

**BAMBOO TECHNOLOGY AS A SUSTAINABLE
VOCATION FOR SENIOR HIGH SCHOOL
VISUAL ARTS LEAVERS**

BY

JOHN BOATENG, B.A (ARTS), HONS

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DECLARATION

I have declared that, this thesis is my own work towards Mphil, and to the best of my knowledge, it contains no materials previously published by another person or material which has been accepted for any other award for any degree in this university. Except where due acknowledgement has been made in the text.

Boateng John (No. PG1775207)

(Student's Name & ID)

Signature

Date

Certified by:

Dr. Mariama Ross

Supervisor's Name

Signature

Date

Certified by.

Dr. Joe Adu Agyem

Head of Dept.

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ABSTRACT

The Objectives of this project are to identify interested group of Senior High School leavers and train them how to design and construct bamboo artifacts to make them self-reliance.

Many Senior High School Visual Arts leavers have the problem of practicing what they were taught in School, partly because, some were not equipped with the requisite skill needed to enable them establish themselves in any of the aspects in visual arts. Some also find it difficult to acquire the raw materials necessary for the production process. This plight makes them unemployed hence increasing dependency ratio and also defeating the vocational objectives of the Education reforms of the Government in 1987. The project aims at giving the needed skills and potentials to Visual Arts leavers such that they will be able to design and construct bamboo artifacts that will meet market standards. Another aim is to use bamboo technology to teach Visual Art leavers to be self-employed. The project also seeks to create awareness in Art Education that bamboo grows fast; it is cheap to grow as a glassy material. Simple tools are used in its construction. Many beautiful items can be produced out of bamboo due to its versatility.

Finally, it would also create the needed awareness for the existing materials in Art Education and institutions of learning.

The research method used is action research. The research tools employed are interview guide, observation and photography.

The findings of the research will help in the promotion of bamboo technology in Art Education.

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KNUST



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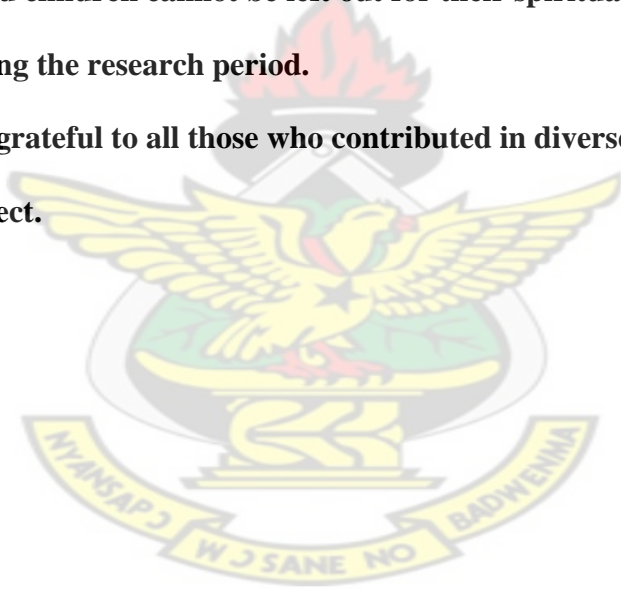
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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Unemployment has become a problem over the years, to the Senior High School Visual Arts Leavers. Graduates complete the three year programme all right, yet most of them are unable to practice the art programmes they undertook in school. This is so, partly because the materials that are involved in the production of art pieces in some of the art areas are sometimes difficult to come by. Classical examples are found in the areas of metal, sculpture etc. With the proliferation of computers, greater level of practical skill of leavers has been taken away from them in some art areas like graphic design and others.

Bamboo as a grass is almost found across the country. It grows very fast on many types of soils. It is cheap to produce. Varieties of beautiful items are produced out of it. It is a material that subjects itself to preservation. Unlike wood, simple tools are used in its processing.

Research acknowledges the fact Ghana boasts of seven known species of bamboo. These are bambusa bambos, bambusa vulgaris, bambusa var vitata, dendrocalamus strictus, bambusa arundenacea, bambusa multiplex, and bambusa pervariabilis. Among these, bambusa vulgaris is the indigenous of the species to the soils of Ghana.

However, bamboo in the country presently, have not been well managed, so most of them in the stands have no economic value.

It is upon this background that the research seeks to bring to light that, an economic value can be put to this material.

1.2 Statement of the Problem

In 1987 the Government of Ghana had to restructure second-cycle education realizing that the five years secondary school leavers were not getting employment as envisaged,

hence the new Education Reforms: This was invariably, geared towards the psychomotor skill development thus equipping the student with vocational/technical training. The underlying objective was to ensure that senior high school graduates become self-reliant, thus to forestall rural urban migration.

Yet the system of Education did not train them as programmed. And these graduates troop into the cities seeking for job opportunities which are woefully non-existent.

They thus, end up selling dog chains and trifles in the street.

One specific group that is seriously affected is those who study visual Arts. There are several problems that characterize that education system in the Senior High School.

The following are some of the reasons why design skill training has not been possible:

- a} Absence of qualified vocation teachers
- b} Inadequate tools and materials
- c} Absence of adequate workshops
- d} Large class number

The purpose of this study is to design a programme for bamboo technology suitable for Senior High School Leavers. Bamboo is in abundance, it grows faster than wood, it is easy to come by, simple tools are used in its production and variety of beautiful products can be made from it.

1.3 Research Question

When a group of Senior High School Leavers is trained in bamboo technology, is there any possibility that, they should have a job oriented skill to be self-employed ?

1.4 Objectives

The project seeks to:

- a) Identify an interested group of Senior High School Leavers.
- b) Write syllabus for bamboo production training.
- c) Train a group of Senior High School Leavers how to design and produce simple bamboo products.
- d) Evaluate fully the outcome and make suggestions to Ghana Education Service.

1.5 Research methodology

Action research was employed for the study.

1.6 Research Instruments

The following tools will be used.

Observation

- b) Evaluation of the course

1.7 Delimitation

The research is centered on the identification of Senior High School Leavers in Assin Foso District and training them bamboo technology to be self-employed.

1.8 Limitation

The researcher encountered a lot of problems in his study.

- There was the difficulty in the identification of visual art students in the area.
- There was the problem of getting them in a group for the training.
- Learners were occasionally given transportation fares to come to the training center.

1.9 Importance of the study

- The project will be useful for bamboo technology to be taught in Senior High Schools.

- The learners in bamboo technology will be self- employed.
- It will promote and provide valuable information on bamboo technology.
- The research will increase knowledge in education in general.

1.10 Available facilities/ sources of information

- a} KNUST Libraries
- b} Ashanti Libraries[Centre for National Culture]
- c} INBAR
- d} BARADEP
- e} Bamboo and Rattan Laboratory of Forig
- f} Forestry Services
- g} Assin Fosu Bamboo Factory
- h} Bamboo Factory { KLL }
- I} Bamboo Growing Areas { Assin Fosu, Bosomtwe Kwawoma,Dunkwa }
- J} Ghana Education Office { District Office }

1.11 Definition of Terms

For the purpose of this research, some technical terms used in the text are explained as follows.

1. Bamboo Culm: A stem of a bamboo plant.
2. Artifacts: An object that is made by a person (man made) For example, an art work.
3. Concave: A surface shaped inward curving like the inside of a bowl.
4. Composition: To put things or ideas together.
5. Column: A vertical division of a page

6. Evaluation: The ability to judge the worth or value of something based on some criteria.
7. Skill: this involves demonstration of manipulation ability to carry out practical operation.
8. Profile dimensions: It is the abilities expected of a student having gone through a period of instruction.
9. Epidermis: The outer part of bamboo culm.
10. Lumen: The concave inner part of bamboo.
11. Node. It is the jointed part of bamboo pole
12. Dehairing. The process of removing the hairy part of bamboo.
13. Groove. It is the indented lines carved on bamboo poles.
14. Facet. This is a half piece of a ring.
15. Laminated Bamboo: It is bamboo strips glued together to a board.
16. Splits and slivers: They are the prepared strips of bamboo used for lamination.
17. Lacquering : This is the process of putting lacquer on bamboo products to make it shining .
18. Cross Iron Splitter: A simple set of device used for splitting bamboo.
19. Delimbing : A process of cutting branches from bamboo culm.

1.12 Abbreviations

- 1.12.2 S.H.S : Senior High School.
- 1.12.3 V.E.T: Vocational Education Training
- 1.12.5 C.T.E: Carrier and Technical Education

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The following sub- topics are going to be considered under the literature review.

- Vocational Education
- Unemployment Effect
- What is technology?
- Bamboo Defined
- Brief History of Bamboo
- Bamboo Requirement
- Species of Bamboo in Ghana
- Traditional Uses of Bamboo Production
- Contemporary Bamboo Products
- Design
- Product Development

2.1 Vocational education:

Wikipedia encyclopaedia defines vocational education “as a technical education as a learner directly develops expertise in a particular group of techniques of technology”.

It is also looked at as Vocational Education and Training (V E T) also called Career and Technical Education (CTE) which prepares learners for Careers that are based in manual or practical activities, and totally related to a specific trade, occupation or vocation, hence the term in which the learner participates.[[Http://en .wikipedia .org](http://en.wikipedia.org)]

Generally, vocation is an occupation for which a person is suited, trained or qualified (wikipedia encyclopaedia)

It is also the inclination to undertake a certain kind of work. It is often in response to a perceived call or inner instinct. The idea of vocation is central to the Christian belief that

God has created each person with gifts and talents oriented toward specific purposes and a way of life.

Martin Luther taught that each individual was expected to fulfill his God-appointed task in every life. Although the Lutheran concept of the calling emphasized vocation, there was no particular emphasis on labour beyond what was required for one's daily bread.

Carlyle (1843) (p.42) would proclaim "The latest Gospel in this world is "know thy work and do it"

In view of the fore-going, each person is indeed imbued with specific hidden talents and gifts that need to be developed. The implications are that not all persons can be useful to their communities when educated to be academicians but the specific talent if found and trained through vocational education will ensure the application of psychomotor skill of the Senior High School (S.H.S) leavers.

[Http://en.wikipedia.org](http://en.wikipedia.org) (VET) has it that up until the end of the twentieth century, vocational education focused on specific trades such as craft, leatherworks and was therefore associated with the activities of the lower class. "As a consequence, it attracted a level of stigma."

Vocational education is related to the age-old apprenticeship system of learning. However, as the labour market becomes more specialized and economies demand higher levels of skill, government and businesses are increasingly investing in the future of vocational education.

This serious investment in vocational education should be done right at Senior High School, with the aim of developing skill of students who can be useful to the economy in times of vocational and technical need. Vocational education has been diversified over 20th century and now exist in industries such as information technology, traditional craft and cottage industries.

Amenuke, et al (1991) (p.1) explain the basic reasons for visual arts education, stated that: “visual art with reference to education foster creativity by helping individuals to think, act and feel creatively. It also educates the whole person, that is, head, hand and heart. Promoting qualities of citizenship desired in an artist”.

But can we say that, the Senior High School (S.H.S) students experience all those good things of vocational education? There are a whole lot of serious problems facing the S.H.S student. A problem that really does not let the psychomotor skill development of the S.H.S leaver be felt in the society. (Ulbricht, 2001)

The idea of a vocation being an occupation for which a person is suited, trained or qualified is in a way defeated. For S.H.S visual arts student faces the plight of unemployment and cannot be self-reliant, (Day,1972)

Ulbricht, (2001) opines that the “art teachers often ignore teaching about careers in art for a variety of reasons. To him some teachers find that they are too busy. Some think that vocational education is not appropriate for the age of their students, while other teachers believe that it is beyond the scope of art education.”

Klar, Winslow and Kinby, (1933) explain that, in 1899, National Education Association’s Committee of Ten on Drawing USA, outlined objectives such as “to prepare students for industry is purely incidental” and “the development of professional artists is not the aim of art education.”(p.27) But then in the 1850’s, William Minifie of Philadelphia and later Water Smith of Boston, saw art and specifically drawing as an aid to industry. [Ulbricht]

Later, after the economic crash of 1929 and the great depression of the 1930s, Haggerty (1935), then Dean of Education at the University of Minnesota, advanced an applied art focus for art education. In Haggerty’s Owatonna project, the curriculum included design instruction for vocational education.

Haggerty's project had a positive public support since it was perceived to have practical benefits for everyone. Although not stated as a goal of art education, many elementary and secondary teachers continue to prepare students as potential artists in spite of the fact that some former students initially found it difficult to support themselves.

Geahigan (1981) an art educator, found that only 40 US school art programmes that emphasized Career Education in 1980. Since that time, it appears that education about and for careers in art have not been a major concern of authors whose work appeared in Art Education.

Advanced students who have learned a lot about art often have little knowledge about an art career. To keep students from becoming discouraged or making inappropriate career decisions, art teachers should help students to see how they leave school. (Finnie, 2001)

According to the US Bureau of the Census, there were 1.8 million artists in the United States in 1990, a 127% increase from the previous Census of 1970. With the rate of increase in art employment, one can assume the number of employed artists that will continue to expand in the future. (Geahigan, p.37).

We can infer from the following views of the writers that vocational education should rather be given a paramount attention in every country, because it supports the economic, industrial and technological framework of the country.

Most of the advanced nations have attained their advancement partly due to judicious policies on vocational Education (Vocational Education Training International). <http://en.wikipedia.org/wiki/vocational-edu> 2003.

In Australia vocational education and training is mostly post-secondary and provided through the Vocational Education Training (VET) system by registered Training organization. (<http://www.Training.com.au/aqtt> 2007).

In Finland, the vocational education belongs to the Secondary education. After the nine-year comprehensive school almost all students choose either “Lukio” which is an institution preparing student for tertiary education or a vocational school whose curriculum is work oriented. (Brodhead,.2000)

In Germany a law (the Berufsausbildungsgesetz) was passed in 1969 which regulates and unifies the vocational training system. In 2001 two-thirds of young people aged under 22 began vocational training and 78% of them completed it.

