is low and they give good results at relatively low currents on a variety of metals.

2) 1% Thoriated Tungsten, Color Code: Yellow, Good current carrying capacity, easy arc starting and provide a stable arc. Less susceptible to contamination.

3) 2% Thoriated Tungsten, Color Code: Red, Longer life than 1% Thoriated electrodes. Maintain the pointed end longer, used for light gauge critical welds in aircraft work.

4) 5% Thoriated Tungsten, Color Code: Blue, Sometimes called "striped" electrode because it has 1.0-2.0% Thoria inserted in a wedge-shaped groove throughout its length. Combines the good properties of pure and thoriated electrodes.

5) Zirconia Tungsten, Color Code: Brown Longer life than pure tungsten. Better performance when welding with AC. Ideal for applications where tungsten contamination must be minimized.

Flux core arc welding (FCAW)

Flux Cored Arc Welding (FCAW) is a welding process by fusion which is widely used on ferrous metal. The consumable electrode can have an interior flux or a mix of flux and metal powder.It's an easily automated process that is particularly interesting in high

deposition rate processes. (Houldcroft1973)

Energy source: FCAW has as its energy source an electrical arc that occurs between the fluxed cored wire and base Metal in order to melt consumable electrode and base metal.(American Metallurgical Consultants 2006)

Welding zone protection: Welding zone protection from atmosphere contamination is assured by the products in the electrode's flux (self-shielded flux cored arc welding) and sometimes by additional gaseous protection (gas shielded flux cored arc welding). The slag created by the flux gives an additional protection during cooling time but has to be removed after that.

EQUIPMENT

FCAW uses a constant voltage welding machine and the process can use DCEP or DCEN polarity. For gas shielded flux cored arc welding, a gas bottle is needed.

Advantages

1. A high deposition process

2. High energy rate allow greater penetration and a lower number of welding defects.
3. Metallurgical benefits from the flux such as the weld metal been protected initially from external factors until the flux is chipped away
4. It's an "all position" process.
5. No shielding gas needed making it suitable for outdoor welding or/and windy conditions.

Disadvantages

1. Irregular wire feed.
2. High operator skills.
3. Slag removal spending time.
4. Less suitable for applications that require painting.
5. More costly filler material/wire as compared to gas metal arc welding.

Flux Core Arc Welding requires adequate ventilation and the use of a sealed mask that will provide the welder with Fresh air. Also eyes and skin should be protected by appropriate goggles and clothes. (Walker and Polanin 2004)

GAS METAL ARC WELDNG

GMAW was developed in the late 1940's and is also called MIG/MAG Welding. Since then it unfolded into becoming a major element in industry today. It is suitable for welding a variety of ferrous and nonferrous metals. The arc continuously melts the wire as it is fed in the weld puddle. The weld area is shielded by a flow of gas such as argon, helium, carbon dioxide, or gas mixtures. The consumable bare wire is fed automatically through a nozzle into the weld area. Metal can be transferred into the weld−bead in three ways: Spray, Globular and Short circuiting. Each way has its own advantages and disadvantages. The process is rapid, versatile, and economical and can easily be automated (continuous welding without electrode changing). (Althouse, Turnquist and Bowditch 2004)

The American Welding Society (AWS) (2004) defines gas metal arc welding (GMAW) as “an arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal electrode and the work piece. Shielding is obtained entirely from an externally supplied gas. GMAW is an arc welding process that incorporates the automatic feeding of a continuous, consumable electrode that is shielded by an externally supplied gas. Since the equipment provides for automatic control of the arc, the only manual controls required by the welder for semiautomatic operation are the gun positioning, guidance, and travel speed.

GMAW is used to weld all the commercially important metals, including steel, aluminum, copper, and stainless steel. The process can be used to weld in any position, including flat, vertical, horizontal, and overhead. It is usually connected to use direct current electrode positive (DCEP). (Craig, Ed 1991)

Advantages:

1. Most metals weld-able.
2. High welding productivity.
3. Excellent weld quality.
4. Minimal distortion.

Operation: Semiautomatic (Movement of Gun controlled by hand) or automatic

Energy source: DC

Welding positions: All

Cost of equipment: Low to high

Field of application: General construction, general metal fabrication, car body, work pieces from 0.75mm and 12 mm thickness − with multiple techniques easily to extend.

Submerged arc welding

SAW, developed in the 1940s, is one of the most important automatic welding processes. The arc and the whole welding zone are covered by a layer of powder. The complete cover of the molten metal

prevents sparks, spatter, intensive ultraviolet radiation and fumes. The flux which is part of the powder, acts as a thermal insulator, allowing deep penetration of heat into the work piece.

The consumable electrode is a coil of bare round wire (1.5 − 10 mm diameter) and is fed automatically through a tube (welding gun). Because the powder is fed by gravity, the SAW process is limited to weld in a flat or horizontal position. Circular welds can be made on pipes, provided that they are rotated during welding. The unfused powder can be recovered, treated, and refused. SAW is used to weld a variety of carbon and alloy steel and stainless steel sheet or plate with a high speed and productivity. The quality of weld is very high. Typical applications are thick plate welding for shipbuilding and pressure vessels. (Jeffus, Larry 2002)

Advantages:

1. High deposition rate.
2. High welding productivity.
3. Superior quality weldments.

Operation: Automatic

Energy source: AC/DC

Welding positions: Flat and horizontal

Cost of equipment: Medium

Field of application: Thick plate welding for shipbuilding and pressure vessels.

