SKILLS NEEDS OF WOODWORK TEACHERS IN THE USE OF COMPUTER NUMERICAL CONTROLLED MACHINES FOR IMPROVING PRACTICAL PROJECTS IN TECHNICAL COLLEGES IN KADUNA STATE

BY

PAUL, Patrick Ogbeche

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

MARCH, 2023

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A RESEARCH PROJECT SUBMITTED TO THE
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
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IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF TECHNOLOGY DEGREE (B. TECH) IN INDUSTRIAL AND TECHNOLOGY EDUCATION

MARCH, 2023

DECLARATION

I hereby declare that this project has been conducted solely by me and that; it is the correct record of my own research work. It has not been presented for any award of a degree anywhere. All sources of information all acknowledged by means of books, journals and internet service or in the bibliography.

PAUL PATRICK OGBECHE **Signature & Date**
2016/1/63816TI

CERTIFICATION

This research project titled **"Skills Needs of Woodwork Teachers in the Use of Computer Numerical Controlled Machines for Improving Practical Projects in Technical Colleges in Kaduna State"** by **PAUL, Patrick Ogbeche** (2016/1/63816TI) meets the regulation governing the award of Bachelor of Technology Degree (B.Tech) in Industrial and Technology Education, Federal University of Technology, Minna, and is approved for its contribution to knowledge and literary presentation.

Dr. B.M Mohammed _____
Project Supervisor Signature & Date

Dr. T. M. Saba _____
Head of Department Signature & Date

_____ _____
External Supervisor Signature & Date

DEDICATION

I dedicate this work to God the source of life, the fountain of knowledge, my help and my refuge who is ever faithful and to my immediate family whose support cannot be quantified.

ACKNOWLEDGEMENTS

The completion of this project is by the will of God Almighty, on this note I will like to express my sincere gratitude to all the people that contributed towards the success of this project. My sincere thanks goes to the following people Dr. B. M. Mohammed my supervisor whom I have been consulting on how to go about the project, for his necessary advice, assistance and suggestion on this research work.

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ABSTRACT

The purpose of this study was to assess the skills needs of woodwork teachers in the use of computer numerical controlled machines for improving practical projects in technical colleges in Kaduna State. Three research questions and three null hypotheses tested at 0.05 level of significance guided the study. A survey research design was adopted for the study. The population for the study comprised of all the 43 woodwork teachers in the technical colleges in Kaduna State. A structured questionnaire consisting of 41 items was used for data collection. Data collected were analyzed using mean and standard deviation for the research questions while t-test was used for testing the null hypotheses. It was found from the study that six skills were not possessed by woodwork teachers in the use of computer numerically controlled lathe and grinding machine, while seven skills were not possessed in using computer numerically controlled milling machine. It was recommended that regular and systematic retraining should be organized for woodwork teachers who lack required skills in using these machines.

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CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

The manufacture of wood commodities in everyday use (furniture, decorative molding, cabinetry, recreational items, and others) requires a variety of woodworking machines to surface, drill, and shape wood into complex parts (Trela, 2018). In the past, parts were assembled largely by hand by a single skilled workman who carefully checked for dimensional accuracy at each stage until final assembly (Pedersen *et al*., 2016). By the mid-19th century, sufficiently accurate woodworking machinery was developed, thus eliminating the need to machine and assemble single parts by hand. Workers instead produced hundreds of identical parts which were later joined by others in a final assembly operation. This was the beginning of mass production, a precursor of automation (Groover, 2020).

Innovative automatic machines developed rapidly and by the turn of the century, woodworking machines could turn out thousands of identical parts with little human interaction. Productivity improved but the machines were limited in that they could only perform a series of sequential operations (Groover, 2016). Computer numerical controlled machines is a tool that can be used in woodwork to improve practical projects (Magrisso *et al*., 2018).

There are many forms of technology that can help in teaching woodwork trade. Tools such as education software program, drill-and-skills program, scientific calculation, interactive white board, projectors and computers (Obichukwu *et al*., 2021). Short coming lies in that same teachers lack knowledge of ideas of utilizing the technological tools to integrate technology effectively and sufficiently; hence, teachers need to obtain the knowledge and skills that would assists them in improving their skills in contemporary technology (Behera, 2012). Lee *et al*., (2017) stated that research on Technical Colleges and teaching has suggested for decade that

student's success and achievement are principally associated with the way teachers handle technological instrument.

If this is true then woodwork trade teachers are the key agent in bringing out reform towards technology integration. The effective preparation of teachers in the use of computer numerical controlled machines to teach woodwork trade in Technical Colleges in Kaduna state of Nigeria recognized as a vital factor toward student academic balance and success. In conjunction with the current curriculum, teachers are the key in assisting students to learn the required skills necessary to succeed ahead. Therefore, for the technical colleges graduate to be well trained in woodwork trade the teachers must have possessed the needed relevant skills for teaching the subject at the college level.

Technical skills refers to the ability to do something expertly and well (Oviawe and Uwameiye, 2018). According to Sasson (2018), to possess skills is to demonstrate the habit of active thinking and behaving in a specific activity in such a way that the process becomes a natural to individual through practice. More so, skills development is very important in harnessing nation's natural resources. Shabbir *et al*. (2018) defined skills as basic ability, by which man adjust to life.

A person's attitude and work functions are required and necessary antidotes suggesting the suitable skills performance and acquisition of some by going through a given work sample (Nnodim and Ogbuji, 2017). In the work place skills is what the workers give in exchange for numeration. If the skills (or the accumulation of skills popularly recognize to as aptitude or ability) given in satisfaction (Suweidu, 2019). The worker satisfaction and the employers get satisfaction in correspondence. This process if sustained culminates in promotion, retaining and prolonged tenure will lead to productivity (Suweidu, 2019).

On retirement from active working life, man's repertoire of skills will no longer be relevant to assist him to adjust to life. He needs new skills on how to enjoy his leisure and adjust in his new way of life. This situation is the same for handicapped persons. Hence, man's rehabilitation in these contents requires new skills with special consideration to his aptitude and work functions.

In this case of study, whole adjustment in the world of work will rest solely on computer numerical controlled machines skills improvement which will be used first at school and later at work (Luo *et al*., 2019). Therefore, Sara (2020) has shown how bending the policies, rules and regulation often lead to various acts of indiscipline among stakeholders in education which is based on the implementation stage of the school curriculum. This fact underlines the needs to focus on the skills of technical college teachers.

Okorie (2000) stated that, the developed technical schools always ensured well-being of their students through knowledge and skills pertinent to their times (Kardefelt-Winther, 2017). Yet schools are moving in a direction that needs high levels of skills (Ainscow, 2018). Therefore, Technical and Vocational Education and Training (TVET) should include both social and productivity skills to pave way for some teachers in Technical Colleges (Aridi, 2021).