New Zealand is served by 4 Industry Training Organizations (ITO). The unique element is that ITOS purchase training as well as set standard and aggregate industry opinion about skills in the labour market (<http://www.itf.org.nz>).

In the United States, junior high schools and high schools have offered vocational courses such as wood, metal, drafting, leather. Federal involvement is principally carried out through the Carl D. Perkins Career and Technical Education Act.(Pekins,2002)

The critical pedagogical perspective of Joe L. Kincheloe indicates that vocational education has often reflected the perspective of dominant political economic power, working more in their interest than in the needs of vocational education students. And that, too often, vocational education became a marker of “academic failure” rather than ticket of good paying, high status jobs (Kincheloe, 1999)

In United Kingdom the government has introduced new funding under the “Train to Gain” contract and the Leitch Review 2006. Vocational Education should not abandon measurable objects which lead student to job competencies in favour of career education. Edwards T. sources Evaluation of Research in Education 1998 vol. 12.

Based on the above examples it seems clear that vocational education is equipping the working force with the necessary know how for economic purposes.

Thus, vocational education should not be sidelined in our education system so that the requisite training given to S.H.S leavers will suffice to give the student technical / vocational skill to fulfill the national development goal and also to be self-reliant.

2.2 Unemployment

According to Nutifafa (1986) Unemployment could be voluntary or involuntary. Involuntary unemployment arises where able people actively looking for work at the going market rate are unable to find one. Voluntary unemployment is the situation where labour on the other hand, refuses to give off its services even though it can be employed at a going market rate. (p.142)

www Politicses :uk / issue describes “unemployment as an economic indicator that refers to the number or proportion of the people in an economy who are willing and able to work but have no jobs to do.” Some people in the present times are not well trained for skills and that are not absorbed into their appropriate area of proficiencies.

Beardshaw, [1998] defines unemployment as the state in which a person is without work. He distinguishes among four major types of unemployment – frictional, structural, seasonal and technological.

He refers to frictional unemployment as, when the people are displaced by the normal working of the economy. It is inevitable in a growing economy that people will, from time to time, change or lose their jobs or look for a new job. Since this procedure may take some time it is also referred to as search unemployment.

By structural unemployment, he describes it as the result from the change in the structure of the economy ; for example ,it could be the result of the imbalance caused by the decline of one industry and hopefully the rise of another. Beardshaw continues that seasonal unemployment occurs because some jobs are dependent upon the weather and the season. (p.643)

Beardshaw,[1998]explains technological unemployment as that which occurs when improvement in technology reduce the demand for labour, and it is often regarded as a form of structural unemployment .The spinning jenny for instance, allowed one person to do the work previously done by 100 (p.644)

According to Walstad, (1993) it is obvious supply point side that improving the quality of factor inputs should improve productivity and output. These schemes to train and retrain labour must have beneficial effects upon the economy. The result of better trained labour should be to shift the demand curve as it becomes more productive. Governments during 1980s introduced many training schemes such as TOPs [Training Opportunities Programme] YOPs [Youth Opportunities Programme] All these are worth noting because most of the measures described above are designed to improve labour market flexibility ; that is the ability for workers to move easily and speedily between different tasks and jobs.(p.74-75)

Steinbeck,(1939) gives an accounts on what he saw about unemployment in New York in 1939 as, they scampered about looking for job. They swarmed on the highways. The movement changed them; the camps along the road, the fear of hunger changed them. The children without dinner changed them. The endless moving changed them. (p.329)

The fore-going implies that unemployment puts economic pressure on the unemployed. There is the need for the S.H.S students to be given a vocational training so as to equip them with the necessary skill to be self-employed.

Steinbeck further indicates that, work satisfies many needs. For individuals it satisfies the need to exercise their faculties and to participate in the collective work of society. It also gives them a claim on social products enabling them to support themselves and their families. From the stand point of the community, therefore, one can conclude that work is necessary for the survival of the human race and of its civilization.

For the purposes of the current study, unemployment will be described as the total number of people regarded as looking for job but not finding one in the mist of abundance. This may happen when the individual has not acquired the requisite skill to explore around a certain vocation to be self-reliant.

The plight of the Senior High School leavers is that there is no competency based training offered them to be self- employed. They become aggressive after school yearning for job but in vain. They are thrown to the street laying hand on any opportunity not gainful enough to sustain them, let alone contributing to economic development by selling dog chains.

From an interview granted the Minister of Youth and Employment, Prof. Fobi (2006) unemployment situation in Ghana, he explained that the National Youth Employment (NYEP) has employed 100,000 youth. (TV3).

He said emphatically again that, a good number of jobs await the unemployed but until they are given vocational training they cannot fill the remaining vacancies. (Fobi)

From the above information, we can see that unemployment prevails in a situation where the people have no vocations.

Since the beginning of the Industrial Revolution people have feared new machinery, would lead to unemployment with machines replacing people in their work in the Secondary Sector in the United States. This reached its peak in the period from 1920-1970 (Encyclopaedia Britannica 15th edition 1984 p.864). The implication is that technology can take away the work of people from their hands.

But it must be known that vocation establishes one firmly in an economically viable venture, because vocation controls the economy of a country. There is a category of Visual Art Students who leave Senior High School and do not find jobs commensurate with their education because they are not trained to use the available resources to satisfy their wants and needs.

To forestall any future occurrences of unemployment, bamboo technology as a vocation can be a means to equip S.H.S Leavers to be self-sustainable and self-reliant

2.3 Unemployment effects

Taylor [1988], stipulates that, the unemployed suffer a loss in self-esteem. That, researchers have found that, unemployment appears to link to variety of affliction; a greater incidence of heart disease; suicide; mental illness; and crime. It also imposes a cost on the economy in the distribution of national cake and also a loss in taxation (p. 392).

Hall (1988) argues that, one of the most important questions in macro economics is why the economy does not provide work for the entire labour force? People are interested in working and are available for work, but have not found jobs. The unemployment rate is the percentage of the labour force that is unemployed. And the labour force is defined as the a number of persons 16 years of age or over who are either working or unemployed.(p.392).

These are the caliber of people in the S.H.S. The implication is that, where these students are not given the requisite skills, they go out unable to fix themselves in any job even if some exist.

2.4 What is Technology?

According to Encyclopaedia Britannica (15th Edition, 1984, vol.18) Technology is a combination of the Greek *techni*, ‘art, craft,’ with *logos*, ‘word, speech,’ meant in Greece a discourse on the arts both fine and applied. When it first appeared in English in the 17th century, it was used to mean a discussion of the applied arts only, and gradually these ‘arts ‘ themselves came to be the object of the designation. By the early 20th century, the term was coming into general usage and embraced a growing range of means, processes, and ideas in addition to tools and machines. By the second half of the century, technology was defined by

such phrases as “the means of activity by which man seeks to change or manipulate the human environment.”(p. 21)

It further explains that, ‘Technology includes the use of materials, tool, techniques, and sources of power to make life easier or more pleasant and work more productive.

Whereas science is concerned with how and why things happen, technology focuses on how things happen. Technology began to influence human endeavors as people began using tools, and accelerated with the Industrial Revolution and the substitution of machines for animal and human labour’.

World Book Encyclopaedia (Vol.19), describes “Technology as the ways people use in their inventions and discoveries to satisfy their needs. Ever since people appeared on earth, they have had to work to obtain food, clothing, and shelter..” Through the ages, people invented tools, machines, materials and techniques to make work easier. The encyclopaedia further states that: “Many people call the age we live in the age of technology. Yet people have always lived in a technological age to obtain most of life’s necessities and many of its pleasures. Technologies thus include the use of both primitive and highly advanced tools and methods of work. (p.76).

False,(1993) postulates, that technology is all around us .It is part of our daily lives. Technology is the way people use resources to meet their wants and needs (p. 20). False continues to highlight that, people have invented refrigerators and stoves to meet needs for storing and cooking. People have invented beds to meet their comfortable sleep. They have invented cars, buses, trains, and planes to meet their needs to move from one place to another. How many other examples of everyday technology can you think of?

Feldman, (1990) has it that, the technology people create change lives. He distinguishes five separate categories of technology namely construction technology, manufacturing technology, transportation technology, biotechnology, combined technology, and

communication technology (p.10) All these technologies require special skill to get into it. Pierce (1993), reiterates that ,technology involves turning natural items into useful products. What technology isn't is, the use of natural items like trees, plants, rocks, sand, and even water. These are in themselves not technology.

But people take those natural materials and turn them into useful products. Bamboo is turned into lumber to make house and furniture. Special rocks like iron ore turned into steel and sand can be changed into glass. Pierce continues that, technology is the practical use of human knowledge(p. 3).

Invariably, the lives of Senior High School art students can be changed when special skill in bamboo technology is given them.

2.5 History of Technology

False,(1993) opines that, technology has been around as long as the human race.

When we think of modern technology, we often think of computers, complex machines, and space shuttle.

However, people have to find ways of solving problems and meeting needs, in other words, develop technology, way back in the Stone Age (beginning around two million years ago). People were making tools out of natural materials like stone, wood, and bone. In the bronze age (beginning around 3000B.C), people learned how to make bronze out of copper and tin. Using this technology, they could make better tools. Collins continues that, in the iron age (beginning around 1200 B,C.) people learned how to mine and use iron which is harder than bronze, and improve their tools even more .

That, as people began to farm land to provide their food, they developed technologies like ploughs, carts, and carriages, and the western wheel to help them plant, harvest, and prepare their food.(p. 22)

The foregoing is an indication that, simple tools and equipment can be developed even into more complex ones in the space of time, as bamboo technology is taught as a vocation in the Senior High School.

2.6 Bamboo Defined

Farrelly, (1995) introduces us to the oldest and the most remarkable resource on the planet.

The book of bamboo shows us how this versatile wood which is both sustainable and plentiful has been used for thousand of years to make items ranging from things needed for survival like clothing and housing to more exotic and luxurious objects like phonograph needles and children's toys as well as dozens of others.

Farrelly further tells us about the plants biology and life cycle. He gives tips on harvesting and planting and more about the ancient wood. Farrelly conveys the rich and timeless message on bamboo being strong, flexible and beautiful in both its natural and its finished states.

The New Oxford Dictionary of English, (1998) also defines bamboo as a giant woody grass which grows chiefly in the tropics.

Although forest areas in many countries have drastically decreased areas under bamboo, cultivation have progressively increased by almost three fold each year.

Gnanaharan (1997) stated that at present, the total bamboo growing areas of the world are up to 22million hectares. The science and technology content in the bamboo industry is steadily increasing and breakthroughs have been achieved in bamboo cultivation, processing and utilization.

The New Encyclopaedia Britannica (1984) states that, "bamboo is any of the tall grasses comprising the subfamily Bambusoideae of the family poaceae."

Bamboo therefore is a tall plant of the grass family. Due to its hollow form it is relatively strong and stiff. It can be cut and split with simple tools because of its stiffness and solid

culm or stem. Bamboo has age-old connections with fishing, paper-making, land scaping, gardening, handicraft, the fine arts and poetry.

Victor Cussack, Deidre Stewart (2000) communicates to us of “knowledge both scientific and practical to those with little knowledge of the fabulous clumping bamboo of the world. The western world is not yet taking clumping bamboo serious.”

Most Asian countries have these tallest growing varieties in abundance. Bamboo feeds them, houses them and shades their environment. It is used to make their musical instruments, cooking and eating utensils, furniture, hunting weapons and ceremonial artifacts. It even provides the reinforcement for their concrete roofs. Bamboo provides their carrying and storage baskets, lamps and lampshades, ropes and strings, roof tiles, hats and has hundreds of other practical and spiritual uses. Bamboo world distils simple practical advice using bamboo for wealth of applications. It draws on both traditional village technology and modern scientific research.

Trier, (2006) Bamboo is one of the fastest growing plants on the earth, easy to harvest, alternatively flexible or stiff (depending on the location). It is used in diverse ways as flooring, building, furniture aeronautics and high-end racing bikes. Bamboo a dynamic material has many uses across the design spectrum. Harry Van Trier was trying to explain the fact that bamboo is a good material for landscape and garden design.

According to Taschen, (2006), quite apart feeding pandas and making a yummy addition of many Asian dishes, bamboo is also used as a building material and also for decorative purposes.

The culms are extremely sturdy and lend themselves to a multiple of uses. Stinger Ban for example, found a way to create lumber from laminated woven bamboo for a house he designed in Beijing. Other houses show of bamboo in more straightforward way, lining the ceiling or floors with stems or even forming walls. Bamboo is also used to construct

furniture. Taschen captures the many uses of bamboo in houses throughout China, Japan, Indonesia etc.

From the fore-going definitions, it comes to light that bamboo has several capabilities and possibilities. Therefore can be used in the production of several products from ordinary to meticulous and that when S.H.S leavers are exposed to the genuine method of production can have a vocation with cheaper and faster source of raw materials.

2.7 Brief History of Bamboo

Perhaps, one of the greatest break throughs in sustainable development in recent years, is that bamboo has a bright future as a naturally beautiful and incredible durable material.

JMX Bamboo Homepage (2006) informs us that there are well over 1,000 species worldwide with several hundred available mainly in the tropical and sub-tropical areas.

Bamboo has been used in China for over 5000 years, the earliest history of bamboo used in the entire world. China is known as the kingdom of bamboo because she has most of the bamboo of any country in the world. More than 400 species of bamboo, one-third of all the known species in the world, grow in china.

The oldest archeological finds of bamboo articles in China were unearthed from the remains of a primitive society that existed some 7,000 years ago in what is now Hemudu, Yuyao country Zhe Jiang Province.