Welding as a career

Welding touches virtually all construction, manufacturing, and repair work. Welding is used to build projects such as aircraft, tanks, satellites, weapons, machinery, heavy equipment, trucks, helicopters, trains, power generation units, ships, etc. Some typical projects for construction welders include bridges, power plants, airports, prisons, breweries, refineries, aqueducts, dams, hi-ways, shopping malls,

railroads, and gas, oil, and water piping systems. Welders will also be involved in the maintenance, repair, and modification of these projects. (American Welding Society 2012)

Most people think of tradesmen who weld as “Welders”. Care must be used if researching job opportunities and wage rates for “Welders”. Welding is done by many crafts. Some fulltime “Welders” work in specialized fields that classify them as “Pipe Fitter,” “Boilermaker,” “Ironworker,” “Sheet Metal Worker,” “Sheet Metal Mechanic,” “Fitter,” or “Fabricator”. Regardless of title, welding is integral to all these crafts. Additionally, electricians, carpenters, mechanics, machinist, millwrights, maintenance men, and other tradesmen commonly weld, occasionally approaching fulltime. Work conditions vary widely. Welding may be done under extremely comfortable and clean conditions for aerospace work, or even in a “clean room” environment during manufacture of equipment for computer chip production operations, or other highly sensitive items. More commonly however, welding is done outdoors on construction sites, or in indoor heavy industrial settings. Heavy industrial work environments require hands that aren’t afraid of dirt and sweat. Many require dedicated professionals who can produce code quality welds in all positions, in uncomfortable and difficult to access locations, sometimes high above the ground, while close to other loud and distracting work operations. (Rowings, FederleBirkland 1996)

Welders are employed by small job shops, mobile repair companies, private and corporate manufacturers, construction contractors, utility districts, and various town, city, state, and federal government branches. Pay varies widely based on skill level, technical knowledge, work habits, and geographical location. Some welders working in small private shops doing low skill level work may barely make over minimum wage, while highly skilled construction workers earn up to N200,000 per month.

While many welders enjoy the challenging nature and visible end product of their craft, a welding background provides many opportunities as well. Experienced welders may move on to become business owners, welding engineers, welding inspectors, quality assurance personnel, supervisors,

welding procedure writers, testing lab technicians, equipment salesmen, consultants, or educators. A formal education is an important component to skill building, entry opportunity, and advancement.

A Training welding program provides instruction in all common manual welding and cutting processes. Training includes welding with “TIG”, “Stick”, “MIG”, and flux cored wires. Steel, stainless steel, and aluminum are welded in all positions. (Welder Training Institute 2011)

Materials include pipe, tubing, sheet, plate, and structural shapes such as I-beam and channel. Cutting is done both manually and mechanized with plasma and oxy-fuel systems. Training is geared to provide the skill base, knowledge, and professional attitude required to eventually become a journey-level combination welder.

Safety in welding

Safety rules as stipulated by ShaikTq and Bhojani FA. (1991) for operators are given below:

(a) Always treat all electrical equipment as “live”. Do not take chances. Keep water and other liquids away and keep yourself dry.

(b) Keep leads and cables clear from obstructing passageways, ladders and stairways.

(c) Use only cables of a sufficient capacity to carry the current used. Do not overload.

(d) Use only a proper earthing clamp or bolted terminal.

(e) Use only standard cable connectors.

(f) Use only an insulated hook or other suitable device to hold the electrode holder when you are not actually using it.

(g) If you are using a welding generator driven by an internal combustion engine inside a building or confined area, the engine exhaust must be conducted to the outside air.

(h) Input cables and extension leads should be kept as short as practicable.

(i) Take particular care in earthing portable welding machines driven by an internal combustion engine. Where an earthing connection is provided, it must be used in accordance with the manufacturer's instructions. (This is also very important when using ancillary power supply for drills, grinders and other equipment).

Arc welding has its own set of hazards. Here are the main ones and how to avoid them:

Electric shock

Check the insulation of all cables regularly. Do not work in wet conditions unless suitable precautions have been taken. Electrical work should be carried out only by a registered electrician.

Burns

Wear suitable protective clothing. Cool down or clearly mark hot objects.

Eye hazards

Use only a suitable helmet or hand shield which is in good condition. Always wear approved safety spectacles with side shields, goggles or a visor when chipping or grinding. Ensure that adequate welding screens are erected where practicable.

Fumes, vapours, dust, and gases

Make sure the work area is well ventilated. There are health risks from the toxic substances in fluxes, filler rods, coatings, and cleaning agents, and the by-products of heat and ultraviolet radiation from the arc.

Dangerous substances

Some dangerous substances as stipulated by Vyskocil and Linquist (1992)

Beryllium: Used mainly as an alloy with other metals, beryllium is deadly and extreme precautions must be taken. This metal must be welded in inert atmospheres, inside airtight enclosures, with the welder outside.

Cadmium: Used in electroplating and as an alloy with metals, cadmium is also an ingredient in some paints. A single exposure to cadmium oxide fumes can cause a severe lung irritation that may be fatal.

Chromium: The oxidation of chromium alloys can produce chromium trioxide fumes, often referred to as chromic acid. These fumes may produce skin irritation as well as bronchitis and other problems.

Lead: Poisoning generally results from inhalation of fumes, although the swallowing of dust is also a cause. Lead-based paints are a source of lead fumes, especially when old steel structures are cut or welded. Signs and symptoms of lead poisoning may include abdominal pains, constipation, headaches, weakness, muscular aches or cramps, loss of appetite, nausea, vomiting, weight loss, and anaemia. In severe cases it can be fatal.

Magnesium: The oxide fumes from magnesium can produce metal fume fever, which is characterized by influenza-like symptoms.

Manganese: Fumes from manganese are highly toxic and can produce total disablement after a few months of exposure to high fume concentrations.