The improvement of technical college teachers in skills is an essential function of educational institution. This made the government (FRN, 2004) stress that Technology Education through which practical and applied technical skills is to be acquired starting from technical colleges (Lee *et al*., 2018). Alayoubi *et al*., (2020) affirm that, technical college there being the starting point for whosoever wishes to receive technology education through which practical and applied technical skills is to be acquired.

Woodwork trade program is organized to operate on the objectives of developing, producing top quality engineering, technicians or engineering aids needed by woodwork industries. The

students that have completed the woodwork trade in Technical College level have an option of continuing their education into bachelor of technology degree in industrial technology. Once a graduate enters the workforce, the opportunities for advertisement are endless.

Federal Republic of Nigeria FRN in the National Policy on Education defined technical education as that aspect of education in which acquisition of practical skills as well as basic scientific knowledge (Fedorenko *et al*., 2019). Technical education program in Nigeria evolved in response to technological or industrial need of the people. It has received the support of Federal Republic of Nigeria in national policy on education FRN (Akanbi, 2017) as:

i. To provide trained man-power in applied science, technology and business particularly at craft and technical level.

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

iii. To give training and impact the necessary skills leaving for the production of craft men, technicians and other skilled personnel who will be enterprising and self – reliant economically. It is noted from the forgoing that technical and vocational education is all about skills acquisition necessary for the world work.

Technical teachers have to provide quality technological training that keeps pace with quality control in technology education, this means that technical teachers have to plan their lessons based on good instructional objectives as well as see the learner through practically. Smale *et al*. (2019) noted that for education to achieve national objective, it has to be more sensitive to societal problems and aspirations to play a greater proactive role.

Technical education is a major component of vocational education. The Nigeria research and development council (NERDC) (Boateng, 2012) stated that vocational education is the form of

education which is obtainable at the technical college's level. This is equivalent to senior secondary education but designed to prepare individual to acquire practical skills, basic and scientific knowledge and attitude required as sub-professional level. The technical college teachers according to Sjöström *et al*., (2017) must be versatile in their areas and in the general and science education course.

Federal Republic of Nigeria (FRN) in national policy on educational stated that from all indications, there is a lack of quality in technology teacher's training including woodwork teachers in technical colleges (Okwori *et al*., 2021). The insufficient college training in terms of technical skills required of the various areas in woodwork trade has deprived or constituted the apparent failure of the college products to secure paid employment after completion of their technology programs.

The needs to shift from mere acquisition of knowledge of the operation of engines, studying performance characteristic of components of woodwork computer numerical controlled machines and a lot of woodwork trade teachers in technical college, for instance, for a technical institution graduate who are prepared to teach at technical colleges to effectively stimulate the student into acquiring relevant skills to handle electrical/electronic equipment together with complexities in modern machines must be well, efficiency and trained.

1.2 Statement of the Research Problem

Every society needs efficient and well-trained workforce. The problems of technical college teachers in Kaduna state over the years, has to do with lack of practical skills and training. Ikeja (1995) stated that, theory is taught in woodwork trade classes more than practical. This makes graduates of woodwork trade to perform below average when employed in wood industry. Ikeja further explained that, most technical colleges do not have workshops let alone computer numerical controlled machines. It is however, a problem to note, that lack of adequate practical

skills by woodwork students may hinder their employability in any of the industry if they are to be tested based on practical skills.

The present problems now are that of shortage of facilities, equipment's and low level of competencies. Some of the teachers do not know how to use the CNC machines. Staff training and retention has been an existing problem in technical colleges in Kaduna state. The training of academic staff is ordinarily a continuous exercise to ensure consistent improvement in the quality of skills and output. Therefore, the teaching of this course requires teachers who can demonstrate competencies desirable for intellectual growth of student.

Bassu (1997) stated that most problems associated with teaching of woodwork trade is teachers lacking the ability to teach. Bassu further explained that these problems have given rise to inefficiency and inadaptability of technical education graduates in the worlds of modern Woodwork trade. Due to lack of modern Woodwork trade skills by teachers in technical colleges, the products of institution are being restricted in skillfulness, efficiency, proficiency and productivity. Hence the rate at which unemployment is increasing is very alarming.

However, if teachers should keep their knowledge and skills up to date by gaining better experience within their field and could teach effectively there is high probability that technical teachers and students will be familiar with, and acquire adaptability in the world. Therefore, it has now become necessary to examine these problems in great details with hope towards identifying possible strategies that can be employed to improving the use of CNC machines in practical projects when studying woodwork trade in technical colleges in Kaduna state.

1.3 Aim and Objectives of the Study

The main aim of this study was to assess the skill need of woodwork trade teachers in the use of computer numerical controlled machines for improving practical projects in technical

colleges in Kaduna state. The aim of the study was achieved through the following research objectives:

- To determine the skill needed for the operation of computer numerically controlled lathe machines by woodwork trade teachers in technical colleges in Kaduna.
- To determine the skill needed for the operation of computer numerically controlled milling machine by woodwork trade teachers in technical colleges in Kaduna.
- To determine the skill needed for the operation of computer numerically controlled grinding machine by woodwork trade teachers in technical colleges in Kaduna.

1.4 Significance of the Study

The findings of the study would benefit woodwork trade teachers, woodwork trade students, The Ministry of Education Niger state, curriculum planners, parents and guidance, woodwork trade industries as well as people and government of Kaduna state.

The findings of the study will provide information for woodwork trade teachers to improve their teaching to solve the current problem inherent in students' poor performance in woodwork trade and ways of improving woodwork trade students' performance at National Business and Technical Education Board (NABTEB) examination in Kaduna state.

On the other hand, the woodwork trade students would benefit from the findings. They will be able to overcome some of the difficulties encountered in producing woodwork practical projects. The students would as well acquire and develop the appropriate skill that would make them self-reliant, enterprising and improve their employability.

The Ministry of Education through science and technical schools' board would be more committed as a result of this study to the financing of technical colleges regarding the training of woodwork teachers to upgrade their skills. The Ministry would through the knowledge of the study supply qualified and competent teachers, and also provide adequate facilities for the execution of practical projects.

The result of the study will also provide information to curriculum planners on aspects of curriculum in woodwork practical projects that require improvement. Hence information will be integrated by the curriculum planners for the purpose of improving the skills of teachers in woodwork practical projects by updating the requirements of the woodwork trade curriculum for practical projects.

Moreover, parents and guidance will benefit from the findings of the study because when their children and wards are empowered with improved practical skills, they may be employed or establish their own enterprises and thereby take the responsibilities of some member of the family financially and otherwise.

In addition, the result of the study will be of immense benefit to industries by obtaining the skilled personnel that will facilitate the production of the industries in terms of woodwork practical projects. This would increase the productivity and marketability of industries and their products.