As early as the Shang Dynasty (16th – 11th Century BC), the Chinese used bamboo for making household articles and weapons such as bows and arrows, rafts, hats, rain capes and shoes. Bamboo shoots were eaten in a popular dish because of its crispness and freshness, sweet taste. Bamboo shoots also contain vitamins, sugar, fat, and protein, JMX Bamboo Homepage,(2006).

Before paper was invented, slips of bamboo were the most important writing medium. More widely used than silk, for example, they were cheaper, resistant to corrosion and more

abundant. Bamboo has thus played an important part in the spread and development of traditional Chinese culture.

Zhu Zhaohua (1998) stipulates that, the fast growth and strong regenerating capability of bamboo help to draw attention in countries where the plant grows, resulting in the building up of industry based on bamboo. This point is pertinent to the report because it supports the fact that a vocation in bamboo technology is sustainable.

Most bamboo produce flower and the classification of bamboo are not entirely satisfactory. One fascinating fact about bamboo is that soon after flowering many of the species die. They grow in single season from a mass of root and underground stem rhizomes as do many of the grasses. These culms or stem when they emerge from the ground are just as large, (Zhu Zhaohua, 1998).

According to Recht (2001) bamboo range from ground cover bamboo that will reach several inches at maturity to giant bamboo that can reach over 100feet in the tropics and from quick spreading species to clumping types that expand outward only a few inches a year. Some types of bamboo thrive in that hot, humid rainforests while others are cold hardy, surviving in temperatures as low as 20 degrees Celsius.

Bamboo comes in many colours, sizes and textures. Bamboo is a grass that has many different varieties.

It is native to most parts of the world, including U.S.A, China, Malaysia, South Africa etc. Bamboo is a fastest growing plant. Some varieties can send new shoots up out of the ground at a rate of over 1 foot per day.

There are two basic types of bamboo. They are the running (spreading) and the clumping (non-spreading). The clumping bamboo remains in a tight bunch of culms (stalks) with the addition of new culms. The bunch gets larger each year. It expands at a rate of a few inches per year. The running bamboo is an excellent screening plant that will spread quickly and densely fill an area.

Recht continues that, the annual global output of bamboo pulp has exceeded two million tons; over hundred kinds of artificial bamboo boards have been developed. These new dimensions in the study of bamboo are necessary to this report. The environmental applications of the ecological benefits of bamboo are actively activating bamboo groves for conserving water, protecting soil against erosion, protecting water-sheds, guarding against natural disasters or promoting eco-tourism.

Invariably, the brief historical background will enable the researcher to compare the characteristics of varieties of bamboos and where they could be located and the requisite treatment and uses. (p.30).

In *Ornamental Bamboos* by Crompton (2006) bamboo cultivation technologies, such as laws governing heredity and heteromorphosis and biodiversification of bamboo and fast reproduction and cultivation of bamboo have found extensive application, with regard to the processing and utilization of bamboo.

The areas of application are steadily widening. For example paper-making technology using bamboo is near perfection. (p.27)

2.8 Structure of bamboo

In the fibres of *Dendro calamus strictus* and *D. Longisparthus*, it has been shown that the refractive indices of the outer wall Lamella is parallel and perpendicular to cell length. They are correlated that not only with cell length, but also with the density of the whole wall.

The indications nevertheless are still that, there is variation of the cellulose microfibrils. There is however a subsidiary effect of factors associated with density, (Prestones and Singh 2001 vol. 3, p.162).

Bamboo consists of rhizomes, culms, branches and leaves. Culms are that part between two nodes. The outer layer has a compact structure, the smooth surface and the tough texture. The outer surface of bamboo is coated with wax which protects the surface quality.

Jayanetti and Follett (1998) explain that “the tensile and compression strength of outer-layer of bamboo is greater than the layers which can reach one and half strength of steel”.

Bamboo membrane is found in the inside layer of bamboo wall which has a light yellow colour.

The inner cortical layer lies between the outer layer and membrane and it consists of the vascular bundle canal and fibre. The usefulness of this part is greater and that is the main material of bamboo appliances. The tensile strength of young bamboo is low but gets sturdy as it grows older due to this moisture content.

Bamboo dries off its water content when kept in the open air and it shrinks in different directions. Bamboo drops its 95% water content to 65% within 60 days under gas drying. Such situations in bamboo reveals to the researcher as the processes to go through after harvesting fresh bamboo before usage. (pp.4 -7).

2.9 Bamboo Requirement

Sheers (1998) postulates the fact that bamboo is harvested feasibly from October to December of the lunar calendar year. Since bamboo is quite dormant during this period, and felling does not damage too much of the rhizomes and bamboo shoots.

Bamboo harvested within this period contains less nutrient as such are not eaten by worms. This period is recommended for harvesting, (p.12).

Bamboo experts have the saying that, “Do not harvest bamboo in spring and tree in summer” No shoot produced as a result of the last rains may be cut. The shoots of bamboo thrive well from February to May every year. Shoots may be cut only at a height of 150-300mm above the ground. Cutting may not be allowed in two operations, (Inbar, 2003)

The information given about bamboo requirement equipped the researcher to be certain of the exact period for harvesting bamboo for processing.

2.10 Species of bamboo in Ghana.

Bamboo in the country presently, have not been well managed, so most of them in the stands have no economic value. There is the need to facilitate the establishment of more nurseries and encourage establishment of plantation (Besona,2001).

However, bamboo grows predominantly in areas of heavy rainfall. Such growing areas are Central Region, Brong Ahafo Region, Ashanti Region, Volta Region and Eastern Region.

Baah (2001) acknowledges the fact that Ghana boasts of seven known species of bamboos. They are bambusa bambos, bambusa vulgaris, bambusa var vitata, dendrocalamus strictus, bambusa aroundinacea, bambusa multiplex, and bambusa pervariabilis. Bambusa vulgaris is the indigenous of the species to the soils of Ghana.

Bambusa Valgaris is one of the bamboo species found in Ghana. It is yellowish and green. It grows to average height of 2400cm and to about 12mm diameters (see plate 1)

It has a high nutrient level and that makes it susceptible to worm destruction. Anku Gollo(1984),Bambusa var vitata (yellow bamboo) is common in Ghana and can be easily propagated. A study conducted on this particular bamboo shows a very low resistance to biological deteriorating agents or pest and fungi. though like all other bamboo varieties bambusa var vitata has within its structure starch, wax, gum, and lignin which give strength to the material. The presence of sugar makes the material prone to insect pest.

Because the sugar content is on the high side making the bamboo sweet and attractive to pest.

Bambusa bambos

Bambusa bambos or Bambusa aroundinacea is regarded one of the bamboos that have some level of resistance to pest attack Studies have shown that this variety grow straight and they are the choice by most craftsmen in artifacts production. These types are commonly found around water bodies. Bambusa bambos has low sugar content due to its large culm size. The size enables for processes like lamination into boards for paneling and joinery.

Dendrocalamus is another species found in Ghana. This species is identified as male Bamboo in India. The branches are curved with very thin leaves. It grows to about 80-100feet high (Baradep, 2001).



Plate 1. *Dendrocalamus* species / *Bambusa var vitata* species

Oxithrianthera abyssinica is yet a species on Ghanaian soil. This species is found to grow in the dense clumps to the height of 1200cm. It has long culms. It is used for shelter, hedges and serves as wind break. Because of its heavy thicket, it is difficult to penetrate.

According to Amoako (2007) (Forig, bd Fumesua), *Bambusa arundinacea* thrives well on Ghanaian soils. It also grows to a considerable height of 72feet to 900feet. The internodes or culms measure, 30cm to 46cm with the diameter of 3cm to 8cm. It is rather difficult harvesting *Bambusa arundinacea* due to its thicket with spines.

Marcelo (2003) mentioned two species found in Ghana *Bambusa guadua* and *Bambusa striata* (*Bamboo cramineae*). They are species found in Japan and China, indeed, they are of tropical species. They are erect, strong standing plant that grows to height of 450cm with pendulous stem, which are yellow and green and are densely crowded together.



Plate 2. Species of bambusa aroundinacea found in Ghana

The fore-going information helped the researcher to identify variety of species of bamboos grown in Ghana.

2.11 Traditional uses of bamboo in Ghana

Bamboo is used for purposes that do not require much durability. This is due to its relative short span. According to AnkuGallo (1984), the culms are used whole or split halves for fencing and temporal roofing; seats fixed to the ground; handicrafts such as spoons and cups made for serving palm wine. Sharp spikes made from the split culm for removing snails, sticks for roasting of kebab. On farms, bamboos are used as props to support plantain and banana stems, as climbing poles for yam stems and other creeping plants; as protective baskets (kono) for storage of kola-nuts. Fishermen use it to trap fish. Canoe operators also use the long poles to push canoes over shallow waters. For flutes (Dr. Ephraim Amu) used bamboo for different kinds of flutes and other wind pipe musical instruments.

2.12 Contemporary Bamboo Products

Bamboo stands a great possibility of being fashioned into several products across the design spectrum. Because of this dynamic nature of the material, attention must be directed towards its development.

Amin (KLL) outlines a wonderful and remarkable variety of products ascertained from the golden grass.

Some classical examples of the modern items of bamboo are; rings, chains, pens, bangles, picture frames, pendants, book covers, mirror frames, jewel boxes, key holders, fan, buttons, wall vases, flower vases, tooth picks, watch straps, cups, spoons, book ends, waste paper basket and a lot more.

The Department of Integrated Rural Art and Industry, KNUST, explore very much in the production of bamboo products. The department has a strong feeling for bamboo. That bamboo is a remarkable material that has a bright future.

Steiner (2006) opines that, bamboo products even though are easily produced, they have to undergo special preservation and treatment for durability to worth its competitiveness and price.

He describes bamboo products as being quality and also a vocation that leads to sustainability which is a solution to unemployment.

Baah, (2000) describes bamboo technology as a field of magnificence. That, the aesthetic value of bamboo products is rather high and appealing to all. According to him, bamboo produces a wide range of products that can support a big market. If the government should give a special vocational training on bamboo to people more especially at Senior High School level, the nation will derive benefits.

From this information, the researcher thought strategically as how to train some S.H.S Leavers in bamboo technology to become self-reliant.

2.13 The concept of curriculum

The term “curriculum” is said to have initially come from the Latin word “currere” which means “the course to be run”. The origin of the term, which also means “to run a course”, is supported by a brief account of Oliva (1992). He narrates that Julius Caesar and his cohort (B.C) had no idea that the oval track upon which the Roman chariot raced would bequeath a word used duly by educators 21 centuries later. The track curriculum has become one of the

key concerns of today's schools and the meaning has expanded from a race course to an abstract concept. This excerpt implies a track, a set of obstacles or tasks that an individual is to overcome. Something that has a beginning and an end, something that one intend to complete, (p.4).

Schofield, (1992) also explains that whatever the origin of the term, the concept of curriculum has come to associate with many other terms. It implies content, aim, training, worthiness, and culture. However, the term that comes most readily to mind when the term curriculum is used is "content". Content is variously defined as subjects, projects, areas of study and terms, which raise the issue of teaching methods. This, too, is closely connected with the concept curriculum, (p.123).

2.14 Curriculum Development Process

As part of the objectives of this study, the S.H.S. Leavers ought to be trained skills in bamboo technology. In view of that, a well structured curriculum needs to be developed to stipulate the course content of the discipline.

Mensah (2003) asserts that, there are several views that people uphold about curriculum. Some of these views look as if curriculum is limited to schooling alone. Some people maintain that it is the central process in education. Curriculum, from the perspective other people look at it, as a field of study whereas others term it as an instructional programme or course to study,(p.64).

Shiundu and Omulandu, (1992) opine that curriculum is a discipline of a field of study. Its distinguishing mark is that knowledge, which comprises it, is instructive. (p. 22).

Curriculum as a discipline has also developed and adopted methods of inquiry. Its content can be organized for instructional purposes.

Curriculum theory addresses the question of what should be taught in school or any institution. As there is too much knowledge, what should be included in the school curriculum and should be left out. There must be enough justification for whatever goes into

the curriculum. For instance, when we say that we must teach bamboo technology in Senior High Schools in Ghana, we must provide a rationale for decision. Another pertinent and related question curriculum theory poses is ‘who should be taught what?’ This has to do with characteristic relating to age, background, interest, and present or future role of the people in society.

Shiundu and Omulando continue that education should develop one’s potentials fully and makes one a functional member of society. Many scholars have attempted to provide a set of principle, concepts, ideas and methods which serve to define the nature and scope of curriculum as a field study. They deal with objectives, learning activities, organization and evaluation. Bamboo technology can measure up to these four basic elements should Ghana Education Service adopts it to be taught in the Senior High School. Around these four basic elements the following issues and ideas have developed. The issues and ideas according to Shiundu and Omulando; *ibid* (p. 23) are {a} the significance of the philosophical, political and social context within which the curriculum decision for bamboo technology are made. Curriculum objectives must be formulated and all the subsequent steps directed towards the achievement of those objectives

{b} The importance of the human element in the process of bamboo technology curriculum planning. Objectives and instructional activities must be based on the need of the society and individuals therein and on the educative process.

{c} The problem of selection. The subject matter, learning experience and materials for bamboo technology instructions must be selected, organized and administered in accordance with the set objectives.

{d} Knowledge of the learner and the learning process is vital.

{e} Bamboo technology curriculum, content and process. The curriculum content and process should be assessed and the result appraised.

{f}Provision of the curriculum. Since revising of the curriculum is a perennial task, all steps in the bamboo technology curriculum process must be continuous.

For a clear understanding of the curriculum process, the term Curriculum Design and Curriculum Development are explained further.

2.15 Curriculum Design

The term curriculum design according to Shiundu and Omulando (1992) refers to structure, pattern or organization of the curriculum. It is a set of abstract relationship embodied in the materials and learning activities of a course in use.

In other words, it is the way in which the critical variables of the subject matter, learners, teachers and the environment or social surrounding have been arranged in order to enable visual arts schools to formulate feasible daily and weekly schedules.