Mercury: Mercury vapour can be produced by welding or cutting metals coated with protective materials containing mercury compounds, such as the antifouling paints used on ship bottoms. Nowadays less toxic substitutes are used in place of mercury, but there will still be some vessels in service which are protected with mercury-containing antifouling compounds. Exposure to mercury vapour may result in abdominal pain, vomiting, diarrhoea, and other serious problems which, collectively, can result in death.

Nickel: Often used as an undercoating on chrome-plated parts, nickel and its compounds are generally considered to have low toxicity.

Titanium: Dust may irritate the respiratory tract in high concentrations.

Vanadium: Dust and vanadium pentoxide fumes may cause severe eye, throat, and respiratory tract irritation and pain.

Zinc: Welding, brazing, or flame cutting of galvanised steel causes zinc oxide fumes. Inhalation of these may result in metal fume fever.

Flourides: These and other toxic compounds of fluorine may be found in some welding and brazing fluxes, electrode coverings and submerged arc fluxes. Containers are labelled to warn of the presence of fluorides. The fumes will cause chills, fever, painful breathing, and coughs if inhaled. Over a long period, fluoride can build up in the bones, causing them to lose calcium and become brittle.

Overalls and protective clothing

Spatter from the welding arc, ultraviolet radiation, and slag from chipping can all cause burns or health problems. Always wear industrial overalls and appropriate eye protection when you are engaged in welding and cutting operations. Keep overalls fastened up to the neck, with the sleeves down and fastened about the wrist. (American National Standards Institute 1998)

Wear gloves or gauntlets for arc welding, as protection against shock, burns and radiation burns. Various jobs may require additional protective clothing to be worn such as aprons, leggings, skull caps, and shoulder covers. Safety footwear, preferably boots, should also be worn, especially when heavy materials are handled.

The employer has a duty to provide these items where needed, and the worker must wear them. All such items must be made of suitable flame-resistant materials.

Protective equipment

Never use a helmet or shield which has cracks, splits, or pinholes in it. Similarly, do not use, even for the smallest job, a cracked or broken filter glass. It is an offence for an employer to provide unsatisfactory equipment, and no worker should knowingly use it.

Safety spectacles with side shields must always be worn for chipping or grinding, or when in an eye danger area. (Proctor 2004)

You have a specific duty to protect others from the ultraviolet radiation given off by electric arc welding. Unless you are welding in a room or a booth which prevents other people from being affected, you must place suitable screens around the work. There are several types of portable, flame-resistant screens and translucent curtains available. If a screen is damaged it must not be used again until properly repaired. It may sometimes be necessary to use suitable signs in addition to the screens.

Noise is not usually a problem associated with gas welding and cutting, but some operations involving fabrication of steel plate can generate high noise levels. If so, or if there are noisy processes nearby, discuss the matter of personal hearing protection with your supervisor. If fumes given off from the work are highly toxic, such as those from cadmium, chromium, or beryllium, then some form of respiratory protection, such as an air-supplied helmet, is still necessary even though the work is done outside.

Fire protection and extinqiusher

Fires are an ever-present danger around welding and cutting work. No welding or cutting work should be started unless all the requirements in this checklist have been met:

(a) All operators who are to use the equipment must be fully trained.

(b) All equipment must be in good working order and correctly assembled.

(c) Cylinders must be secured against falling or being knocked over.

(d) Sufficient and suitable fire extinguishing equipment must be available in the immediate vicinity of the work.

(e) All workers should know how to operate the fire extinguishing equipment.

(f) Fire watchers must be appointed in locations where any major fire may develop.

Always notify the Fire Service even if you put the fire out. They may wish to examine the scene for your benefit.

Fires from gas welding operations tend to occur while work is in progress, while those caused by arc welding often occur sometime after work has ceased. This is because hot slag and spatters of molten

metal will bounce into awkward places, where they are not noticed, and smoulder for some time before igniting.

Be careful when wetting down the work area, especially where there is electrical equipment. It is advisable to check the area an hour or so later. A fire watcher, equipped with sufficient and suitable firefighting equipment, must remain behind until all danger of fire has passed. This will be not less than 30 minutes after hot work has been completed.

Working in confined spaces

It is always dangerous to work with welding or cutting equipment in a confined space.

Here are the safety procedures to follow:

(a) Never enter any confined space unless you are satisfied it is adequately ventilated with fresh air. If in doubt, wear suitable respiratory protection.

(b) Do not attempt to weld or cut if the presence of explosive vapours or dusts is suspected. Test the atmosphere with a suitable gas detector

(c) All workers should wear a safety belt or lifeline as appropriate, so that they may be easily removed from the confined space without the need for anyone else to enter it.

(d) Keep welding plant outside and run leads only to the work site.

(e) Do not work in a confined space unless you are closely watched by someone outside. This person must understand the welding plant and must be able to shut it down properly and quickly in an emergency.

(f) Remove the gas torch and hoses from the space every time that work stops-even for tea breaks. A small leak, for ten minutes or so, could result in an explosion when work restarts.

Job Satisfaction of a Craftsman

Construction projects are completed by amount of professional craftsmen. Job performances of craftsmen play an important role to qualities of construction projects. Job satisfaction has been a topic in organization research (Hoppock, 1935) for its impact on job performance. Knowledge of the job satisfaction of the craftsmen helps understanding their motivations, and thus the ways to improve their performance. Job satisfaction is a function of the job outcomes desired and expected and those received (Porter and Lawler, 1968). Describing job satisfaction from a facet approach emphasized the attitudes of employees towards various aspects of job, such as satisfaction of rewards, opportunity, etc. (Maloney and McFillen, 1985; Rowings et al., 1996; Dabke et al., 2008). In addition, demographic variables may be one factor influencing workers' job satisfaction. (Rowings et al. 1996) identified that craftswomen reported higher average levels of satisfaction with their jobs than craftsmen did. (Maloney and McFillen 1985) identified that craftsmen with more education were less satisfied with their jobs than did workers with less education.