Finally, people and government of Kaduna state will equally benefit from the findings of this study by obtaining the desired skilled and professionally qualified woodwork trade teachers and graduates. This knowledge of the finds and their integration in the curriculum would eventually reduce the rate of unemployment in the society at large by increasing the living standard of the people. An understanding of the findings would also assist government in policy making and implementation about woodwork trade teachers and students in the states.

1.5 Scope of the Study

This study covered skills needed by woodwork trade teachers to operate computer numerically controlled machines for improving practical projects in technical colleges in Kaduna state.

1.6 Research Questions

- What are the skills needed for the operation of computer numerically controlled wood lathe machines?
- What are the skills needed for the operation of computer numerically controlled milling machine by woodwork trade teachers in technical colleges in Kaduna?

- What is the skill needed for the operation of computer numerically controlled grinding machine by woodwork trade teachers in technical colleges in Kaduna?

1.7 Research Hypotheses

The following research hypotheses (H_o) were tested in the study:

H_{o1}: There was no significant difference between the mean responses of woodwork teachers in urban and rural areas on the skills needed for the operation of computer numerically controlled Lathe machine

H_{o2}: There was no significant difference between the mean responses of woodwork teachers in urban and rural areas on the skills needed for the operation of computer numerically controlled Milling machine

H_{o3}: There was no significant difference between the mean responses of woodwork teachers in urban and rural areas on the skills needed for the operation of computer numerically controlled Grinding machine

CHAPTER TWO

LITERATURE REVIEW

2.1 Woodwork trade

Woodworking is the skill or activity of making wooden objects using wood. It is also referred to as the parts of a house or room that are made up of wood. The program in woodwork trade will give an individual best possible knowledge related to wooden materials and industrial production of wood items meeting up with the needs and expectations from the wood-based industry.

Combining the skills acquired with the specific knowledge in wood and wood technology, make the learner to become and attractive competence at the labour market. woodwork trade programme has a pronounced project-oriented profile in technical colleges. The teachers of woodwork trade trade in technical colleges have the train the woodwork students in both the theoretical studies as well as the more practical projects work.

This is due to the ever-increasing need for more advanced technology used by the industries to be competitive (Oztemel, & Gursev, 2020). According to Chinonso (2017), woodwork trade as part of vocational technical education is that types of training intended to prepare the students to earn a living in an occupation in which success id dependent largely on understanding of technology as applied to modern technology and design. This type of education provides skill, knowledge and attitudes necessary for effective employment in specific occupation (Helyer and Lee, 2014).

Woodwork trade in technical colleges therefore, involves the engagement of both woodwork teachers and students in theory and practical activities. In this respect, students will become familiar with main aspects involved in the design and development of new and existing

woodwork production based on costumer need, technology and processes. Teacher of woodwork trade in technical colleges should have the knowledge of a wide range of production machinery currently used in the advanced woodworking industry and modern woodwork trade hand tools.

Woodwork trade in technical colleges is viewed as a written course aimed to meet the need of a range of syllabus lacing emphasis on practical procedure added that woodwork trade is a versatile and career avenue (Carpenter, 2016). Students start to learn when they are involved in the learning situation. At present we have woodwork trade teachers who emphasize more on theoretical aspects in the woodwork shops with no emphasis on practical work due to lack of improved skills in practical projects.

This indicates that if woodwork trade course is well taught especially in terms of practical projects in technical colleges, many of the students graduating from the technical colleges will engage in woodwork related business or open their own woodwork shops instead of waiting for government work.

Umar (2014) discovered that more than 60 per cent of the staff teaching woodwork trade in technical colleges could not perform the skills or provide technical services they were expected to teach other despite their high-level paper qualification. This is of course due to lack of improved skills or non-skill acquisition from their respective institutions. Therefore, the development of woodwork trade in Nigeria technical colleges cannot be achieve without adequate, qualified and skilled woodwork teachers, modern tools and equipment as well as well facilities to enable our country achieve economic and technological advancement. But with prevailing problems of woodwork trade, its dependence as base for the nations progress cannot be reality in woodwork trade except quick steps are taken forestall it.

Code *et al.*, (2020) pointed out that teaching is a process of facilitating learning. Therefore, for effective teaching of woodwork trade to take place, it is considered quite appropriate that prospective teachers should interact with the prevailing teaching environment. This is due to the fact that the important of teaching woodwork in our technical colleges cannot be over emphasized, considering the unemployment rate in the country and the job opportunities offered by the woodwork trade. This indicates that woodwork trade in Nigerian technical colleges can also provide a better basis for educational and skills development for both the teachers and students respectively.

2.2 Advancement in Woodworking machines

Abbreviation CNC means Computer Numerical Control (computer numeric control), and refers in particular to the computer 'control' that reads the instructions of the production code and that moves machine tool. CNC is numerical control and it began to develop in late 1940s and early 1950s in company MIT Servomechanisms Laboratory in USA. The CNC was created from NC systems which already have been developed. First CNC systems used NC hardware style, and computer was used for calculation and sometimes for editing tool calculation. The use of punched tape as the transfer medium for G-code started in early 1950s until the late 1970s. Later it was replaced with floppies (disks), and finally today for those operations a standard computer network is being used. The first NC machines have appeared in the beginning of the 50s of last century in the US. The main objectives, which they wanted to achieve were:

- increase productivity,
- improve the quality and accuracy of production,
- reduce production costs,
- enable production of more demanding products, which otherwise can’t be done.

With the development of electrical engineering, especially electronics, machines are physically changed, offering greater processing capabilities. By adopting the highly automated CNC machines, speed and accuracy of production are being increased and production costs are lower. The great evolutionary leap was a switch from the NC control on CNC control, where the computer takes over the management. Compared to the manual machines, the advantages are enormous:

- simple modification and reparation of given task
- greater productivity
- great quality and accuracy of workpiece
- high flexibility in processing

Introduction of CNC machines radically changed the manufacturing. Curves is now cut out easily as straight lines, complex three-dimensional products (reliefs) are relatively easy to produce, and the amount of mechanical operations, which previously required considerable human labor, has dramatically declined - machines began to "work alone" and they are never tired. With increased automation of production with CNC machines also increased precision and quality of products. CNC production has reduced the number of waste and increase the speed and flexibility of production (flexibility - all can be done), the number of manual workers has decreased, and the need for highly educated professional staff has increased. In this way, the production costs are drastically decreased. Newer technology - cheaper production. In production environment, a series of CNC machines can be connected in one - the so-called CNC station. Today we can manage CNC machines with files from one of CAD software, starting from the design of product. CNC machines are in some way part of robot industry because they can be programmed to do many operations, just like a robots can. CNC machines can work during the night and weekends without the presence of people (Ran *et al*., 2020).