Thus the role of the curriculum developer is to tell what the content of a curriculum planning. Basically curriculum design aims at identifying and collective components of the plan of instruction.

2.16 Curriculum Development

This is the most common term used under which all processes and activities of the school curriculum are subscribed.

To some people, the term is synonymous with curriculum studies and to others it is the same as curriculum planning

To say that curriculum development is synonymous with curriculum studies would be exaggerated, while to contend with that it is the same as curriculum planning, and that would be to underestimate the scope of curriculum development.

Shiundu and Omulando (1992) contend that curriculum development is a process which involves the interpersonal dynamics of decision making. Unlike in design the focus in development is on the people and the operative procedures out of which the design or plan instructions emerge. Curriculum development does not necessarily precede design in a linear fashion. Instead the two enterprises overlap and occur conjunctively.

A distinction between design and development of curriculum is that the design is a substantive entity which can either be conceptualized or written down and which one can single out and say this is our curriculum, whilst curriculum development is the process or activity of arriving at or producing a design.

For the purposes of this study, curriculum development could be summarized as the planning, implementation and evaluation of the programme. It is the process which will determine how bamboo technology curriculum construction will proceed. It involves decision making on the various issues.

Usually curriculum development will address specific questions such as

- Who will be involved in the curriculum construction?
- What procedures and strategies will be used in curriculum construction relating to administration, committees training panel consultancy and others?

The process is practical and judgmental. Considerations on factors related to the teacher, the learner, the school, the society and the physical environment have to be looked into. Usually, curriculum development will address specific questions such as: who will be involved in the curriculum construction? What procedure and strategies will be used in curriculum construction relating to administration, committee training panel, consultancy and others? How will the committee or panel be organized? How will the curriculum be implemented? How will the worth of the curriculum be evaluated. Having explained the term curriculum design and curriculum development it becomes clear that a curriculum is developed to solve

educational problem. But in solving education problem, the choice of solution depends on a number of factors such as the philosophical view of education held by the society relevant educational philosophies and psychological approaches for solution or direction. The solution finally selected must satisfy the philosophy of the society. To develop a sound curriculum of bamboo technology for a nation, therefore, depends on certain significant factors that must be considered. The factors are:

- (1) The philosophy of the nation
- (2) The education policy of the nation
- (3) The educational objective of the nation
- (4) The concept of curriculum
- (5) The foundation of curriculum
- (6) Models of curriculum and
- (7) Patterns of curriculum

2.17 Design

According to Amenuke et al (1999)., design refers to a plan within a work of art. It is the organization, arrangement or composition of a work. This means that design can be considered as a process or as the result of a process. (p. 32). When a designer plans a work, he puts together certain qualities such as dot, line, shape, texture, and colour. These qualities may be called “elements”. It is the relationship of that the viewer sees. Elements of design are the basic parts or qualities of a design. They are sometimes referred to as element of art when they are used to describe a work of art. Basic elements that are commonly used in art are: dot, line, shape, texture, space, plane, volume, and mass, colour (value, tone, and pattern).

Amenuke et al., continue that, the structure of the work of art, being it drawing, painting, carving, or basketery is based on the organization of elements of design according to certain

principles. Some of the principles are: variety, unity, harmony, rhythm, balance, contrast, repetition, opposition and dominance. In nature, we observe order in the structure of tree branches, leaves, flowers, fruits, and seeds. Similarly, the arrangement of patterns, colours, textures and tones on plants, objects and animals show evidence of variety, harmony, unity, balance and other principles of organizing a design. (pp.40-41). From the foregoing, to bring artistic bamboo products to the admiration and comfort of the people, one of the vital activities to undertake is design. Bamboo culm should be designed first before construction. Design technique is a prerequisite that ought to be grasped by the S.H.S. leaver to make him a unique artist.

2.18 Visual design

Karwatka (1993) explains that, in order to communicate a message effectively using art media, the visual design is extremely important. Visual design refers to how something looks. Do people find it appealing? Does it capture your attention? Does it communicate the idea well? Each of these questions refers to the visual design of the product. They are important questions to consider when designing an art piece. Certain designs seem to catch attention better than others. (p. 198). He elucidates that; designers must consider how a design will be used. They must think about the function of the design. Does it need to appeal to young people or old people? Manufacturers can have an impact on the effectiveness of a design with response to the application of the principles of design namely: balance, proportion, contrast, harmony, variety, rhythm, repetition, opposition, and dominance.

Pierce (1993) indicates that, designers go through a sequence of steps to create a design. The creative design process consists of four major steps. Thumb nail sketches, rough layout, comprehensive layout, and camera-ready art. Most designs starts from thumb nail sketches. Designers will often come up with many ideas before choosing the one they like best. A rough layout and comprehensive layout are made from designs that a designer thinks is most appealing and functional. Camera-ready art (often called a past up) is prepared

after the layout stages are complete. Computers and other special tools are used to make Camera-ready art, (p.200).

2.19 Product development

The purpose of this activity is to develop problem solving skills in the product development process. Sutton, Cardine (1981) says that, some of the design steps you will need to solve the problem include brainstorming, sketching, and model making. Skills that one should develop in this activity include creative thinking, group dynamics (teamwork), verbal communication, and graphic (drawing) communication (p. 129). They explain further that, to design product one needs to follow the nine steps of the design process.

- (1) Identifying the problem: Define the problem by identifying cause-and-effect relationship.
- (2) Researching and gathering data: Find background information about the problem. Do this by retrieving recorded facts and data about the problem.
- (3) Developing preliminary ideas: Brainstorm for possible solution. This step also includes preparing rough sketches of your ideas.
- (4) Selecting a possible solution: select one or two of your best ideas.
- (5) Refining the design: This design step includes preparing refined sketches and scale drawing as well as engineering your chosen design.
- (6) Preparing models: During this step of the design process, you will construct a model (mock- ups of your design solution, using the required materials).
- (7) Analyzing the design: Using standard formulas and information, the strength and predicted performance of your design can be calculated.
- (8) Experimenting: This design step will help you make sure your design is sound and workable. During this stage your design may be tested changed and tested again.
- (9) Implementing the final solution: The final product or solution is ready for presentation

From the fore- going reviewed related literature, a clear indication of strategic solutions to unemployment situation of some countries were made known. Specific mention were made on technical /vocational education that leads to skill which is the prerequisite of technological advancement. Bamboo has been proven to be a remarkable material which produces variety of meticulous artifacts that are exported for income.

For that matter, it is gainsaying that, Bamboo technology can be a sustainable vocation to curbing unemployment menace of Senior High School visual arts leavers.



CHAPTER THREE

METHODOLOGY

3.1 Research design

Action research is a form of qualitative research methodology that concerns itself in researching and supporting change Somekh,(2006). It tends to combine social research with exploratory action to enhance development. It is viewed in a circular chain reaction of investigating the current situation in partnership, and planning change by trying out new practices with the aim of improvement, through monitoring the impact of changes by collecting a wide range of data to analyzing and interpreting data to general actionable knowledge and finally reporting outcomes.

Somekh (2006) explained that, action research creates knowledge concerning the interrelationship between human behaviour and socio-cultural situations, rather than making generalizations. It is reported in narrative accounts and descriptions as well as analysis and interpretation so that readers can make comparisons with their own situations.

Action research gained recognition in 1970s through the growth of the teacher-as-researcher movement that sprang from Stenhouse's insight that curriculum reform in education depended for its success on the active participation of teachers in researching the purposes and pedagogical practices of reform or change. Somekh (2006). On the other hand, Carr and Kemmis (1986) established a significant new direction for action research by recasting it with Habermas's (1986) critical theory as a means of empowerment for practioners and an instrument for promoting social justice in education system and organizations.

According to Zeichner and Noffke (2001) action research has three main categories: technical, practical and critical action research. This methodology was once established in mid 1980s in the United States, grounded in teacher education rather than curriculum reform.

The emphasis was on merging teaching and research and on reconceptualizing the knowledge base of teaching as grounded in teachers' inquiry into their own practice rather than in predetermined decontextualized knowledge developed outside of schools. Because action research is grounded in the values and practices of its participant groups, action research focuses on understanding one's own subjectivities and how they affect the research process rather than on trying to eliminate them.

Action research is normally written in the first person singular as a reflexive account that combines critique of the research process with the generation of knowledge. Action research is often seen as qualitative methodology but in fact it is eclectic, using where studies are on a scale, to make these appropriate as a means of enabling interpretation (rather than objective measurement) (Somekh 2006).

Action research being "professional", "personal", or "political", allows itself to adapt to suit the shifting stances of different communities or professional groups.

Somekh(2006) states that one of the most important contributions of action research as a methodology for building understanding of change and development is its unique access to insider knowledge. Through adopting the role of researchers, practitioners are to reflect on and make perfect knowledge that guides practice, and their involvement as co-researchers ensures that the knowledge generated by action research includes this unique and often neglected component. Action research forms a bridge between practitioner understanding and the generation of theoretical knowledge.

This is to say that, action research is knowledge generation and development of new practices is integrated and theorized.

I chose action research because, May (1989) elucidates that, action research is the conceptions of "teacher-as-researcher. It is invariably, described as job related, through

reflective teaching. The methodology adapted in the project has the characteristics of action research. Action research is problem solving, and that was what this project sought to do.

3.2 Library Research

Library research constitutes a large segment of the study. One the whole, the under listed known Libraries were consulted many times. The Kwame Nkrumah University of Science and Technology main Library, the College of Art Library, the British Council Library, Assin Fosu College of Education Library, Assin Fosu Community Library, the University of Education, Winneba, Kumasi Campus Library. All the secondary data in the study were secured from the affore-mentioned Libraries. The sources of information obtained from these libraries include internet, Catalogue and books.

Data on bamboo technology that is closely related to Art Education and Vocational Training were critically looked at. In sum, about six (6) books were read and (100) articles from the web site were seen. This information forms part of the related literature even though it was scanty. .Since the objective of the study is Bamboo Technology as a Vocation for Senior High School Leavers, pain was being taken to teach the various technologies identified in the various sources of information to equip the school leavers with the necessary skill to be self-sustained.

3.3 Industrial & Institutional-Research

The researcher visited the following bamboo factories in Ghana; Kumasi Lumber and Logs (KLL) at Kaase in Kumasi, Bamboo Factory at Fumesua in Kumasi, Bamboo Processing Plant at Assin Fosu, Integrated Rural Art and Industry KNUST-Kumasi, Rattan and Bamboo Industry at Airport Roundabout Accra and Aids to Artisans Ghana (ATAG), Accra, Takoradi Polytechnic to seek information relating to bamboo processing techniques. Among the techniques were bamboo as material, bamboo treatment, tools,

materials and equipments for bamboo processing, decorating and finishing. This was done to find out different manufacturing processes and adopt the simple techniques for effective teaching and learning process.

Unfortunately, some of the factories visited were shut down for example Kumasi Lumber and Logs Ltd. Some were also reluctant to give information needed for the study because they do not want their company secrets to be known outside. The researcher also visited some educational institutions like KNUST and Takoradi Polytechnic which offer bamboo as a course of study and talked to some of the teachers and those who offer the subject. This enabled the researcher to identify some problems and techniques related to the teaching of bamboo in their institutions.

3.4 Population for the Study

The target group for this study is all Senior High School Visual Arts graduates in Ghana. The size of the population was limited to all visual arts leavers in Assin Fosu District. To reach the target group, I initially went into churches and Senior High Schools which offer Visual Arts in the region soliciting for information to reaching the target group.

Some Art tutors and curators were interviewed and some students were also interviewed. There were directives given about some leavers. Addresses and contact numbers were ascertained of others. Unfortunately, there were a lot of problems encountered by the researcher. Some directives happened to be misleading. Some contact numbers were also non-existing.

Even though, some were reached on phone, they were found in distant destinations. The method of getting the target group for the study remained rather hectic. Five sample units were obtained but that looked rather insignificant for the study.

However, for the project to be cost-effective, the target group ought to be found within a given locality.

A brother who owns a computer training centre at Assin Fosu agreed to give visual arts students computer training for three months free of charge. As such I used the F.M Station in Assin Fosu to bring to the notice of the general public about the fee free computer training programme to be. Some posters were also put around with the caption “3 months fee free computer training for visual arts leavers”. Contact numbers and location of the training centre were given. Within one week a total number of 32 Visual Arts leavers had responded to the advert. A day was scheduled for registration. Even though the computer training was not an objective of the study, it served as a platform to come face to face with the target group for an interview. By the close of the bamboo technology training, learners also got computer training. Assin Fosu was chosen for the project because it is the researcher’s village and also bamboo grows there abundantly.

3.5 The Research Instruments

The research instruments adopted in the project were interviews and observation to ascertain knowledge of respondents’ problems in visual arts education at the Senior High level. The researcher’s endeavor was to come out with the possibility of using Bamboo Technology to equip Senior High School leavers to be self-sustained

3.6 Sampling Technique

Interviews were conducted. The aim of this research technique was vital to the researcher since all the leavers’ used as sample for the study were secured during the interviews.

Besides, these techniques helped respondents, which later became the class to establish cordial relationship with the researcher. Direct interviews in Twi, Hausa and English were conducted in Assin Fosu in the Central Region . The interview yielded, (25) twenty-five

Senior High School Visual Arts leavers at Assin Fosu of which (6) six were girls and (19) were boys.