Hoppock, (1935) also indicated that satisfaction of the work of a craftsman arises from the satisfaction of the users (costumers) that actually consume or make use of the products made by the craftsmen, and the satisfaction of these costumers is derived not only from the quality of the products purchased but also from some activities carried out by the craftsmen, such as: engaging in after sale services (installation), performing home service (repair works), show different samples of their products to the costumer to choose, attend to complaints of costumers.

Porter and Lawler (1968) suggested some activities to improve the satisfaction of costumers, such as: subsidies their products, offer some free minimal repair services, engages on community services, entertain their costumers and provide warranty services. With such activities the patronization of these craftsmen will increase thereby reducing the use of imported goods.

Adequacy of tools/equipment's/machinery, ability to directly offer opinions on job, ability to execute work, and amount of freedom in work are deemed important by craftsmen. On the other hand, the least

important items are particular task assignment, opportunity for promotion, adequacy of technical supervision, opportunity for challenging work, and opportunity to do something that gives a sense of self-esteem.

Craftsmen are most satisfied with friendliness of coworker, interaction with coworker, supervisor support, coworker support, and participation in decision making. They are least satisfied with personal protective equipment, benefits, pay, opportunity to do something that give a sense of self-esteem, and opportunity to learn new things.

A comparison between rankings of importance and satisfaction items reveal that pay and adequacy of tools/equipment's/machinery for job performance are the most important things to construction workers, yet their satisfaction level in these areas is low.

Several demographic groupings show significant differences for satisfaction with Working Environment. Workers between 21 to 30 years report highest satisfaction with Working Environment, while the worker Older than 61 years report the lowest. Single workers are more satisfied than married. Workers without child are more satisfied than workers having one child. Workers having college degree are more satisfied than workers not having high school education. The differences in satisfaction with Work appear to be in terms of gender, age, and education. Female workers are less satisfied with Work than males. Workers between 21 to 30 years are more satisfied than workers elder than 61 years. Workers having college degree are more satisfied than worker not having high school education.

Satisfaction with Pay/Incentive has significant differences for three demographic variables. Workers between 21 to 30 years are more satisfied with Pay/Incentives than workers elder than 61 years. Workers without child are more satisfied than workers having three children or more. Workers having college degree are more satisfied than worker not having high school education.

CHAPTER III

RESEARCH METHODOLOGY

This Chapter describes the Research design, Area of study, Population of the study, Instrument for data collection, Validation of the instrument, Administration of the instrument, Method of data analysis and Decision rule.

Research Design

The research design used in carrying out this study was the survey research design where questionnaires were used to source for opinions of respondents on the issue of assessing job satisfaction and the needed competency in the improvement of road side arc welders in Suleja town, Niger state. The survey research design was chosen as an appropriate method for the research as it seeks the view of people about a particular issue that concerns them, give room for research to study the group of people and items to source for information from the respondents.Baihie, Earl (1990)

Area of the Study

The study covered some selected Roadside Arc Welders in Suleja Town Niger State; it shares a boundary with the Federal Republic of Nigeria and as thus is a fastdeveloping town which has a great need of welding. Been a recipient and a witness an unreliable work from these Roadside Arc Welders gave the zeal to assess the Job Satisfaction and Needed competency in the improvement of the Roadside Arc Welders.

Population of the Study

The targeted population for this study is 30 respondents consisting of 10 craftsmen and 20 customers. The entire population was used for the study, therefore no need for sampling. The population of the study covered some major centers and streets were Roadside Arc Welders are

found in Suleja Town, the area includes TudunBariki, AngwanGayan, Chaza, Gwazunu, Hassan Dalhatu and Checheniya area.

Instrument for Data Collection

The questionnaire was the main instrument used by the researcher for the data collected for the study. It consists of three sections as follows:

Section I: This section contains 21 items dealing with the needed competencies of Road side Arc Welders in Suleja town, Niger state.

Section II: This section contains 13 items dealing with the needed improvements of an Arc Welder's competency for effective service delivery in Suleja town, Niger state.

Section III: This section contains 12 items dealing with what are the levels of customer's satisfaction with the Roadside Arc Welders in Suleja town, Niger state.

The instrument uses four point like-type scales which are:

HN - Highly Needed (=4)

MN - Moderately Needed (=3)

N - Needed (=2)

NN - Not Needed (=1)

VHL - Very High Level (=4)

HL - High Level (=3)

LL - Low Level (=2)

VLL - Very Low Level (=1)

VHL - Very High Level (=4)

HL - High Level (=3) LL - Low Level (=2) VLL - Very Low Level (=1)

Validation of the Instrument

The instrument was validated by my supervisor and two other lecturers in the Department of Industrial and Technology Education, Federal University of Technology Minna. The validation suggestions and corrections made by the validators were incorporated in the final draft of the instrument. This was to ensure that the instrument was capable of eliciting necessary information for the data needed for the study.

Administration of the Instrument

The questionnaires for the study were administered to those craftsmen and customers that can read and write by direct delivery technique that is on the spot method. For the most of those who cannot read and write, the researcher and two research assistants interpret the questionnaire to the respondents and tick in the column of their options.