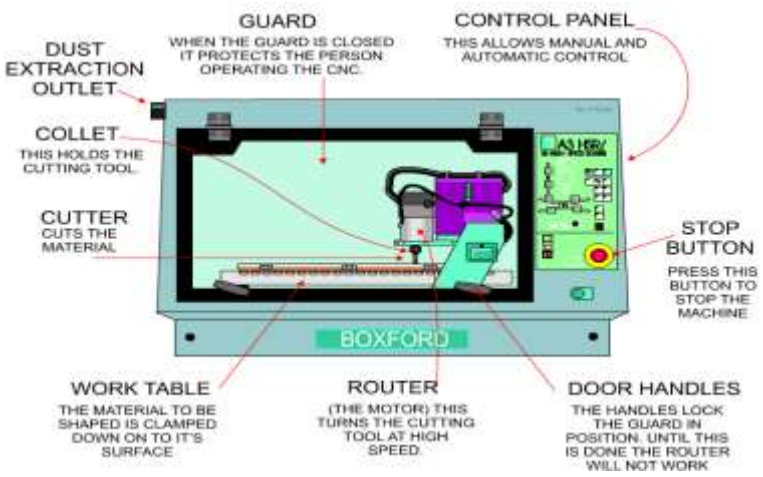

Figure 2.1 Example of CNC machine with its parts

As in every field of industry, even in the furniture manufacturing industry, efficiency is a key factor which affects the performance of the firm activity. As such, it is aimed to increase the efficiency of using the time of labor and raw materials. By “using of time of work in the manufacturing process” is intended to achieve that stage of the technological process where the coefficient of utilization of machinery to be in such values so the machinery doesn’t have idle time during working shifts and by “utilization of working time during the assembling process of finished wooden objects” is intended implementation of all necessary operations in such a way as to eliminate as many "minor works" of assembling from the assembling workforce. By “exploitation of raw materials” is intended reducing as much waste as possible (Wang *et al*., 2011).

The traditional production process and assembling of bedrooms include several processes as cutting, edge banding and fixing elements. Final assembling is a very long process in time, because the assembling workforce should carry out a series of measurements in a way such to achieve a accurate and qualitative assembling.

Today, with the introduction and use of numerically controlled machinery (CNC) many production processes in the wood processing industry including the production of bedroom

parts are revolutionized. Computerized numerically controlled (CNC) woodworking machinery can automatically control the movements of a spindle and table. Recently, CNC woodworking machinery has been widely introduced in wood industries for automatically cutting, drilling, and shaping operations (Raihan, 2018).

In a similar direction are moving also many wood processing factories in Albania. We have seen in the last years in the wood industry in Albania, investments mainly in 3-axis and less in 5-axis machining technology. 5-axis machining provides flexibility and efficiency that cannot be obtained with 3-axis milling, cause a 5-axis machine can produce parts with more complex geometry using a single setup without the need for complex and expensive fixtures. Such machines can produce special geometry, eliminating the use of specialized cutters often used in 3- axis machining (Obrovac *et al*., 2020). Realization of large volumes of work in pieces is an important factor in lowering the costs of productions, specially the fix costs, when the wood industry has the necessary large market to sell these quantities of products (Jåstad *et al*., 2019).

Technology educators worldwide have witnessed changes in students' interests, career goals, perspectives, and study habits. As well, colleges at all levels have put increasing pressures on faculty research productivity and have often sacrificed some scientific and technical detail to the point of alarm. This suggests that old pedagogies and traditional teaching approaches and even timber engineering education may not sustain through the next decade and beyond (Correa *et al*., 2019). These changes present challenges to the education in timber engineering but also the opportunity to choose a different path in an interdisciplinary setting. The process of bringing a building into being requires communication and collaboration between architects, engineers and builders. Problem solving is at the very essence of these professions in satisfying all regulatory requirements, performance criteria and economic constraints on any one project. Yet, at most colleges, collaborative learning is not a mandatory part of the education for any of these professions, and traditionally, engineering and design programs are worlds apart. But the

benefits of interdisciplinary learning - having students from diverse academic backgrounds work together in one class - are becoming well accepted. The design, build and technology professions have much to gain from the interaction of their students as it gives them invaluable experience and skills for their future careers, however the management and successful implementation of an interdisciplinary course, can often be challenging (Halberstadt *et al*., 2019).

Over the past few years, several courses and workshops that involved CNC technology combined students from the departments of wood science and civil engineering as well as from Architecture where they engaged in complex tasks to integrate the insights of their disciplines.

2.2.1 CNC machines for making wooden furniture

Computer technology is responsible for the revolution in the field of inventions and technology. It has made work faster, accurate and reliable. Now we can achieve all our ideas due to this technology. The wood working industry has also experienced amazing designs and fine woodworking patterns due to the blessing of computer technology. Now we can make any design with the help of machines. **CNC woodworking machines** have proved their worth. These machines are widely used in the wood working industry. CNC woodworking machine is managed by the control unit as well as CNC machines for wood processing, but differences are the following:

- Motors of CNC woodworking machines usually revolve at higher speeds than the CNC machines for metal, one of the reasons for that is because during the higher speed we get better quality of wooden products, and we get greater productivity
- A wood router is controlled in the same way as a metal mill, but there are CAM and CAD applications such as Artcam, Mastercam, Bobcad, and AlphaCam, which are specifically designed for use with wood routers.

Another difference between the CNC machines for woodworking and metalworking is their size. Size of CNC machines for wood is generally much higher than those for metal because of the products intended to be made of wood. These are for example products such as parts of beds, room closets, kitchen cabinets and the like. One of the most commonly used CNC machines are CNC milling machines and they can be divided on the basis of their working dimensions and it depends on which part of the furniture is produced at those mills, but rough division CNC milling machine to work dimensions is:

- small CNC milling machines: aerial dimensions to 400x400mm,
- middle CNC milling machines: aerial dimensions to 1200x1200mm,
- big CNC milling machines: aerial dimensions to 2000x3000mm.

Figure 2.2 CNC milling machines of different sizes

There are also universal CNC woodworking machines that are in the context of furniture used in the production of several different types of products. Such machinery should ensure that the switch from one type of treatment to another is easy and fast. Machines like that should ensure universal way of accepting or fixing workpieces and quick and efficient exchange more or less universal processing tools. Tools on such machines are usually used in more types of treatment. For example, a specific cutter can be used in processing the table legs as with processing the chair. In general, universal CNC machines can be easily adapted to the required process and desired product.

Figure 2.3Processing of parts on universal CNC machine

Figure 2.4 CNC machine for doors

Specialized CNC woodworking machines are facing production with usually one type of product inside which they can produce different types of products. Such machines have specific features, either in terms of approaches to the workpiece or the type of tools that are used. Generally it should be noted that the specialized CNC machines use a limited number of different types of processing. As an example of specialized CNC machines can be named those for the production of windows, door frames, machines for coating edges and others.