STUDENTS' PARTICULARS

Some Senior High School Leavers in Assin Fosu Locality

Core	Name of student	Home town	Age	Sex	Year of completion	Religion	Parent
01	Akwasi Mintah	Assin Fosu	25	M	2005	Christian	Kofi Mr. Badu
02	Stephen Asamaning	Assin Fosu	23	M	2005	Christian	Mr. Michael Fosu
03	Ibrahim Adama	Tamale	24	M	2006	Moslem	Mahamadu
04	Adusei M. Boampong	Assin Nsuta	24	M	2006	Christian	Paul Manu
05	Dominic K. Yeboah	Assin Nsuta	24	M	2005	Christian	Adu gyamfi
06	Richer Addai	Assin Dominase	25	M	2005	Christian	Op. Addai
07	Prince Bondze	Assin Nyankumase ahenkro	25	M	2004	Christian	Edumadze Michael
08	Newlove Amponsah	Abura Dunkwa	23	M	2005	Christian	Kweku Mensah
09	Tieku Desmond	Assin Nankumase	23	M	2006	Christian	Op. Kwasi Tieku
10	Biney Abeiku	Cape Coast	25	M	2006	Christian	Obodae Aworwe
11	Darko Tsibu	Assin Fosu	24	M	2007	Christian	Papa Poramah
12	Obeng Asamoah	Assin Breku	24	M	2005	Christian	Owusu Menka
13	Lestowel prince	Assin Fosu	24	M	2007	Christian	Anarfi Ben
14	Panford Cobbina	Mankessim	24	M	2006	Christian	Papa Yaw Baffoe
15	Dapaah Johnson	Assin Akrofuom	23	M	2006	Christian	Agya Yaw Katribu
16	Manu Regina	Assin Fosu	25	F	2006	Christian	Alex Bimpong
17	Sakina Iddrisu	Assin Manso	25	F	2005	Moslem	Awudu Iddrisu
18	Mohammed Rakia	Bolgatanga	24	F	2006	Moslem	Mohammed zariah
19	Fordjour Adjoa	Assin Fosu	23	F	2007	Christian	Frimpong Manso
20	Abban Josephina	Abura Dunkwa	25	F	2005	Christian	Nana Benyin
21	Cynthia Abena Attaa	Assin Manso	23	F	2006	Christian	Kofi Boye
22	Alice Dziwornu	Kpedze	23	F	2006	Christian	Kwami Dziwornu

In order not to bore them, I interviewed them by using an interview guide and recorded their responses. The following were some of their responses from the interview guide.

1.Question: When did you complete Senior High School?

Response: “I completed long ago” “I completed in 1994” “in 1995” “in1996” “in 1997” “in 1998” “in 2000” etc.

2. Question: Why are you not furthering your education?

Response: “My parents refused to take care of me” “I could not get a good grade in visual arts”.

3.Question: What do you do at home?

Response: “Nothing” “I follow my parents to farm” “I am learning sewing”

4,Question: What do you do for a living?

Response: “I am tired of being home without job” “I am not doing anything gainful at home” “I am a driver’s mate; (Aplanke)” “I am a store attendant” etc.

5.Question: Have you looked for any job opportunity?

Response: “I’ve tried in vain to securing a job” “No job opportunities available”
“I’m now trying to travel to Accra to look for job” “I been to Kumasi for six months but I did not get any job”

6.Question: Why have you not been practicing art for a living?

Response: “I am not well equipped with skills in art” “I started something on graphics but with the advent of digital art, patronage has dropped mercilessly” “what I was taught in school is not marketable”

7.Question: Why don’t you learn any other trade?

Response: ”I wish I’m trained in art again” “I’m only interested in practicing art”
“I’m applying for an art school.

8.Question: Is bamboo scarce in your area?

Response: “Bamboo thrives in town abundantly” “Bamboo is common in my area”

9.Question: Is there any vocation in bamboo as a material?

Response: “No we only use it as firewood” “we use bamboo for fencing” “we know of the bamboo industry in Assin Fosu that uses bamboo for chairs but we don’t have the skill”

10.Question: Are you interested to earn a living from bamboo

Response: “Yes, but how do we?” “Can we also create something good out of bamboo?” “Then bamboo will no more grow waste” “I wouldn’t travel to look for job, if bamboo can be processed into marketable items”



Plate 3. the Respondents answering interview guide

Based on the information given by the respondents, it was obvious to say that some Senior High School Visual Arts leavers are not self-sustained after completing the Senior High School Visual Arts programme.

However, there is the need for a cost-effective vocational training to be given such graduates to make them self employed.

The study sought to bring to light bamboo technology into Senior High School Visual Arts curriculum. Bamboo as a prolific material, growing in wider geographical vegetations in Ghana, can be used to solve unemployment situation of Visual Arts leavers.

3.7 Sampling

For a convenient workable fashion to concretize the course of the study, a simple random sampling was chosen. Instead of all Visual Arts leavers in Ghana, Assin Fosu District was demarcated to form the workable fraction of the study.

Demonstration: The researcher's visit to some Bamboo processing industries and some institutions that offer Bamboo programme, gave him an opportunity to envisage some equipment, tools and materials necessary for the various processes in bamboo technology. The researcher again had the feel of some of the tools and their uses in their vocations and their related problems. Some simple tools were improvised to ensure that all students have one. By these observations, the researcher was able to demonstrate process after process job related training of bamboo technology in the training. This ensured a rapport during teaching and learning process. Activities were arranged systematically for students to emulate.

3.8 Data collection

The primary data was solicited from the students during teaching and learning process. As such a syllabus was constructed to indicate what to be done in a logical manner in a given period of time. Responses from students during questioning also formed part of the data collection activities and projects assigned them contributed enough data for the study. The secondary data were mostly collected from documentary sources (books, publications, and the internet) and observation of the activities in bamboo processing industries. Both primary and secondary data sources collected were assembled, synthesized, and critically analyzed.

3.9 Procedures in Executing the Project

The first objective was meant to identify an interested group of students of Senior High School Visual Arts leavers who were unemployed. Students for the study were not identified so easily. They were not however, identified in Fosu Township alone they were a

little scattered in the localities, reaching them took a lot of time, energy and resources. Getting them understanding the need to co-operate to get the study under way was painstaking. So much went into it to have them convinced. Apart from about five (5) of them who happened to be closer to the training center, the rest was given transportation fares to and fro every training session. Again, a computer training school adjacent to the training center, agreed to providing 3 months free computer literacy services to all the bamboo technology students. Programmes taught were Excel, Corel Draw, Rhino, Maya, Word, 3-D max etc. Aprons and some working tools were supplied by the researcher; these motivational tools helped to converge the students used for the study.

The second objective aimed: at constructing alternative syllabus for Bamboo Technology. A well structured and organized senior High School Bamboo Technology Syllabus was developed. Processes, skills, requisite tools and materials necessary for the construction of Bamboo items were spelt out in sections and units. Each section of the syllabus was divided into five units, where a unit consisted of a body of knowledge and skill that form a logical aspect of the section.

Column1unit: This talked about the major topics of the section that was provided and this was followed according to the order as presented.

Column 2 specific objectives: Specific objective for each unit was stated in terms of the student which tells what student will be able to execute after every teaching and learning process in the unit. Specific objective is the identification of students learning problems. It is normally stated in behavioral terms (students will be able to....) Here careful study of the syllabus was made to identify activities students will carry out during a particular lesson, by assembling the tools, materials and procedures required in advance. The researcher served as a facilitator and motivated the students in various ways to sustain their interest. Resource persons were invited to carry out demonstrations and talked about their work in the class. Field trips were organized to other Bamboo industries.

Column 3 content: This describes a selected body of information to the content presented, through reading and personal investigations. The column also spells tools and materials that can be used for the unit or lesson.

Column 4-Teaching and learning Activities (T/LA): For maximum student participation in the lesson T/LA must be used since the research is activity oriented. The major part of the class work and assignments emphasized practice. Students are expected to acquire valuable basic practical skill that will ensure values in their behavior and in creative activities.

Column 5- Evaluation: Class works and activities were evaluated at this column. Evaluation exercises included oral questions, quizzes, project work, and class assignments. The implication for these is to challenge the students to apply their knowledge to skills and problems teaching them creativity. Processes undertaken by students should be in performing various activities were observed. Processes and products are equally important and need observation and correction until students master the instruction spelt in the specific objective of each unit.

The syllabus was used as a substitute for lesson plans as such a scheme of work and lesson plan were developed to teach the units of the syllabus.

3.10 Proposed Content for the Syllabus for Senior High School Leavers Bamboo Technology

Section 1 Bamboo Technology as a Vocation

Unit 1. Rationale and History of Bamboo Technology.

Unit 2. The Bamboo Industry

Unit 3: Career Opportunities in Bamboo

Section 2 Introductions to Bamboo tools and Equipment

Unit 1: Prospecting, Processing and Forming Tools and Equipment.

Unit 2: Care Maintenance of Tools and equipment

Unit 3: Fabrication of Local Tools and Equipment

Section 3 Introductions to Bamboo Raw Materials

Unit 1: Bamboo: Meaning and Cultivation

Unit 2: Types and Properties

Unit 3: Prospecting and Processing

Section 4 Drawing and Designing 1

Unit 1: Elements and Principles of Design

Unit 2: Idea Development/Preliminary Designing

Unit 3: Computer as Tool for Designing 3-D objects

Unit 4: Sketch Modeling

Section 5 Other Bamboo Raw Materials

Unit 1: Binders

Unit 2: Colorants

Unit 3: Finishers

Unit 4: Preservatives

Section 6 Drawing and Designing II

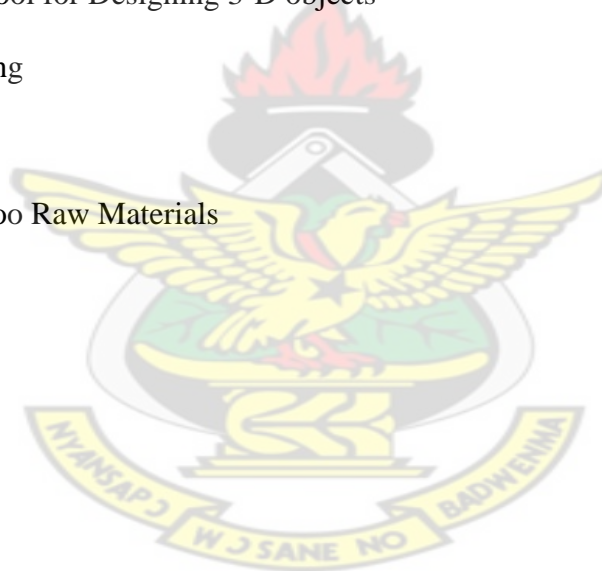
Unit 1: Object Drawing

Unit 2: 3-D Computer Design

Section 7 Constructions of Objects

Unit 1: Tracing of sketches

Unit 2: Cutting shapes/Parts



Unit 3: Joining of Parts

Unit 4: Treatment/Finishing

Section 8 Entrepreneurial Skills

Unit 1: Establishing Small Scale Bamboo Industry

Unit 2: Managing Bamboo Enterprise

Section 9. Costing, Pricing and Marketing

Unit 1: Costing and Pricing

Unit 2: Marketing

Section 10. Tools, Equipment and Materials

REFERENCES:

The third objective seeks to train a group of Senior High School Visual Art leavers. To achieve the requisite vocational training expected of visual arts leavers, profile dimensions were seriously looked at. Profile dimensions describe the underlying behaviours or abilities learners are expected to acquire as a result of having gone through a period of instruction. In the teaching process specific objectives were basically action words that specified the type of learning or skill that the learner should acquire by the end of the instructional period.

A specific objective as follows: The student will be able to describe what a bamboo culm is. Contains an action verb “describe” that indicates what the learners will be able to do after teaching and learning have taken place. Being able to “describe” something after the instruction has been completed means that the learners have acquired “knowledge”. Being able to explain, summaries, give examples, etc. means that the learners have understood the lesson taught. Similarly, being able to develop, plan, construct, etc means that the learners can “apply” or use the knowledge acquired in some new context. Each of the

action verbs in the specific objectives of the syllabus describe the behaviour the learner will be able to demonstrate after the instructions “knowledge”, “application”, etc, are dimensions that was the prime focus of teaching, learning and assessment of bamboo technology as practical oriented and that learning required is best achieved by practical application of skills learnt.

The profile dimensions specified and their respective weights were as follows:

Knowledge and understanding 40%

Application of knowledge 60%

3.11 Dimensions explained

(Knowledge and understanding)

Knowledge: Is the ability to recall, remember, identify, define, describe, list, name match, state principles, facts and concepts. According to teaching syllabus for visual art, (2008) knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning.

Understanding: The ability to explain, summaries, translated, give examples, generalize, estimate or predict consequences based upon a trend. Understanding invariably, is the general ability to grasp the meaning of some material that may be verbal, pictorial or symbolic.

For the Senior High School Visual Art learners to be able to grasp adequately, the skill needed in the practical vocation of bamboo technology, critical calculation on the dimensions were taken seriously. The research focused on what one can do better, based on knowledge and understanding processes of individual learner.

Then also, application of knowledge; the ability to use knowledge or apply knowledge remained a watch word in every instructional period. That is yielded a number of learning/behaviour levels. These levels included application, analysis, synthesis and evaluation.

By application: What was looked out for was the ability to apply rules, methods, principles, theories, etc to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, plan, demonstrate, and discover.

By analysis: The study sought to find out the ability of learners to break down materials into its component parts.

By synthesis: learners ought to have the ability to put part, plan, and design, create, and organize. It is the ability to put parts together to form a new whole.

By evaluation: Finished pieces of learners ought to be subjected to judgment. This is the ability to appraise, contrast, criticized or making of recommendation and also finding worth or value to pieces. In the training process, job related method called for critical observation of practical skills. Practical skills involve demonstration of manipulative skills using tools/equipment and materials to carry out practical operations. Pre-imaging to solve practical problems and produce items was also paramount in the course of the study.

3.12 Design

This is a preliminary plan within a perceived work of art. It is a vital concept that leads to the organization, arrangement or composition of a work. Design is a process or a result of a process Amenuke et al (1999). Although visual arts leavers have been taken through the visual arts syllabus in school their competency level vis-à-vis the necessary skill needed for technology is low. For competency based training, learners should be passed through the design process. Where an artist can be able to undertake preliminary design before construction, beautiful works are produced that command the market. From the foregoing, the leavers were taken through the design process.