Method of Data Analysis

The data collected was analyzed using mean, standard deviation and t-test. A four points rating scale was used to analyze the data collected for the study, mean was used to analyze research questions while Standard deviation and t-test were employed to analyze the hypotheses.

Decision Rule

In order to determine the level of acceptance or rejection of any item, a mean score of 2.50 was used. Therefore any item with a mean response of 2.50 and above was accepted and any item with a mean response of 2.49 and below was rejected. The t-test was also employed to test the hypotheses at 0.05 level of significance to compare the mean response of the Roadside Arc

Welders and the Costumers. Each t-value calculated that was less than the critical value (1.98) at 0.05 level of significance was accepted while t-value that is equal to or more than (1.98) was rejected.

CHAPTER IV

PRESENTATION AND DATA ANALYSIS

This chapter deals with the presentation and analysis of data with respect to the research questions formulated for this study, the result of this data analysis for the research questions are presented as follows.

Research Question 1

What are the needed competencies of a Roadside Arc Welder?

Table 1: ***Mean Responses of Craftsmen and Customers on the needed Competencies of a Roadside Arc Welder***

S/N	ITEMS	X_1	X_2	X_t	Remarks
1	Consult work requirement from request/work orders	3.30	3.55	3.43	HN
2	Identifies and monitors work area hazards	3.30	3.15	3.23	HN
3	Identifies material resources required to satisfy job specification	3.30	2.95	3.13	HN
4	Determines correct sizes of materials in accordance with job specification	3.70	3.40	3.55	HN
5	Obtaining quality materials in compliance with job specifications	3.50	2.90	3.20	HN
6	Preparing work area in accordance with job requirement	2.90	2.55	2.73	HN
7	Use of protective attire	3.00	2.55	2.78	HN
8	Connecting welding machine to power source	3.90	3.30	3.60	HN
9	Selects suitable electrode in accordance with work requirement	3.40	2.90	3.15	HN
10	Inserting the electrode into the electrode holder	3.80	3.60	3.70	HN
11	Setting the arc welding selector of the welding machine to suite the base metal	3.50	2.75	3.13	HN
12	Cleaning the work surface before welding	3.10	2.50	2.80	HN
13	Checking position and alignment of work piece	2.90	2.40	2.65	HN
14	Maintains a constant arc length required for welding	2.90	2.70	2.80	HN
15	Use of a uniform travel speed during welding	3.80	2.35	3.08	HN
16	Cleaning all welds with a chipping hammer and wire brush	3.60	2.95	3.28	HN
17	Inspecting weld for identifying defects	3.40	2.80	3.10	HN
18	Repairing weld defects on articles	3.70	3.15	3.43	HN
19	Clearing off waste from work area	3.60	2.30	2.95	HN
20	Appropriate storage of unused electrodes	3.80	2.90	3.35	HN

21	Maintaining tools and equipment as required	3.50	2.75	3.13	HN

Key
N1 = Numbers of craftsmen
N2= Numbers of customers
X = Mean of craftsmen
X2 = Mean of customers
Xt = Average mean of craftsmen and customers
The data presented in Table two revealed that the respondents highly needed with all the items with mean score ranging between 2.65-3.70

Research Question 2

What are the needed improvements of a Roadside Arc Welder's competency for effective service delivery?

Table 2: The Mean Responses of the Craftsmen and Customers on theneeded improvements of a Roadside Arc Welder's Competency for effective service delivery

S/N	ITEMS	X_1	X_2	X_t	Remarks
22	Install welding machine before welding	3.80	3.20	3.50	HN
23	Use guillotines to cut metals	3.60	3.15	3.38	HN
24	Prepare edges for welding operation accurately	3.60	2.95	3.28	HN
25	Weld with different welding positions	3.70	3.35	3.53	HN
26	Select appropriate electrodes for welding different kinds of metals	3.40	3.45	3.43	HN
27	Have technical college certificate	3.70	3.60	3.65	HN
28	Have good maintenance culture	3.50	3.45	3.48	HN
29	Should be conversant with dangerous situations in welding shop	3.50	3.35	3.43	HN
30	Use overall and protective clothing during welding	3.80	3.50	3.65	HN
31	Use protective equipment like the helmet, goggles and face shields	3.80	3.55	3.68	HN
32	Have fire protection and extinguishers in their workshops	3.60	3.35	3.48	HN
33	Have the knowledge of the use of fire extinguishers	3.70	3.40	3.55	HN
34	Should wear overall when welding	3.60	3.50	3.55	HN

The data presented in table three revealed that the respondents highly needed with all the items with mean score ranging between 3.28-3.68

Research Question 3

What are the levels of customer's satisfaction?

Table 3: ***The mean responses of craftsmen and customers on thelevels of customer's satisfaction***

S/N	ITEMS	X_1	X_2	X_t	Remarks
35	Engages in after sale service (installation)	3.20	2.95	3.08	HL
36	Entertain their customers	2.40	2.15	2.28	LL
37	Perform home services	3.10	2.75	2.93	HL
38	Subsidies their products	2.30	1.60	1.95	LL
39	Sale their products on credit	1.80	1.90	1.85	LL
40	Engages on community service	1.80	1.60	1.70	LL
41	Offer free repair services	1.70	1.80	1.75	LL
42	Show different samples of their products to their customers to choose	3.50	3.00	3.25	HL
43	Enquire from their customers if their products satisfy the customers want	3.40	2.85	3.13	HL
44	Attend to complaints from customers	3.40	2.70	3.05	HL
45	Provides warranty services	3.00	2.70	2.85	HL
46	Employs a sales boy/girl to attend to customers	1.60	1.40	1.50	LL

The data presented in table 4 revealed that the respondents high level with all the items with mean score ranging between 2.85-3.25 and low level with the items on 36, 38, 39, 40, 41 and 46 with mean score of 1.50-2.28.