2.2.2 CAD/CAM software

Modern wodwork began to develop back in the 19th century under the influence of modernism in art and developed ever since. With the advancement of technology, woodwork design has progressed, and application of the above mentioned machines woodwork design has barely any limits. CNC machines allowed us faster production of furniture with less unused material and enable the production of complex furniture, and one of the best things is that we can first construct furniture in one of the CAD software. Most software packages is 3-D, because it is a new generation of CAD software packages for design. Engineers in this way can create virtual

models of their projects or products. This significantly speeds up the process of work, because they are able to control production and by using 3-D software we can drastically reduce the number of production errors, which may occur when viewing tolerance, which can significantly reduce production costs, because there is no large unused material, while design process becomes a competitive advantage. 2-D software can be effective when we produce parts that are not complex. Simple and easy we can convert an object into CAM. The most famous 2D software packages are: AutoCAD and MicroStation. The most famous 3-D software packages are: CATIA, Inventor, TopSolid, SolidWorks, Alibre Design.

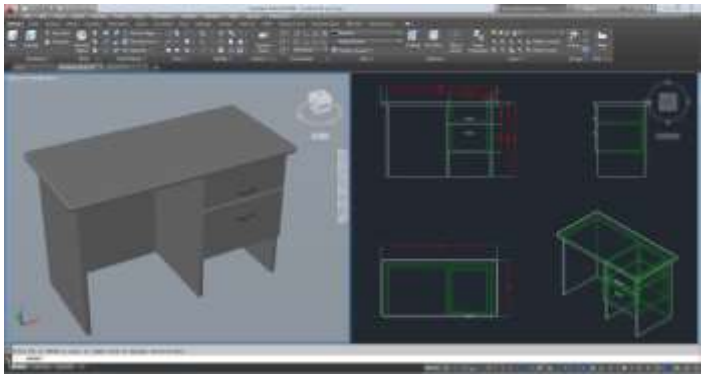

Figure 2.5. Example of drawing in AutoCAD

CAM is an acronym for computer-aided manufacturing / processing (Computer Aided Manufacturing). It was developed at the same time as the CAD. Sometimes CAM applications are integrated with CAD and that is a software package called CAD / CAM. Most popular CAD / CAM softwares are: ESPRIT, Surfcam, RhinoCAM, ArtCAM, AlphaCAM, SheetCAM. G-code is defined and generated by CAM software. G-Code is a simple text commands, which are used for understanding of CNC machines. It is good to know some basics of G-code, but with a good CAM software even that is not necessary. There are several versions of G-code, but all are very similar, various companies have they G-codes. For each of these codes it is required to have a post-processor or converter code. CAM software packages allow you to create the necessary "toolpath" in order to process the workpiece, based on the geometry

created in CAD software. By specifying, the tool path determines which tool is going to be used and how to use it. Post-processor has an inverter (converter), which converts "tooling" commands in the G-code. While the G-code is theoretical standardized, most of the machines has its own 'dialect'. In this way, machine manufacturers protect against competition. Today CAD / CAM software packages come with post-processors, which are translated into tasks and dialects.

2.2.3 Woodwork design

Contemporary is defined by the Oxford Dictionary as just “following the latest ideas.” That definition doesn’t adequately grasp contemporary furniture design’s essence. **Contemporary woodwork** also referred to as modern furniture or modern contemporary furniture is furniture that has been built after the 19th century. The modernist art movement has heavily influenced its design. Concepts from modernist art got directly translated into the furniture world. Instead of creating furniture that was substantially visual, furniture evolved into more simplistic visual designs. The furniture, as well as the area that it resides in, are used by contemporary furniture design as part of a home’s overall design theme.

Contemporary furniture started to emerge during the 1950s. At this time New York’s Museum of Modern Art made the decision to address the trend. An overall design theme is considered by contemporary design. It may be something that the future owner of the furniture is trying to accomplish. According to some writers, the form, texture and colors of the item should directly spring from whatever materials are used. Also, the design should combine the beauty of the materials with the utility of an object to present an item that is visually satisfying. It should be a simple design with no redundant materials and an apparent structure.

2.3 Technical colleges in Kaduna state

Technical colleges in Nigeria are the institutions that provide technical and vocational education at secondary school level. Technical colleges offer courses in technical areas, among

which are woodwork trade. Woodwork trade is the programme designed to produce woodwork trade graduates the necessary skills in production and maintenance of wooden products and components for the utilization of human and industries. However, technical college graduates are those who has successfully completed the programme. These technical college graduates need experimental skills that will enable them move from school to a relatively stable workplace. When employed in an industry, a graduate of technical college is expected to put into practice what his teachers taught him in the classroom under the supervision of woodwork trade industrial supervisor.

Teacher of woodwork trade is the one who teaches woodwork trade as a course in the technical colleges, on the other hand, woodwork trade industrial supervisor is the one whose job is to oversee and guide the work or activities of individual and group of workers in the industry (Ayeoribe, 2017). The programmes of technical colleges in Nigeria are classified as vocational education. FGN proved this assertion by stating that vocational education is that form of education which is obtainable at the technical colleges (Akanbi, 2017). The purpose or goals of vocational education (technical college programmes) in Nigeria according to FGN in the National Policy of Education are:

i. Provide trained manpower in the applied science, technology and business particularly at crafts and technical level.

ii. Provide technical knowledge and vocational skills necessary for agricultural, commerce and economic development.

iii. Give training and impart the necessary skills to individual who shall be self-reliant economically.

To ensure that those objectives are achieved, the Federal Government establishes the National Board for Technical Education (NBTE) to accredit the programme of technical and vocational

education and training (TVET). The NBTE defined accreditation as the recognition granted by a National agency (i.e. NBTE) to an institution or it's programme that has met the minimum national standard laid down for that for that level of institution or programme. The role of the National Board for Technical Education in ensuring standard in technical and vocational education in Nigeria is summarized by NBTE (2014) as follows:

a) General education, which accounts for 30% of the total hours required for the programme,

b) Trade theory, trade practice and related studies which account for 65%, and

c) Supervised industrial training/work experience which accounts for 5% of the total hour required for programme.

This indicates that there is a continuing need for highly skilled woodwork trade teachers in Nigerian technical colleges in the manufacturing trades of the woodwork.

Therefore, additional training opportunities should be made available for technical college teachers of woodwork in the safe and efficient use of a wide variety of modern hand and power tools as well as computer-controlled machines used to manufacture wooden products (practical projects).

2.3.1 Practical Projects in Technical Colleges

The term practical project is defined by Enamul Hoque (2016) as the level of proficiency on a specific task or limited group of task. It is also referred to as the manipulative skills that involve parts of the body. These definitions emphasized physical performances which are the performances that involve either the movement of the body or used of tools or objects to assist performance as the case in operating a machine. On the other hand, Nicholas and Steyn (2020) defined practical project as the term applied to any task that involves the construction of a products. It is a decision chain model consisting of three phases namely; initiation, execution and terminal result. It is also described as a method of instruction that enable students to acquire wholehearted purposes.