Most of the Senior High School Visual Arts leavers do not practice art due to their inadequate competency design level. The main objective of the study is to give an

amplified training to make them self-sustained. This is a preliminary plan within a perceived work of art. It is a vital concept that leads to the organization, arrangement or composition of a work.

3.13 Lesson One:

Topic: - Designing (Preliminary designs. and idea development.)

Specific objective(s): The leavers will be able to plan and make preliminary designs for making items and show its importance.

Date: 10th Nov. 2008.

Time: 9:00am – 12:30pm

Previous knowledge: Leavers have ideas on elements and principles of design.

Researcher: What is preliminary design?

Leavers: Asamoah: “Preliminary design is a form of Art”

Biney: “It is the way something looks”

Cynthia: “Design is the combination of principles of design to make art works”

Dominic: “It is what you have to do before the works”

Richer: “Preliminary means before and design means combine elements of design.

Researcher: Definition: - Preliminary designing is a form of one’s ideas by drawing or sketching. Preliminary designing is the first step in planning towards making an object and it entails developing ideas from artificial and natural sources to create a design.

Isaac: Does it mean we have to plan a work before execution?

Researcher: Yes, this is to ensure quality work

Learner(s): How do we plan a work?

Researcher: Can anybody help her?

Learner(s): Asamoah: By looking at the original object and doing the same?

Josephine: To think and measure the work and executing it.

Cynthia: We use elements of design to plan.

Researcher: Planning is a systematic development of ideas from first stage to final stage.

The researcher explained to learners that there are appropriate steps that need to be followed in designing. The steps are normally described as design process. I helped them to understand that, design process is an activity to develop problem solving skills. Cardine (1981) described the design process as product development. And it includes brain storming, sketching and model making skills. These involve creative thinking, group dynamic (teamwork) and communication (drawing).

Learner(s): You talked about creative thinking which is individualistic, why team work? Won't design be the same?

Researcher: Anybody with an idea?

Lestowel: I think group dynamic will add to ones idea and collectively a wonderful design will be created.

Adwoa: To ensure uniqueness, is teamwork necessary?

Researcher: Yes, uniqueness is important in Art but group dynamics ensures quality. Ones idea can be enriched by another, as such team work is good in Art.

NB: For uniqueness the following nine design steps must be passed through.

Cardine and Sutton have it that, let people ask, "How did you do it when it comes to product development?" Now let us look at the design steps

1) A designer must identify the problem by identifying cause and effect relationship.

2) The next steps in design are the researching and gathering data. This is done by finding the background information about the problem. We do this by retrieving recorded facts and data about the problem.

Learner: Please, how do you gather data of a bamboo product?

Researcher: Ask your self, what do I want to do? Has somebody done it before? If so, do I want to do the same? How did he do it? By so doing much data will be collected about the perceived product.

3) The next step to consider is developing preliminary ideas. That is the situation where the designer brainstorms for possible solution. This step includes preparing rough sketches of your ideas. Note that, elements and principles of design must come to play here. More sketches of the product are made at this stage.

4) This is the step for selecting a possible solution. One or two of your ideas in step (3) selected for further development.

Learner(s): Why do we have to do more sketches on only one product and not just one sketch?

Researcher: More sketches means, variety of sketches, these give designers opportunity to choose the best sketch suitable for a product.

5) The next designing step is refining the design. The stage calls for preparing refined sketches and scale drawing and also the step helps to engineer your chosen designing.

6) Immediately after engineering chosen design, models are prepared. Mock ups of your design solution are done using bamboo as a material.

7) The seventh design step enables designers to analyze the design using standard formulas and information.

8) Having analyzed your design in step seven, you have got to experiment your design. This is done to make sure your design is workable and sound. Design at this stage may be tested, changed and tested again.

9) The step calls for implementing the final solution. Then the final product is ready for presentation.

Learner(s): Sir, are you saying these nine steps must be followed during designing?

Researcher: Yes, if you aim at high standards.

Obeng: Are these steps new? It seems we were not taught.

Researcher: You may not be taught, depending on whoever taught you visual arts. Lucky you, that you are taught today.

Researcher: What do you think are the importance of design process?

Learner(s): Design offers opportunity for selecting from a series of designs.

John: It gives the opportunity to plan and prepare adequately

Researcher: You have all given good answers.

Ben: It serves as guide.

Researcher: Very good! Design guides us to produce good presentation. Further more, design prevents wastage. Learners were guided through a series of preliminary designs.

Evaluation: a) What is preliminary design?

b) Use the design steps to come out with sketches of a bamboo bangle.

Remarks: From the responses and questions learners put forward during the lesson, there are indications that some Visual Arts teachers fail to teach the requisite design aspects and that, learners lack the competency skill that is needed to design let alone construct any art piece perfectly to make them self sustained. Invariably, lesson was well taught and learners tried hands on several preliminary designs.

Assignments were marked and marks awarded.

3.14 Lesson Two:

Date: 25th November, 2008

Time: 2:30pm - 5:00pm

Topic: Designing and construction of bamboo bangles.

Objective: Learners will be able to fashion out bangles from bamboo culms.

Previous knowledge: Learners have done preliminary sketches (designing) of bangles in their sketch pads.

Tools and materials: Soldering iron, sand paper, white glue, bamboo culms, brushes etc.

T/L/M: Samples and pictures of bangles in other media.

Researcher: I divided the class into four groups. Tools and materials were given to each group.

Learners were helped to identify and tell the uses of tools and materials given them.

3.15 Introduction:

Researcher: What are Bangles?

Learner(s): They are round things women put around their wrist.

Bondzi: They are beautiful big rings worn around the wrist.

Christopher: Bangles can be described as Jewels on the hand.

Researcher: Bangles are circular band of Jewel or ornament worn around the wrist.

Bangles come in various shapes made from variety of media eg. (metal, plastic wood, clay) etc.



Plate 4. Variety of bangles made in other media

Isaac: Sir, can we make such beautiful bangles from bamboo?

Researcher: As I have told you, we can produce many beautiful items from Bamboo.

Bamboo stem is made up of nodes and internodes.

Isaac: Please Sir, what are nodes and internodes? But then, nodes and internodes in bamboo are referred to as joints (nodes) and internodes (between joints). Technically, from one joint to another is called Culm.



Plate 5. Display of bamboo poles

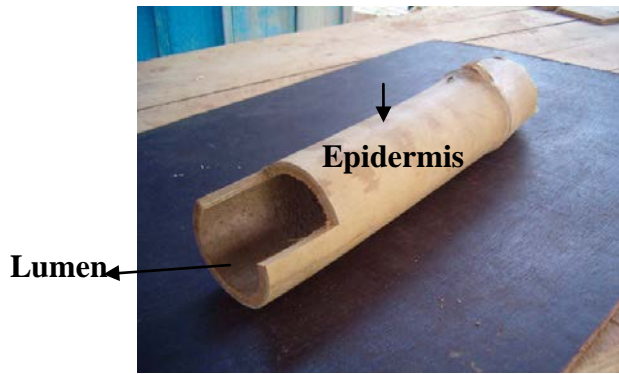


Plate 6. Culm of Bamboo



Plate 7. Bamboo nodes

Showing the lumen and the epidermis

KNUST

The culm is conical already and it is in a shape of a bangle.

Now I instructed each group to get onto their working table with all necessary tools and materials.

Learner(s): Are we to start cutting?

Addai: Won't you listen to instruction?

Researcher: Learners were asked to put bamboo culms on working benches. Choose a group leader. Now with saw cut away the joints of each Culm through the marked up area.

Learners cut the joints of culms away. With the help of ruler measure any width of say 3cm to 4cm on the culm beginning from the tip inward? Mark out the dimension with a pencil round the culm. Having gotten several rings with said dimension on the culm, Learners were asked to cut through the outline of the marking by clamping the culm or held tightly or firmly to the table with a table vice or by Group members.

Learner(s): Sir, cutting is difficult. The saw does not run through the marked lines easily.

Researcher: I demonstrated in series of cutting. Caution was also given not to cut deep at one side alone. In cutting, the saw is gently run along the outline to indent outline before serious cutting is done.

Learner(s): Sir, come and see. I have cut an accurate ring. By that, the other groups learnt a cue and started cutting perfect rings



Plate 8. Learners taking measurement of rings to be made into bangles



Plate 9. Learners cutting rings of Culm to be made into bangles

Dominic: Apart from carpenter's saw, can we use sharp cutlass in cutting ring of Culm?
Because that is what we have been using to harvest bamboo locally.

Researcher: Any idea?

Manu: I think cutlass cannot be a good tool for cutting bamboo rings. For it will instead break the Culm.

Josephine: Can't we use chainsaw too?

Learners: They burst into laughter, chainsaw to cut bamboo ring?

Researcher: For harvesting of bamboo, cutlass and chainsaw can be used but in the case of the ring, cutlass is not the best: yes the smaller size chainsaw can do the cutting. But the appropriate cutting tools for bamboo rings are, carpenters saw, Hacksaw, Jewelers' saw etc. These give good cutting effect than cutlass.



Plate 10. Cutting tools

Listowel: I have now enjoyed the use of the saw for cutting. Do we have to paint the bamboo rings having cut them?

Researcher: No, you have not considered what shape, motifs, patterns that the ring Culm should take.

3.14.2 Design Process

Researcher: Learners were asked to go back for their sketches of the bangle and have them transferred unto rings of Culm taking cognizance of shape, patterns, style, colour, texture etc.



Figure 1. Sketches to be transferred unto rings of Culm

Learners: How do you get the design on paper unto the bamboo Culm?

Researcher: Any idea?

Ben: I think we can transfer ideas on paper unto the ring Culm by look and draw method.

Researcher: That is a good effort!

But elements and principles of design should be taken into consideration once again.



Plate 11. Transferred design on ring Culm

Researcher: By using sharp tools like gouge or knife the transferred design were carried and appropriate shape given to ring Culm. Having gone through those

processes, the designed Culm was sanded with rough sanding paper and followed by using smooth sand paper.

3.14.3 Treatment process

Researcher: There are many treatment processes for bamboo. But we will concentrate on the use of poisons for now. Bamboo is prone to powder post beetle due to its nutrient content. It is more susceptible to biodeteriorating agents, as compared to timber such as fungi, termites, and especially insect borers (Liese, 1980).

Alice: Please Sir; are you saying bamboo contains nutrients? Can we eat bamboo?

Researcher: Yes bamboo shoot is food to the Chinese, it is called “Yummy”. I told you, when we treated the uses of bamboo. The young shoot of bamboo is highly nutritious and it is good for consumption. That is why insect borers attack it easily.

Abban: How can we prevent the borers?

Researcher: Having cut the desired shape from the Culm, the cut pieces are immersed in deep water diluted with Dursban 4E. Overnight, for the grains of the Culm to be poisoned to prevent borers / beetles to feed on. Dry the Culm immediately on removal from poison solution. Wash hand with soap.

Biney: How can already infested Culm be treated?

Researcher: Solution of Dursban 4E is sprayed on Culm or treated by immersion.



Plate 12. Dursban 4E

3.14.4 Carving Process

Researcher: What do you understand by carving?

Panford: It is the method of using an axe to cut wood into a shape

Lestowel: Carving is cutting on wood to form a shape.

Biney: It is a method of coming out with a shape by chopping a wood.

Researcher: You have rich ideas. You are all correct:

Carving is subtractive sculpture. It is the art of using sharp tools to reduce size of wood or any capable medium into an intended shape. In order to carve the design is transferred unto the Culm,

1. Tools must be well sharpened.
2. Outline of design on Culm must be clear.
3. Culm must be clamped
4. Tools used to chop along the outline.
5. Care taken to avoid cracks and breakages.

Learners: Were instructed after demonstration, to carve through intended outlines.



Plate 13. Learners carving on Culm

3.14.5 Supervision

Corrections were done on tool handling and proper carving process. Each group worked on two carved bangles.

Each group given rough and smooth sand paper to sand rough first followed by smooth sanding. This is done to smoothen the ware to be user friendly.

Biney: How long do we have to sand the ware?

Researcher: As much as possible.

Panford: Is sanding done any how?

Researcher: Sanding is done along the grains of the Culm but not across the grain. Sand paper held strongly in one hand and then pressing the Culm and run it left to right or forward and backward movement. All carved areas sanded well.



Plate 14. Learners sanding bangles

Learner(s): After sanding the Culm very well, the bangle does not look like bamboo again.

Lestowel: What a wonderful article from bamboo.

Biney: The girls in our area will buy these.

Researcher: Why will they buy these articles?

Biney: Because they are beautiful and attractive.

3.14.6 Finishing process: To make the bangles look glossy each group was made to spray or polish the bangle with finishers like vanish, lacquer or neutral polish.

Panford: Can we use paint to finish them?

Researcher: You can, but the natural bamboo touch will be destroyed by the paint.
Preferably, finishers that will show the grains are used.

Learner(s) All the groups polished their final products and allowed to dry.



Plate15 . Displayed bangles of all the groups

3.14.7 Evaluation:

Researcher evaluated lesson with the following

- 1) What article have you produced?
- 2) What material were the bangles made from?
- 3) Explain the following processes as in bamboo Technology.
 - a. Cutting,
 - b. Preliminary design
 - c. Measuring
 - d. Sanding
 - e. Carving
 - f. Finishing

Researcher's Remarks: Group D could not complete carving within the three hour duration. Group B could not give finishing to their work within the given time.

Learners Remarks:

- (a) We will not spare bamboo at all.
- (b) The bangles are so beautiful to be offered for sale
- (c) I believe that by the next lesson I would have gained more skills to create something on my own.
- (d) I am going to make ten different bangles for my sisters before we meet next week.

Lesson was successfully delivered

KNUST

3.15.0 Lesson Three:

Date: 18th December, 2008

Time: 10:00am – 1:00pm

Topic: Designing and construction of bamboo hair clip.