Hypothesis One

There is no significant difference between the mean responses of the customers and the Road-side Arc Welders on the Needed competencies of arc welder.

Table 4: ***t- test Analysis of Craftsmen and Customer regarding the Competency of Arc Welding*****.**

N1 = 10, N2 = 20

S/N	ITEMS	X_1	X_2	SD_1	SD_2	T-cal	Remarks
1	Consult work requirement from request/work orders	3.30	3.55	1.00	0.59	-0.73	NS
2	Identifies and monitors work area hazards	3.30	3.15	0.64	0.79	0.56	NS
3	Identifies material resources required to satisfy job specification	3.30	2.95	0.90	1.02	0.96	NS
4	Determines correct sizes of materials in accordance with job specification	3.70	3.40	0.46	0.86	1.24	NS
5	Obtaining quality materials in compliance with job specifications	3.50	2.90	0.67	0.77	2.20	S
6	Preparing work area in accordance with job requirement	2.90	2.55	1.04	0.92	0.90	NS
7	Use of protective attire	3.00	2.55	1.00	0.97	1.17	NS
8	Connecting welding machine to power source	3.90	3.30	0.30	1.10	2.28	S
9	Selects suitable electrode in accordance with work requirement	3.40	2.90	0.92	0.94	1.39	NS
10	Inserting the electrode into the electrode holder	3.80	3.60	0.40	0.80	0.91	NS
11	Setting the arc welding selector of the welding machine to suite the base metal	3.50	2.75	0.67	0.94	2.51	S
12	Cleaning the work surface before welding	3.10	2.50	1.14	1.02	1.41	NS
13	Checking position and alignment of work piece	2.90	2.40	0.94	1.07	1.31	NS
14	Maintains a constant arc length required for welding	2.90	2.70	1.14	1.00	0.47	NS
15	Use of a uniform travel speed during welding	3.80	2.35	0.40	1.01	5.60	S
16	Cleaning all welds with a chipping hammer and wire brush	3.60	2.95	0.49	0.92	2.52	S
17	Inspecting weld for identifying defects	3.40	2.80	0.66	0.81	2.17	S
18	Repairing weld defects on articles	3.70	3.15	0.46	0.91	2.20	S
19	Clearing off waste from work area	3.60	2.30	0.49	1.05	4.62	S
20	Appropriate storage of unused electrodes	3.80	2.90	0.40	0.94	3.67	S
21	Maintaining tools and equipment as required	3.50	2.75	0.92	0.83	2.17	S

Key

N1 = Numbers of craftsmen
N2 = Numbers of customer
S.D1= standard deviation of craftsmen
S.D2 = standard deviation of customer
t= t-test value of craftsmen and customer.
S= Significant.
NS= Not significant.

The analysis in this table 4: showed that the t-cal values of all the 21 items were below the t-cal except for 10 items 5, 8, 11, 15, 16, 17, 18, 19, 20 and 21. Therefore, the null hypothesis was rejected for each of the three items while it was accepted for each of eleven items. Hence the opinion of the respondents differed in three items but did not differ in eleven items in relation to the road-side arc welders on the competency of arc welding.

Hypothesis Two

There is no significant difference between the mean responses of the customers met at the various workshops of Suleja town, Niger state and the road-side arc welders on the needed improvement in the competency of arc welding.

Table 5:*t- test analysis of Craftsmen and Customer regarding the needed improvement in the Competency of Arc Welding.*

N1 = 10, N2 = 20

S/N	ITEMS	X_1	X_2	SD_1	SD_2	T-cal	Remarks
22	Install welding machine before welding	3.80	3.20	0.40	0.93	2.47	S
23	Use guillotines to cut metals	3.60	3.15	0.66	1.01	1.46	NS
24	Prepare edges for welding operation accurately	3.60	2.95	0.66	1.12	1.99	S
25	Weld with different welding positions	3.70	3.35	0.64	0.85	1.26	NS
26	Select appropriate electrodes for welding different kinds of metals	3.40	3.45	0.66	0.86	-0.18	NS
27	Have technical college certificate	3.70	3.60	0.46	0.80	0.43	NS
28	Have good maintenance culture	3.50	3.45	0.67	0.92	0.17	NS
29	Should be conversant with dangerous situations in welding shop	3.50	3.35	0.81	0.85	0.47	NS
30	Use overall and protective clothing during welding	3.80	3.50	0.40	0.87	1.29	NS
31	Use protective equipment like the helmet, goggles and face shields	3.80	3.55	0.40	0.86	1.09	NS
32	Have fire protection and extinguishers in their workshops	3.60	3.35	0.66	0.91	0.86	NS
33	Have the knowledge of the use of fire extinguishers	3.70	3.40	0.64	0.92	1.04	NS
34	Should wear overall when welding	3.60	3.50	0.66	0.87	0.35	NS

The analysis in this table 5: showed that the t-cal values of all the 13 items were below the t-cal except for 2 items 22 and 24. Therefore, the null hypothesis was rejected for each of the two items while it was accepted for each of eleven items. Hence the opinion of the respondents differed in two items but did not differ in eleven items in relation to the needed improvement in the competency of arc welding.

Findings

Based on the data collected and analyzed, the following findings were made according to the research questions raised for the study.

Findings related to the needed competencies of a roadside arc welder

1. Identifies and monitors work area hazards.
2. Identifies material resources required to satisfy job specification.
3. Determines correct sizes of materials in accordance with job specification.
4. Connecting welding machine to power source.