Emerging from these definitions, is the fact that woodwork trade practical project is a problem solving exercise that involves both process and product. The process component of the woodwork project involves imitating planning, and executions, while a students to solve a problem and the assessor (woodwork teacher) to observe the students and award marks. Thus the woodwork practical project is a problem-oriented assignment given to student that requires the use of knowledge and skills for solving it over a period of time. Therefore, it is clear that woodwork practical project skills in technical and vocational education are organized and coordinated forms of physical observable skills in the use of tools and equipment to perform task. Woodwork trade has a strong emphasis on the practical woodworking skills which make the course enjoyable and simulating by preparing students with the essential sills needed for employment in fine woodworking industry or eventually lead on to setting private woodworking business.

To gain more confidence with their practical skills according to Ofsted, students will also be taught at all of the associated knowledge required in this area which includes:

- Prepare drawings and cutting list, select, prepare and maintain tools and equipment, produce patterns and jigs, identify and select timbers and safely use woodworking machinery.
- Use all wood workshop tools to undertake practical tasks, construct range of joints, use of method to produce shaped and veneered parts, construct and assemble furniture project.
- Fit a range of drawer and cabinet hardware where necessary, apply moldings and finishes and make necessary adjustment to finish the piece.

All practical based woodwork exercises take place in fully equipped wood workshops. Therefore, students need to be encouraged to work towards the highest possible standard in craftsmanship and design. Practical project is exploratory and experimental in nature. It combines elements off techniques and standard practice with element of creativity. It allows learners to use variety of tools, equipment and materials as well as allow the learner to engage with modern technological advancement.

The aims are to enable the woodwork trade students to develop:

- Skills in woodworking and practical techniques.
- Skills in measuring and marking-out timber sections and sheet material.
- Safe working practices in workshop environment.
- Practical creativity and problem solving skills.
- Knowledge of sustainability issues in a practical woodworking context.

From the above aims, it is indicated that the course provide opportunities to develop and enhance psychomotor skills, practical creativity, practical solving skills on appreciation of safe working practices in a wood workshop environment and knowledge of sustainability issues in practical woodworking context. Hence, the activities also provide opportunities to build self-

confidence and to enhance generic and transferable skills in numeracy, employability skills, thinking skill, planning and organizing of work task, working independently and in collaboration with others.

Practical project in technical colleges is therefore a course that enables students gain knowledge in the art and crafts of woodworking, and provide basis and necessary skills for technological growth. The knowledge to be acquired is fundamental and will act as an avenue for continues growth during and after school. In view of the above assertion,

The aims and objectives are to develop student's knowledge, understanding, skills and values related to a range of technologies through the safe interaction with material, tools and processes in the planning, development and construction of quality practical projects. Therefore, the practical experiences will be enhanced throughout the designing, manufacturing, communicating, managing and evaluation of projects. This will make students utilize college workshops in order to product skilled and detailed projects.

2.3.2 Motivation as Means for Improving Practical Projects in Woodwork

Motivation could be referred to as the factors which move or activate the organism. Motivation has been called the "neglected heart" of language teaching. Teachers often forget that all learning activities are filtered through students' motivation (Aliyu, 2016). In this sense, Aliyu reiterated that students control the flow of the classroom; without student motivation, there is no pulse, there is no life in the class. In order words, motivation refers to something which the teacher does to boost the morale of students such as words of praise, smile performing of developing task, giving students recognition in the class, certification and cognitive interest stimulation. When motivating an audience, you can use general motivational strategies or specific motivational appeals. General motivational strategies include soft sell versus hard sell and personality type. Majority of new student orientation leaders at colleges of education and

universities recognize that distinctive needs of students should be considered in regard to orientation information provided at the beginning of the higher education experience. Crothers *et al*., (2020) raised the awareness of counselors and educators in this regarding.

All human behaviour appears to arise in response to some form of internal (physiological) or external (environmental) stimulation. The behaviors, however, are not random. They often involve some purpose or goal. It is often held that behaviors take place as a result of the arousal of certain motives. Thus, motivation can be defined as the process of activating, maintaining and directing behavior towards a particular goal (Aliyu, 2020). The process is usually terminated once the desired goals are attained by the person.

While thinking about motivation we often try to locate its source whether it is internal to the person or external to him or her. Undertaking a given task may be motivated by promise of a prize or some other kind of gain which is external to the task (Aliyu, 2020). Thus, the task is instrumental in receiving or gaining access to the external reward. In all such situations the locus of control is external to the person who is asked to undertake the activity. Such situations characterize the kind of motivation which is extrinsic. On the other hand, we have situations in which the source of motivation lies inside the task. In such cases we work because the task itself is interesting and does not require any external source of motivation. Aliyu (2020) expressed that the task is not instrumental in obtaining any external reward. The locus of control is inside the person. Person's involvement in the task is spontaneous and the task itself acts as its own reward. This situation represents intrinsic motivation such as a child's play, reading an interesting novel, writing a poem or a story.

It has been found that intrinsic motivation leads to high quality of work, meeting challenges, and pursuit of excellence. In fact, attachment with outcome often distracts the process or activity. This is why Indian thinkers realized the significance of non-attachment. It is the action

which is important and on which we have control and therefore we need to focus more and more on the action without bothering much about the outcome of action. In the modern life extrinsic rewards are being emphasized more and more and everything is becoming contractual. The exchange relationships are becoming central. This situation is creating many problems in personal and social lives of the people. It is therefore important to plan activities and organize relationships in such a manner that the task remains in the center of interest.

Motivated people are those who have made a conscious decision to devote considerable effort to achieving something that they value. What they value will differ greatly from one individual to another. There are a variety of ways to motivate people, including the fear of losing a job, financial incentives, self-fulfillment goals and goals for the organization or groups within the organization.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter focuses on the methodology used in conducting the study. They include; Design of the Study, Area of the Study, Population of the Study, Instrument for Data Collection, Validation, and Reliability of the Instrument, Method of Data Collection, and Method of Data Analysis.

3.2 Design of the Study

A survey research design was adopted for the study. According to Gall, Gall and Borg (Sileyew, 2019), a survey is a method of data collection using questionnaire or interviews to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized. Uduafemhe, (2019) describe descriptive survey research as a systematic means of data collection. This descriptive survey research design is considered suitable since this study will solicit for information from the woodwork teachers of selected Technical Colleges in Kaduna state for the purpose of generalization.