Objective: By the close of the instructional period learners will be able to fashion out hair clips from bamboo Culms.

Previous knowledge: Learners have constructed bangles and have also made sketches on hair clips.

T/L/M: Variety of hair clips from different materials, groups etc.

Duration: 3 hours.

Tools and materials: Saw, Hack saw, Soldering iron, Sandpaper, pencil, ruler, lacquer, vanish, bamboo Culm, benches, spray gun, brushes, sanding sealer.

3.15.1 Introduction:

Researcher: What is hair clip?

Alice: It is a plastic object that ladies use to tie their hair.

Cynthia: Hair clip is a metal clip that is used to support the hair.

Regina: Hair clip can be plastic or metal clip for binding the hair together.

Panford: It is an object that women use to hold their hair together.

Researcher: What medium do you say hair clips are made from?

Cynthia: Clips can be found in plastic or metal.

Fordjour: It can be found also in wood.

Researcher: How many of you have seen one in bamboo?

Learners: Silence

Researcher: Hair clips can be made from bamboo as well.

A variety of hair clips were shown to learners to observe and feel.

3.15.3 Design processes:

Researcher: Preliminary sketches were inspected. Learners have been taken through design process of the hair clips. The four groups came out with several shapes and designs of the hair clips.

Each group was asked to choose one out of the designs made.

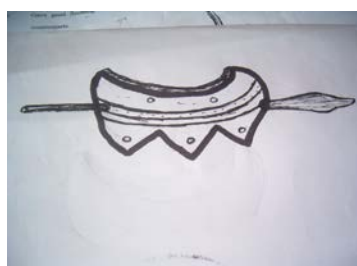
Group A: Sir, we can do all the designs we have made now.

Researcher: Yes, I know! But remain in the group and share ideas for sometime.

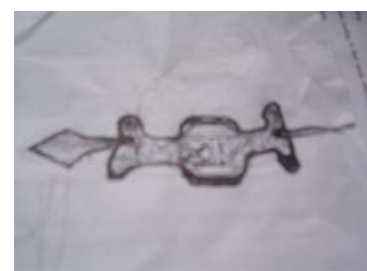
Some final sketches of three of the groups are shown below.



**Figure 2: Final Sketch of
Group A**



**Figure 3: Final Sketch of
group B**



**Figure 4: Final Sketch of
group C**

3.15.4 Construction process.

Researcher: Having gotten your designs on paper, what next?

Panford: In construction, dimensions are taken on the Culms before cutting is done.

Fordjour: We have to measure the size of the hair clip we want to construct first.

Researcher: That is good attempt. Dimension is very necessary in construction.

Now take a measure of a ring on the Culm like you did in the construction of the bangle.

Learners made markings of ring on the Culm and with the help of saw each group made several cutting of bamboo rings.

Researcher: Dapaah, tell me the difference between the rings of bangles and that of the hair clips?

Dapaah: To make a bangle one needs a complete ring of the Culm but in the hair clip one needs a facet ring (half of ring).

Researcher: Good, then learners were directed to cut their rings into two halves.

Darko: Do we have to cut them into two equal halves?

Researcher: It is not always equal halves. It depends largely on your design. In some cases in smaller Culms, a complete ring is used for the hair clip.



Plate 16. Learners cutting rings into halves



Plate 17. Half rings

3.15. 5 Transfer of design process.

Researcher: Group D, tell me how designs are transferred unto the bamboo ring?

Biney: Designs are transferred by either tracing the work on to the Culm or looking at the design and draw same onto the Culm.

Researcher: Do you agree with him?

Learners: Yes.

Researcher: Be cautioned here that, where the design will be carved unto the Culm, then it is transferred before sanding. But where design is not going to be carved the Culm is sanded and treated with sanding sealer before design is transferred unto it. Each group was instructed to transfer designs unto Culm.

3.15. 6Carving process:

Researcher: Cynthia, tell us what it entails during carving?

Cynthia: The outlines of designs are cut with gouges or flat chisels.

Mohammed: What is the difference between gouges and chisels?

Researcher: Gouges are chisels with concave or convex cross section for cutting grooves. They come in various shapes of U, V and flat. They are like chisels. Mallet is used to hit on top of the wooden handle to give a cut.

Chisels are tools with long metal blades that have sharp edges for cutting wood, stone etc. Chisels have flat edges.

Darko: Which of the two is appropriate for cutting or carving designs on bamboo Culm?

Researcher: The V-shaped gouge is best for cutting grooves. In order to make grooves on outlines on bamboo, use the small V-shaped gouge.

Learners followed the demonstration of researcher and came out with grooves on outlines on Culms.



Plate 18. V-shape gouge used to cut grooves



Plate 19. Grooved designs on culms

3.15. 7Sanding process:

Researcher: Newlove, take the class through sanding.

New love: It is the art of smoothening surfaces using sandpaper. To sand bamboo, rough sandpaper is used first to rub vigorously to smoothen rough areas. Later, smooth sandpaper is used to give smoother texture of the ware.

Researcher: Do you agree with him?

Learners: Yes.

Darko: I think care must be taken to ensure that designs and shapes are not marred by strong sanding.

Researcher: That is true; especially when sanding in grooves, care is taken not to widen them. All the groups with exception of group D, were instructed to sand their carved hair clips; whereas group D was told to trace or draw designs on sanded hair clip. After that soldering iron was heated and used to run through the outlines leaving permanent design on the piece.



Plate 20. Learners sanding facet rings

3.15. 8 Perforation and pin making process:

Researcher: After sanding the item to smoothness, the next activity for the learners was to perforate two holes with soldering iron at the extreme ends of the facet rings. These holes will serve as a channel through which the pin to hold the hair within the facet ring will run. Upon a demonstration, learners were shown how to construct pins for the holes made. Learners constructed pins from Culms of bamboo in a form of small paddles. The pins were sanded to smoothness to become user friendly.

Learner(s): Are we to put the pins into the holes?

Researcher: Yes! Now put pins in the holes. Cynthia come and try it on you hair. Cynthia tried one on her hair and it worked.

“Waaw”, Regina exclaimed, turn properly for us to see! It was solidly holding the hair in place.

Learners: Let me also try it on my hair. They were amazed for such an interesting item from bamboo.

Newlove: Sir, I am really touched with these wonderful items we are creating from bamboo. I never had any idea about this; I wouldn't have gone to waste time in Accra looking for job.

Josephine: Sir, do you know what, the bangles we sent home after our previous topic was a talk of the town. Every body wanted to see and have one.

Cynthia: It seems today's activity has been more enjoying than our last encounter.



Plate 21 Facet rings mounted with pins

3.15. 9 Finishing process:

Researcher: Group C, take us through finishing process.

Dominic: Having sanded the hair clip to perfect smoothness, sanding sealer was applied on the ware. The function of that chemical is to cover up all holes on the ware.

Richer: The next step was to dry the ware. To make it glossy, any of the following chemicals, Vanish, or lacquer can be applied on the ware at successive number of times until it sparkles.

Researcher: Finishing is the art of bringing a piece of work to an acceptable standard.

Researcher: Group A, tell us the application method of the finishers.

Stephen: Finishers are applied on wares by

- a) Spraying
- b) Dipping
- c) Painting

Learners: Gave good finishing to their works following the ideas given by their counterparts.



Plate 22 Finished hair chips of the various groups

3.15. 10 Evaluation:

- 1) Mention two products that can be produced from bamboo
- 2) State two tools and two materials necessary for the construction of hair clip.
- 3) Why is the preliminary design important in bamboo technology?

4) Remarks:

Stephen: I wish you come every day to give us such training to be conversant with the skill necessary for bamboo technology.

Newlove: I feel like having the technical capability to create more of these for sale.

Akwasi Thank you for coming, I believe you will help us to get something doing.

Researcher: Learner interest for bamboo technology has been arousing every passing training session.

Some learners have been able to fashion out meticulous objects even outside what is being trained. Instructional period well executed.

3.16. 0 Lesson Four:

Date: 30th January, 2009

Time: 12:00pm – 3:00pm

Topic: Producing Laminated Bamboo.

Objective: By the end of the instructional period Learners will be able to produce Bamboo board and state its uses.

Previous knowledge: Learners know how to split bamboo for fencing.

Duration: 3hours

Tools and Materials: knife, machete, mallet, bondex glue, plane, chisel, clamp, bamboo poles.

T\L\M: Samples of laminated pieces of bamboo items.

Researcher: What is board in timber.

Mintah: A board is a flat wood made from timber.

Sakina: It is a flat timber.

Abban: A board is a sawn timber.

Researcher: You are right. How possible can we get board from bamboo?

Mintah: Sir, I don't think it is possible, because there is vacuum in the bamboo Culm.

Tsibu: How can you flatten the hard Culm? It is not likely.

Fordjour: Even if we can get a board, it will not be as broad as timber board.

Researcher: Bamboo technology has found a possible means of making bamboo boards. That is what we are going to try our hands on. This lesson is going to base on the available bamboo found in Ghana, (*Bambusa vulgaris*) species (yellow and green species) (see plate 2). It has a high nutrient level and that makes it susceptible to worm and insect destruction (Gollo 1984).

Before bamboo can be laminated it is taken through seasoning processes, to reduce the carbohydrate or nutrient content. In the subsequent lessons we will learn what is seasoning.

Learner(s): Are the bamboo poles given us seasoned.

Researcher: Yes, they are. I will take you through seasoning process in the ensuing lessons.

Each group was asked to place the sharp side of their machete on a cross section of one end of a node and pushed down gently by hammering lightly with the mallet.



Plate 23. Learners splitting bamboo into strips

Learners: As for splitting it is our business. We split bamboo for roofing and fencing.

Researcher: Group A and C completed their splitting first. Group B and D were slow workers. Finally the groups completed splitting their bamboo poles into equal halves.

Having done that, they were directed again to split the halves into strips.

Each strip was cut into sixty centimeters (60cm) long.

Abban: Why are we not using the long strips for the boards?

Researcher: The board can be made with long strips but in this case short strips are chosen to let you understand better. Learners were told to remove the inside node with their chisels making room for planing.

S

3.16.1 Planing Process:

Learners for the first time were taught how to use planing device to plane the strips flat and smooth.



Plate 24. Bamboo strips being planed



Plate 25. Coated Strips being assembled

Abban: Are we going to put them together to give us a board?

Researcher: Until then a rectangular frame to support the strips ought to be constructed. Learners were directed to construct a wooden frame of seventy (70cm) by Thirty-five centimeters (35cm). Learners poured some amount of Bondex glue into a container and coated the prepared section of the strips with brush. Coated strips were orderly arranged horizontally in the frame one on top of each strip.

The essence of the frame was to check proper positioning of each strip.

Sakina: Is there any possible way of arranging the strips apart from one on top of the other?

Researcher: There are several ways depending on the thickness of the board one wants. It could be done side ways or in pairs.

Mintah: Which of the arrangements will give us small thickness?

Researcher: Sideways arrangement ensures thin size of the thickness. But the pile, one on top of the other gives a thick size of the board.

Learners were asked to press the strips together in the clamp provided in order to make it compact. The clamp allowed to hold strips for sometime before it was removed.

Mintah: Sir, how can that be flat as a board?

Researcher: By planning the two sides to smoothness. Each group was directed to plane along the grains of the board to smoothness.

Sakina: Why do we not plane across grains in bamboo?

Researcher: Group C, tell us why we do not plane across grain.

Fordjour: The board will be rough in texture.

Mintah: Planning across grains will impede the planning device

Researcher: Plane across grains causes irregularities on the board. The quality of the board is affected.



Plate 26. Learners planning bamboo board



Plate 27. Samples of laminated bamboo board

A board measuring Seventy centimeters (70cm) by sixty centimeters (60cm) in each group were formed indicating the fact that boards can be made from bamboo.

3.16.2 Uses of laminated bamboo

Researcher: What do you think laminated bamboo can be used for ?

Abban: Bamboo boards can be used in the construction of tables and chairs.

Tsibu: It can be used for making all things wood boards can be used for.

Researcher: Wanted learners to concentrate only on decorative pieces for now. So I mentioned these items to their awareness. Laminated bamboo can serve as covers, pedestals, jewel box, key holders, bangles, ear rings, chains, organizers, bracelets, wall hangings, vases etc.

The specific objective for training the learners how to construct laminated bamboo was to enable them combine bamboo Culm with laminated bamboo to fashion out attractive pieces to win costumers in the vocation and also for diversity.

3.16.3 Evaluation:

- 1) Discuss the processes involved in bamboo lamination.
- 2) Mention five decorative pieces that can be made from laminated bamboo.
- 3) State seven tools and four materials used in bamboo lamination.
- 4) Design a circular pedestal of laminated bamboo 15acm by 12cm on which bamboo Culms will be mounted as a desk organizer.

Learners Remarks: Abban; it means we can use the Culm with laminated bamboo for many things

Mintah: With little effort we will have our own source of money.

Tsibu: I am enthused for this programme. Because we did not know laminated bamboo.

Fordjour: The wonderful side of bamboo is how boards can be made out of it. Thank you Sir,

Researcher's Remarks: Learners interest for the programme heightened as more pieces were being constructed.

Learners would not want period to end.

Learners decided to try hands on samples of pieces at home.

3 .17.0 Project Five

Date: 22nd February, 2009

Time: 9:00am – 12:00pm

Topic: Designing and construction of a bamboo multi-purpose holder.

Objective: By close of the instructional period learners will be able to design and construct a multi-purpose holder.

Previous Knowledge: Learners were assigned to design a multi-purpose holder of any shape.

Duration: 3 hours

T/LM: Laminated bamboo, Hole saw, Hacksaw, Light bamboo Culm, Sand paper, White glue, Bondex glue, Pencil, Plane, Lacquer, Sanding sealer.