Findings related to the needed improvements of a roadside arc welder's competency for effective service delivery

1. Prepare edges for welding operation accurately.
2. Select appropriate electrodes for welding different kinds of metals.
3. Have technical college certificate.
4. Have the knowledge of the use of fire extinguishers.

Findings related to the levels of customer's satisfaction

1. Engages in after sale service (installation).
2. Perform home services.
3. Show different samples of their products to their customers to choose.

4. Enquire from their customers if their products satisfy the customers want.
5. Provides warranty services.

Discussion of the findings

The discussion of the findings are based on the research questions raised for the study.

The findings from table 1 indicate that required material resources are Identified to satisfy job specification which is in line with(welding information center. 2004)Before you weld, you first need to identify the parent material or metal is it high strength steels (either high or low alloy) or high carbon steels. But how do you tell the difference? There are couple of tests that can be used.

1. The magnetic test: if a magnet will stick to the material then it is likely iron-based. A magnet that will not stick indicates probably a manganese or stainless product.
2. Spark test: if you take a grinder to the material, do you get moderately large volume of yellow sparks with just few sprigs and/or forks indicating mild steel or yellow orange sparks, a few forks with intermittent breaks but few if any sprigs to indicated alloy sprigs, red sparks in large volume with numerous and repeating sprigs which indicates high carbon metal

Chisel test: help indicates the type of metal as well. If the metal fractures in large chunks when you take the chisel to it, this means you have cast iron, if the chisel yields a cork screw like shavings, you have a weldable steel

The findings also reveal Determines correct sizes of materials in accordance with job specification. According to Vtech Guides (1998) listed the following operational sequence:

- Consult work requirement from request/work orders
- Identifies and monitors work area hazards
- Identifies material resources required to satisfy job specification

- Obtaining quality materials in compliance with job specifications
- Preparing work area in accordance with job requirement
- Connecting welding machine to power source
- Selects suitable electrode in accordance with work requirement
- Inserting the electrode into the electrode holder
- Cleaning the work surface before welding
- Maintains a constant arc length required for welding
- Use of a uniform travel speed during welding
- Cleaning all welds with a chipping hammer and wire brush

The findings from table 2 indicate that the roadside arc welders should use overalls and protective clothing during welding which is in conformance with the Safety rules as stipulated by ShaikTq and Bhojani FA. (1991) for operators are given below: Overalls and protective clothing

- Spatter from the welding arc, ultraviolet radiation, and slag from chipping can all cause burns or health problems. Always wear industrial overalls and appropriate eye protection when you are engaged in welding and cutting operations. Keep overalls fastened up to the neck, with the sleeves down and fastened about the wrist.
- Wear gloves or gauntlets for arc welding, as protection against shock, burns and radiation burns. Various jobs may require additional protective clothing to be worn such as aprons, leggings, skull caps, and shoulder covers. Safety footwear, preferably boots, should also be worn, especially when heavy materials are handled.
- The employer has a duty to provide these items where needed, and the worker must wear them. All such items must be made of suitable flame-resistant materials.

The findings also revealed that Selecting appropriate electrodes for welding different kinds of metals. According to the American Welding Society (1986) has published Specification AWS A5.12-80 for tungsten arc welding electrodes that classify the electrodes on the basis of their chemical composition, size and finish in welding different kind of metal.

Briefly, the types specified are listed below:

1) Pure Tungsten, Color Code: Green, Used for less critical applications. The cost is low and they give good results at relatively low currents on a variety of metals.

2) 1% Thoriated Tungsten, Color Code: Yellow, Good current carrying capacity, easy arc starting and provide a stable arc. Less susceptible to contamination.

3) 2% Thoriated Tungsten, Color Code: Red, Longer life than 1% Thoriated electrodes. Maintain the pointed end longer, used for light gauge critical welds in aircraft work.

4) 5% Thoriated Tungsten, Color Code: Blue, Sometimes called "striped" electrode because it has 1.0-2.0% Thoria inserted in a wedge-shaped groove throughout its length. Combines the good properties of pure and thoriated electrodes.

5) Zirconia Tungsten, Color Code: Brown Longer life than pure tungsten. Better performance when welding with AC. Ideal for applications where tungsten contamination must be minimized.

Electrodes - Electrodes for gas tungsten arc welding are available in diameters from .010" to 1/4" in diameter and standard lengths range from 3" to 24". The most commonly used sizes, however, are the .040", 1/16", 3/32", and 1/8" diameters.

The findings also revealed that the respondents agreed with majority of the itemsin research question III which is in conformance with Hoppock, (1935) who indicated that satisfaction of the work of a craftsman arises from the satisfaction of the users (costumers) that actually consume or make use of the products made by the craftsmen, and the satisfaction of these costumers is

derived not only from the quality of the products purchased but also from some activities carried out by the craftsmen, such as: engaging in after sale services (installation), performing home service (repair works), show different samples of their products to the costumer to choose, attend to complaints of costumers.

The findings revealed that the respondents disagreed with majority of the items in research question III not in conformance with the Lawler (1968) suggested some activities to improve the satisfaction of costumers, such as: subsidies their products, offer some free minimal repair services, engages on community services, entertain their costumers and provide warranty services. With such activities the patronization of these craftsmen will increase thereby reducing the use of imported goods.

CHAPTER V

SUMMARY, CONCLUTIONS, AND RECOMMENDATION

This Chapter describes the Summary the study, Implications of findings, Conclusion, Recommendations and Suggestions.

Summary of the study

The main focus of this research study was to find out the job satisfaction and the needed competency in the improvement of roadside arc welders.

The statement of problem, purpose significance, scope assumption of the study research question and hypothesis were all stated, tested and discussed appropriately in line with the topic.