3.3 Area of the Study

The area of the study is Kaduna State. Technical Colleges in the state that offer woodwork trade were used for the study. Kaduna town is located about 782km away from Lagos, and is located between 100271N and 100 381 and 70 201 E to 70351 E. It experiences two climatic seasons, it has a rainfall season from April to October and dry season for the rest of the year. During the wet season between 1000mm to 1270mm of rain is recorded. The maximum temperature occurs in March to May which ranges between 33.4^0 C and 34.9^0C. The mean minimum temperatures are observed in December and January that records 19.1^0C to 21.8^0C.

The geology of the area is of basement complex and slopes downward toward the river. The topographical relief is relatively flat having an elevation of 607m height a.m.s.l. The vegetation of the study area is within the Guinea Savannah (Saleh, 2010). Kaduna metropolis comprises of Kaduna North and Kaduna South Local Government Areas and part of Igabi and Chikun Local Government Areas. However, Spatially, Kaduna covers an area of about 25km long and 8-10km wide from Kawo in the north to the oil refinery in the south (Maxlock, 2003). According to Olusimeka and Salim (2011), Kaduna is the fourth largest city in the country. It is also one of the most populous Millennium Cities and serves as the most important trade and transportation center in northern Nigeria after Kano.

3.4 Population for the Study

The population for this study were comprised of 43 woodwork teachers and instructors in the selected Technical Colleges that offer woodwork trade in Kaduna State.

3.5 Entire Population of the study

The entire population of 43 respondents drawn out from the schools was used for this study. Since the population is small, no sampling will be carried out.

3.6 Instrument for Data Collection

A structured questionnaire was used as the instrument for data collection. The response categories of the instrument are Very Highly Possessed (VHP), Highly Possessed (HP), Moderately Possessed (MP), Barely Possessed (BP) and Not Possessed (NP), which are assigned numerical values of 5, 4, 3, 2, and 1 respectively. The instrument will be subjected to face and content validation by lecturers from the Industrial and Technology Education, Federal University of Technology, Minna to attest the appropriateness of the instrument in measuring what it intended to measure.

3.7 Method of Data Collection

The questionnaire was administered through personal contact by the researcher, and some through emails to the teachers and instructors. The respondents were allowed a period of a week to fill the instrument, after which the researcher collected the questionnaire for analysis.

3.8 Method of Data Analysis

Data collected from the respondents was analyzed using mean to answer the research questions. In taking decision, any item with mean of 3.50 and above was regarded as Agree while item with mean less than 3.50 was regarded as Disagree. All the hypotheses were tested using t-test at 0.05 level of significance. If the t-cal is more than the t-tab, the null hypothesis was rejected; but if the t-cal is less than the t-tab, the null hypothesis was accepted.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Research Questions

Table 4.1

Mean and t-test Analysis of the Responses of Woodwork trade Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Lathe Machine

S/N	Item statements	X	Decision	X1	$S^2$1	X2	$S^2$2	t-cal	H_0
1.	Set the lathe machine cutting tool according to specification for the job to be performed	3.97	HP	4.04	0.87	3.83	0.71	0.71	NS
2.	Change the path of tool on the lathe for taper turning	4.20	HP	4.34	1.07	3.91	0.90	0.19	NS
3.	Insert thread cutting tool into the tool holders for different thread cut operation on the lathe	4.22	HP	4.21	0.90	4.25	0.62	0.11	NS
4.	Select suitable cutting speed for a particular size of material to be machined on the lathe	4.28	HP	4.34	0.77	3.75	0.62	0.30	NS
5.	Interpret technical and engineering drawing	4.11	HP	4.26	0.68	3.83	0.83	0.62	NS
6.	Install software from a CD	3.08	MP	4.21	0.79	3.83	1.02	0.22	NS
7.	Use keyboard appropriately	3.80	HP	3.56	1.23	4.25	0.86	0.71	NS

8.	AUTOCAD production of the specimen to be machined	1.36	NP	3.69	0.97	2.91	1.16	0.10	NS
9.	Knowing how to pick position points from the AUTOCAD drawing of specimen to be machined	1.22	NP	4.26	0.81	3.75	0.96	0.65	NS
10.	General knowledge of computer programming	1.06	NP	4.30	0.87	4.08	0.90	0.70	NS
11.	Recognize the computer numerical control codes	1.18	NP	3.39	0.73	3.42	0.67	0.04	NS
12.	Know the meaning of each code command	1.21	NP	3.60	0.76	3.33	0.92	0.57	NS
13.	Use the computer numerical controlled codes to write programs	1.09	NP	2.95	0.82	2.83	0.70	0.24	NS

Note X = Grand Mean; X1 = Mean of Woodwork trade Teachers in Urban Areas; X2 = Mean of Woodwork trade Teachers in Rural Areas; S^12 = Variance of Woodwork trade Teachers in Urban Areas; S^22= Variance of Woodwork trade Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H_0 = Null Hypothesis.

Data presented in Table 4.1 shows that the technical skills with mean values from 3.08 – 4.28 are possessed by Woodwork trade teachers while the technical skills with mean 1.06 – 1.22 are not possessed by Woodwork trade teachers in the use of computer numerical control lathe machine.

Table 4.1 shows that all the 13 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of woodwork teachers in urban and rural areas on technical skills possessed by Woodwork trade teachers in the use of a CNC lathe machine.

Table 4.2

Skill needed for the operation of computer numerically controlled lathe machines by woodwork trade teachers.

Table 2: Mean and t-test Analysis of the Responses of Woodwork trade Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Milling Machine

S/N	Item statements	X	Decision	X1	$S^2$1	X2	$S^2$2	t-cal	H_0
1.	Set the knee elevation on the milling machine	4.23	HP	3.17	0.76	3.33	1.70	0.34	NS
2.	Set the table elevation on the milling machine	3.72	HP	3.82	0.81	3.50	1.50	0.72	NS
3.	Select suitable cutting speed to suit the material being milled	3.52	HP	3.30	0.93	3.66	1.15	0.73	NS
4.	Set the feed rate to suit the material being milled	3.62	HP	2.47	0.74	2.91	1.44	0.85	NS
5.	Select milling cutter suitable for the surface to be generated	3.51	HP	2.39	1.30	2.75	1.35	0.76	NS
6.	Mount milling cutter firmly on the arbor or other holder available on the machine	3.68	HP	3.86	0.74	3.33	1.30	0.25	NS
7.	Determine the feed in relation to the direction of the cutter rotation	1.22	NP	4.26	0.91	4.16	1.16	0.25	NS
8.	Interpret technical and engineering drawing	3.50	HP	4.21	0.90	3.58	1.24	0.73	NS
9.	Install a software from a CD	3.31	MP	4.34	0.93	4.20	0.86	0.30	NS
10.	Use keyboard appropriately	3.54	HP	4.26	0.91	3.97	1.08	0.99	NS
11.	AUTOCAD production of the specimen to be machined	1.22	NP	4.30	0.87	4.08	0.90	0.70	NS
12.	Knowing how to pick position points from the AUTOCAD drawing of specimen to be machined	1.20	NP	4.34	0.93	3.91	1.08	0.22	NS
13.	General knowledge of computer programming	1.34	NP	4.00	1.00	3.83	1.14	0.43	NS
14.	Recognize the computer numerical control codes	1.14	NP	4.30	0.82	4.41	0.51	0.43	NS
15.	Know the meaning of each code command	1.28	NP	3.69	1.18	3.66	1.30	0.06	NS
16.	Use the computer numerical controlled codes to write programs	1.11	NP	4.08	1.23	4.16	1.11	0.18	NS

Note X = Grand Mean; X1 = Mean of Woodwork trade Teachers in Urban Areas; X2 = Mean of Woodwork trade Teachers in Rural Areas; **$S^2$1**= Variance of Woodwork trade Teachers in Urban Areas; **$S^2$2** = Variance of Woodwork trade Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H_0 = Null Hypothesis.

Data presented in Table 4.2 shows that the technical skills with mean values from 3.31 – 4.23 are possessed by Woodwork trade teachers while the technical skills with mean 1.14 – 1.34 are not possessed by Woodwork trade teachers in the use of computer numerical control milling machine.

Table 4.2 shows that all the 16 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of Woodwork trade teachers in urban and rural areas on technical skills possessed by Woodwork trade teachers in the use of a CNC milling machine.

Table 4.3: Mean and t-test Analysis of the Responses of Woodwork trade Teachers on Technical Skills Possessed in the Use of Computer Numerically Controlled Grinding Machine

S/N	Item statements	X	Decision	X1	$S^2$1	X2	$S^2$2	t-cal	H_0
1.	Select suitable grinding wheels for generating different shape on the grinding machine	3.71	HP	4.34	0.71	4.25	0.62	0.40	NS
2.	Sharpen the cutting tools correctly	4.45	HP	4.56	0.78	4.25	0.75	0.14	NS
3.	Grind all forms of cutting tools to specified shape and degree on grinding machine	4.40	HP	4.43	0.72	4.08	0.90	0.25	NS
4.	Interpret technical and engineering drawing	3.52	HP	4.17	0.93	3.83	1.26	0.90	NS
5.	Install a software from a CD	3.34	MP	4.26	1.05	3.91	1.08	0.90	NS
6.	Use keyboard appropriately	3.72	HP	4.13	0.91	4.25	0.45	0.42	NS
7.	AUTOCAD production of the specimen to be machined	1.31	NP	4.43	0.72	4.08	0.51	0.10	NS
8.	Knowing how to pick position points from the AUTOCAD drawing of specimen to be machined	1.04	NP	4.21	1.16	4.08	0.51	0.31	NS
9.	General knowledge of computer programming	1.30	NP	4.43	0.78	4.33	0.65	0.38	NS
10.	Recognize the computer numerical control codes	1.44	NP	4.78	0.76	4.41	0.51	0.87	NS
11.	Know the meaning of each code command	1.48	NP	4.47	0.94	4.50	0.52	0.07	NS
12.	Use the computer numerical controlled codes to write programs	1.09	NP	4.30	0.73	4.50	1.16	0.45	NS

Note X = Grand Mean; X1 = Mean of Woodwork trade Teachers in Urban Areas; X2 = Mean of Woodwork trade Teachers in Rural Areas; $S^2$1= Variance of Woodwork trade Teachers in Urban Areas; $S^2$2= Variance of Woodwork trade Teachers in Rural Areas; T-table = 1.56; NS = Not Significant; HP = Highly Possessed; MP = Moderately Possessed; NP = Not Possessed; t-cal = t-calculated; H0 = Null Hypothesis.

Data presented in Table 4.3 shows that the technical skills with mean values from 3.34 – 4.45 are possessed by Woodwork trade teachers while the technical skills with mean 1.04 – 1.48 are not possessed by Woodwork trade teachers in the use of computer numerical control lathe machine.

Table 4.3 shows that all the 12 technical skills items had their t-calculated values less than that of the t-table of 1.56. This indicated that, there was no significant difference between the mean responses of Woodwork trade teachers in urban and rural areas on technical skills possessed by Woodwork trade teachers in the use of a CNC grinding machine.

4.2 Discussion of Results

The findings of the study showed that six technical skills were not possessed by woodwork trade teachers in the use of computer numerically controlled lathe machine. This finding is in agreement with Miller (2006) who found out that, teachers of woodwork trade needed improvement in technological skills for teaching woodwork trade effectively in technical colleges.

Further, the results of the study also showed that seven technical skills were not possessed by teachers of woodwork trade in the use of computer numerically controlled milling machine. This finding is in agreement with Olaitan and Hassan (2010) who found out that woodwork trade teachers require skills in carrying out machine shop practices.

It was also found from the study that six technical skills were not possessed by woodwork trade teachers in the use of computer numerically controlled grinding machine. This is in line with Sowande (2002) that technological skill competence is required by woodwork trade teachers in the use of machine tools.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Based on the findings of the study, it can be concluded that woodwork trade teachers are deficient in some technical skills in the use of computer numerically controlled lathe, milling and grinding machines.

5.2 Implications of the Study

The implications of the study are:

1. **Improvement in practical skills**: The study can help improve the practical skills of woodwork teachers in the use of computer numerical controlled machines. This can help them to create more precise and accurate projects that meet the needs of the industry.
2. **Enhancement of technological skills**: The study can also enhance the technological skills of woodwork teachers. As they become more familiar with computer numerical controlled machines, they can better integrate technology into their teaching methods and create more technologically advanced projects.
3. **Increase in employability**: The study can help increase the employability of graduates from technical colleges in Kaduna State. As they are trained on the use of computer numerical controlled machines, they will be better equipped to meet the demands of the industry and secure jobs in the woodworking industry.
4. **Modernization of technical education**: The study can help modernize technical education in Kaduna State. As technology continues to advance, it is important for technical colleges to keep up with the latest advancements to provide students with relevant and up-to-date skills.

Overall, the study has important implications for the woodworking industry in Kaduna State and can help improve the quality of technical education and training provided to students.

5.2 Recommendations

Based on the findings of the study, the following recommendations were made:

- Woodwork trade teachers should be retrained on those technical skills that they do not possess in the use of computer numerically controlled lathe, milling and grinding machines.
- Technical skills that were not possessed by woodwork trade teachers in the use of computer numerically controlled lathe, milling and grinding machines should be integrated into the curriculum of woodwork trade in Teacher preparation institutions such as colleges of education and universities.
- Government and employers of woodwork graduates should donate modern machine tools to various technical schools in Kaduna state
- Woodwork trade teachers that are well experienced in AUTOCAD and programming should be employed by government to teach in technical schools.
- Government and administrators of technical colleges should organize seminar and workshop for woodwork trade teachers on technical skills in the use of computer numerical control lathe, milling and grinding machines.

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