Three research questions were formulated for the study and two null hypotheses were also drawn. The target population for the study were arc welders and costumers in Suleja Niger State, 10 arc welders and 20 costumers were used as respondents for the study. The data for the study were analyzed by using mean, standard deviation and t-test. The null hypotheses were tested at 0.05, level of significance. The findings revealed that competency needs of arc welders will make improvements to meet with the costumer's needs and satisfaction.

Implications of the study and conclusions were also drawn from the findings and discussed. Recommendations and suggestions for further study were formulated and stated according to the findings of the study.

Implications of Findings

The findings of this study have far reaching implications on the government, local craftsmen, workshop owners and the public at large.

The study provides useful information about the needed competency of roadside arc welders. The study has also unveiled several ways improving the competency of arc welders for effective service delivery and job satisfaction. If these findings are sincerely accepted and actively implemented by the arc welders and workshop owners, it would imply an increment in

the skills of the arc welders and exposure to proper safety conducts (prevention of the loss of skilled manpower through death and injuries also prevent damages to equipment and materials in their workshops). It will also help the customers in quantifying the quality of the work offered by the welders so as to enable them choose the best among the roadside arc welders.

Conclusion

From the foregoing, it can be concluded that several needed competency for arc welding are adequately observe and effectively use. It is also concluded that several ways of improving the arc welding competency in workshop are numerous and if adequately utilized will increase the skills of arc welders thereby increasing their job satisfaction and that of the costumers that patronize them, since they will only be satisfied if their work is done to suit their needs.

Finally, it is concluded that roadside arc welders are competent in the use of welding equipment.

Recommendations

- Due to automation of modern technology, training and retraining of the arc welders and craft men on how to improve their practical skills should be made mandatory.
- Seminars and Workshops should also be organized by Governmental and non-governmental agencies for the arc welders and apprentice on potential hazard identification.
- Government should provide grants and subsidies the welding equipment and materials so as to reduce the cost of welding and welding products.
- The Consumer Protection Council should ensure that all products from the Roadside Arc Welders are up to standard and is satisfying the needs of the costumers.
- Broadcasting media stations should help in broadcasting industrial awareness on the importance of welding competences and of the route to achieve it.

Suggestion

- Evaluation of the effectiveness of the Roadside Arc Welders welding machines in Niger State.
- Assessment of safe work habit of workshop assistance in technical colleges in Niger State.

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APPENDIX II

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

PART 1

QUESTIONNAIRE FOR ASSESSING JOB SATISFACTION AND THE NEEDED COMPETENCY IN THE IMPROVEMENT OF ROAD SIDE ARC WELDERS IN SULEJA TOWN, NIGER STATE

INTRODUCTION: Please complete this questionnaire faithfully as possible and sincerely tick [√] the column that best represent your view about the above topic. The questionnaire is just for research purpose and your view will be treated confidentially.

INSTRUCTION; A [four] 4 point rating scale is used to indicate your opinion, tick the word which best describe your agreement as shown below;

Section 1 and 2 comprises of the following key below

HN - Highly Needed

MN - Moderately Needed

N - Needed

NN - Not Needed

Section 3 comprises the following keys below:

VHL - Very High Level

HL - High Level LL - Low Level VLL - Very Low Level

PART II

SECTION I

1. What are the needed competency of a road side arc welders?

S/NO	ITEMS	HN	MN	N	NN
1	Consult work requirement from request/work orders				
2	Identifies and monitors work area hazards				
3	Identifies material resources required to satisfy job specification				
4	Determines correct sizes of materials in accordance with job specification				
5	Obtaining quality materials in compliance with job specifications				
6	Preparing work area in accordance with job requirement				
7	Use of protective attire				
8	Connecting welding machine to power source				
9	Selects suitable electrode in accordance with work requirement				
10	Inserting the electrode into the electrode holder				
11	Setting the arc welding selector of the welding machine to suite the base metal				
12	Cleaning the work surface before welding				
13	Checking position and alignment of work piece				
14	Maintains a constant arc length required for welding				
15	Use of a uniform travel speed during welding				
16	Cleaning all welds with a chipping hammer and wire brush				
17	Inspecting weld for identifying defects				
18	Repairing weld defects on articles				
19	Clearing off waste from work area				
20	Appropriate storage of unused electrodes				
21	Maintaining tools and equipment as required				

SECTION II

2. What are the needed improvements of a roadside arc welder's competency for effective service delivery?

Arc welders should:

S/NO	ITEMS	HN	MN	N	NN
1	Install welding machine before welding				
2	Use guillotines to cut metals				
3	Prepare edges for welding operation accurately				
4	Weld with different welding positions				
5	Select appropriate electrodes for welding different kinds of metals				
6	Have technical college certificate				
7	Have good maintenance culture				
8	Should be conversant with dangerous situations in welding shop				
9	Use overall and protective clothing during welding				
10	Use protective equipment like the helmet, goggles and face shields				
11	Have fire protection and extinguishers in their workshops				
12	Have the knowledge of the use of fire extinguishers				
13	Should wear overall when welding				

SECTION III

3. What are the levels of customer's satisfaction?

S/NO	ITEMS	VHL	HL	LL	VLL
1	Engages in after sale service (installation)				

2	Entertain their customers				
3	Perform home services				
4	Subsidies their products				
5	Sale their products on credit				
6	Engages on community service				
7	Offer free repair services				
8	Show different samples of their products to their customers to choose				
9	Enquire from their customers if their products satisfy the customers want				
10	Attend to complaints from customers				
11	Provides warranty services				
12	Employs a sales boy/girl to attend to customers				