.17.1 Introduction

Researcher: Describe a multi-purpose holder.

Ibrahim: A multi-purpose holder may be any object that are used to hold many things.

Bondze: It is an art piece that can hold many items.

Alice: A multi-purpose holder can be put on office desk.

Researcher: It is a decorative piece with many holders to keep petty items like pens, pencils, erasers, pins, etc. at the office. It is normally called an organizer.

Biney: Is it used only at the office?

Researcher: No, it is used wherever one wants depending on what one wants to keep in it.

Inspection: Group A & B were invited to present their sketches for inspection.

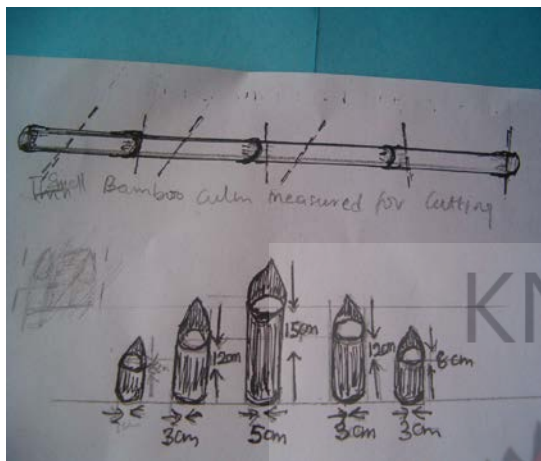


Figure 5. Stages 1 and 2 of design process of Multi-Purpose holder

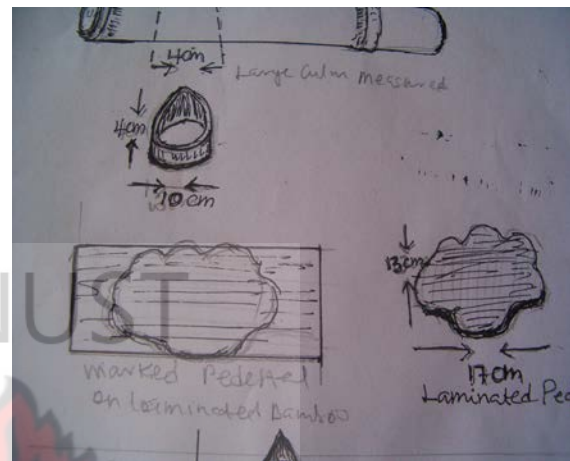


Figure 6: stages 3 and 4 of design process of Multi-Purpose holder

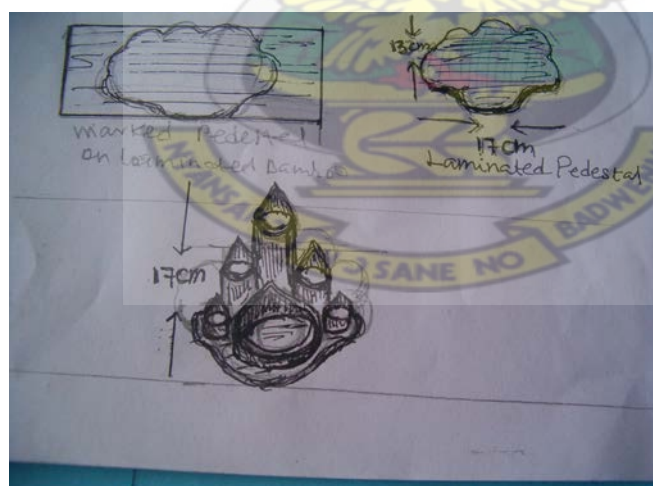


Figure 7 : Final stage of design process of multi-purpose holder

Biney: Please Sir, did you ask us to design as individuals or in a group?

Researcher: I would have expected each of you to have a separate design quite apart from the group work.

After the inspection of the sketches and designs of each group, that of group A was chosen to be executed for convenience sake.

Ibrahim: Please Sir, why did you choose group A's design only?

Researcher: I have told you that, the training is based on concentric approach, that is we are working from known to unknown.

As such, group A produced a design that integrates bamboo Culms and laminated bamboo. But group B's design was fully laminated. In our next lesson we shall deal basically on laminated designs.



Plate 28. Treated bamboo (bambusa vulgaris) For lamination

3.17.2 Measuring process:

Each group was instructed to mark a pedestal measuring fifteen centimeters (15cm) by thirteen centimeter (13cm) on laminated bamboo.



Plate 29. Learners measuring Culms

Light size treated bamboo poles were also given out to learners to measure five varied sizes of the Culm between 8cm – 10cm.

3.17.3 Cutting process:

Learners were asked to cut the outline of the marked area with hole saws.

Newlove: The saw is not cutting well. Do I have to press hard?

Biney: The saw is blunt.

Researcher: That was why I told you to take good care of your tools after use.

Bamboo Culm is hard, so it requires sharp tool to treat it.

Group B, do not rush in cutting outlines. Special care is taken when cutting outlines especially curvy and circular outlines.

The groups finally cut out the marked up outlines from the laminated board for their pedestal for their pieces.



Plate 30. Marked up pedestal on laminated bamboo

After cutting out the pedestal, learners were then directed to cut the measured culms from the treated bamboo poles.

According to the chosen design one end of each Culm was cut slanted to an acute angle whereas the other ends were cut straight for it to rest firmly on pedestal. A short big ring of the Culm was cut to form the central portion of the holder. The two groups went through the process without much difficulty.

3.17.4 Sanding process:

In each group, pieces of sand paper were supplied to them to sand the various parts to smoothness. Bondze, I have found some scratches on my Culm.

Researcher: Be cautioned and do not make such a mistake again.

Do not ever sand across grains.

High graded sand paper within the ranges of (P 60, P 80) are always used first before low graded ones (P 100, P 120) are used to give perfect smoothness.

With time sanding machines will be introduced for you to see how it also works

Learners sanded both the pedestal and the Culms to a wonderful smoothness



Plate 31. Sanding learners

3.17. 5 Assemblage process:

Researcher: Learners were told to bring out their pedestal. They arranged the Culm on the

pedestals on instruction, taking cognizance of principles of design. After satisfied arrangement, positional marking for each component were done by learners.

Tieku: Are we going to nail them together?



Plata 32. Measured pieces of bamboo Culms to be assembled

Researcher: Group B tell us what you think is the next stage of the assembly?

Ibrahim: I think that is the purpose of the bondex glue.

Researcher: That is right! Now with your brushes, collect some reasonable amount of white glue and spread it on the positional marks on the pedestal and the foot of the Culms.

Learners later fixed the Culm on the pedestals considering the design of the holder.

Stephen: Do we need a clamp here?

Researcher: You cannot clamp all the pieces right into the clamp, so it will be left to dry. A multi-purpose holder formed.

Ibrahim: Can we include any idea onto it at this stage?

Researcher: Always stick to your design. If you feel like adding a new idea to it, then it must be added to the design if possible. If not so, create another design and include that new idea.

3.17.6 Finishing process:

Researcher: Group A, describe how you will finish your multi-purpose holder.

Bondze: We will put sanding sealer on the ware for it to dry. After that we will spray the whole pieces with lacquer or Varnish to make it glossy.

Researcher: That is nice.

The two groups painted sanding sealer on the pieces and after sanding vanish or lacquer was sprayed on the ware



Plate 33. Finished multi-purpose holder

317.7 Evaluation:

- 1) State four tools used in making a multi-purpose holder.
- 2) How do you assemble components of a multi-purpose holder?
- 3) Explain the following terms
 - a) Pedestal
 - b) Sanding sealer
 - c) Positional marks
 - d) Across grains

Learners Remarks:

Ibrahim: Sir, I have told you that I'm proud of you. You are making us great. To produce such items from bamboo is wonderful.

Mintah: People have started making orders of some of the items; when will we produce in bulk for them?

Researcher's Remarks: Learners take lesson seriously. Projects are well executed.

3.18.0 Lesson Six:

Date: 18th March, 2009

Time: 12:30pm – 3:00pm.

Topic: Sequence of operations in (harvesting, preparation, processing, finishing) in Processing bamboo.

Objective: By the close of the lesson learners will be able to describe in sequence the operations in processing bamboo.

Previous Knowledge: Learners have been using bamboo for domestic purposes.

Duration: 3 hours

Tools & Materials: Hacksaw, Bow-Saw, Flatsaw, Matchete, Japanese Knife, Bamboo Culm.

3.18.1 Introduction:

Researcher: Have you used bamboo for any domestic purpose?

Newlove: We have been using bamboo for lazy chairs under trees.

Darko: We use bamboo for fencing.

Prince: Bamboo is used for roofing houses.

Researcher: What do you do before using the bamboo for any of the mentioned purposes?

Newlove: We normally cut them and prepare them before we use.

Researcher: Learners were informed that bamboo has to undergo a number of processing operations before converted into different products. Even though, some process are common for some usage, there are sequence of operations involved in harvesting, processing and finishing in each case, followed by description of tools used and technologies employed. Janssen,(1982).

Dominic: Sir, you said we have sequential operations. If I understood you, it means we have one operation after the other; but we do not follow any sequence in getting our bamboo for use. Does it mean we are wrong?

Researcher: In a way yes, but with technological advancement, certain problems are being improved upon to avoid waste of material, time and effort.



Plate 34. Learners at work asking questions

3.18.2 Harvesting (Felling):

Researcher: Learners were helped to define harvesting.

Newlove: Harvesting is the art of cutting down bamboo stems.

Adusei: It is a process of cutting one branch or branches from the main stand.

Beney: It is a practice of removing singles of stems from the main group.

Researcher: Harvesting is the removal of bamboo Culm from the stand using sharp tools.

Learners were taught that harvesting according to INBAR (International Network for Bamboo and Rattan) (1997) follows laid down rules or recommendations. For instance, in India, the following rules are prescribed for harvesting bamboo.

- No cutting of clumps is allowed in the year of their flowering.
- No shoot product as a result of the last rains may be cut.

- At least three healthy, mature and fairly erect Culms of not less than 3meters length have to be left in each clump.
- No digging or extraction of Rhizomes may be allowed.
- Shoots may be cut only at a height of 150 to 300mm above the ground.
- The use of sharp implement is insisted upon in order to avoid tearing and splitting the stumps of the Culm.

Darko: It seems we do not follow such recommendations in Ghana. Here in Asin Fosu we cut bamboo anyhow anytime.

Prince: Why all these recommendations? Does bamboo belong to anybody at all? It is free gift of nature.

Researcher: Darko, it is true that we cut bamboo anyhow but that practice does not preserve bamboo for posterity. The recommendations, if we have in Ghana will enable us to cherish bamboo like it is in the other part of the World.

To go further, Clumps (stands) should be managed such that, they may not be congested, making the cutting of an individual Culm difficult. Learners were also enlightened on removing thorny branches before felling the Culm to avoid physical hazard to the harvested.

Anonymous (1975) suggested the use of long, fairly heavy blades for the matchets.

Delimbing is yet another operation immediately after harvesting. Knives are used to remove branches. The knife should be drawn upward to remove the branches so that no damage is done to the Culm. The right way of doing it was demonstrated as follows.



Plate 35. Right way of delimbing bamboo



Plate 36. Wrong way of delimbing bamboo.

3.18.3 Preparation:

Researcher: Having taught learners much about harvesting the next successive operation to study was preparation. I went directly to explaining to them the two main types of preparation.

(a) Primary (b) Secondary preparation.

By primary preparation, learners were taken through the process of removing nodes or knots with knife or curved blade to make Culm friendly to the hand without damaging the Culm.

Newlove: Can I say that primary preparation is done to set the Culm free from all bulging nodes?

Researcher: You are right.



Plate 37. Learners removing of bulging nodes from Culm

(b) Secondary preparation involves extraction of gummy substances and reduction in starch content. Learners also noted that the purpose of removing gummy substances is to achieve an even colour, while removal of starch reduces later attacks by fungi and insects.

Prince: Are you saying bamboo contains carbohydrates and other food nutrients?

Researcher: Yes of course, that is why it is prone to insect attack. Soft drink is obtained from bamboo due to the presence of the food nutrient.

To achieve a lustrous iron colour to bamboo, the Japanese craftsmen extract the gummy substances by two methods dry and wet, Anonymous (1975). In the dry process, green bamboo is evenly heated at 120^oc. This causes the gummy substances and water to emerge and they are wiped off with a dry cloth.

Abban: How do we heat it? Is it in fire?

Researcher: Bamboo is heated in ovens or kilns or buried under ground and fire set on it

Darko: How do we know the heat is at 120^oc?

Newlove: I think a thermometer is used to read temperature.

Researcher: That is right. But in the wet process, the bamboo is immersed in boiling water for 1 – 2 hours or in caustic soda solution of (0.2 – 0. 8%) or sodium carbonate (0.2 – 1-2%) solution for 10 -15 minutes.

After immersion, the surface of the bamboo is wiped with dry cloth.

Sulthony (1987) has it that other different methods are used to leach out starch.

One widely practiced method is to keep the bamboo immersed in water for 90 days. Learners were again informed that quite apart from these traditional methods, chemical methods are also applicable.

3.18.4 Primary processing:

Researcher: Learners after being taken through preparation process were hurriedly switched on to primary processing.

Here they were told that, after preparation the Culm is ready for primary processing. For use in laminated and woven products, the Culm has to be split into strips, and the strips further processed to get splits and slivers.

Splitting into strips:

Researcher: According to McClure (1953) as in INBAR, a simple set of devices used for splitting Culms are made. Learners realized that instead of using machete in splitting bamboo Culm a cross of iron or hardwood bars (about 25mm thick) is supported by post (100mm cross-section and 900mm high) are firmly set in the ground. Two pairs of slits are made at right angle to each other at top end of the Culm, and the slits are held open with wedges until the Culm is placed in position on the cross. Then the Culm is pushed and pulled by hand until it is split. A steel wedge can be used for splitting quartered Culms.

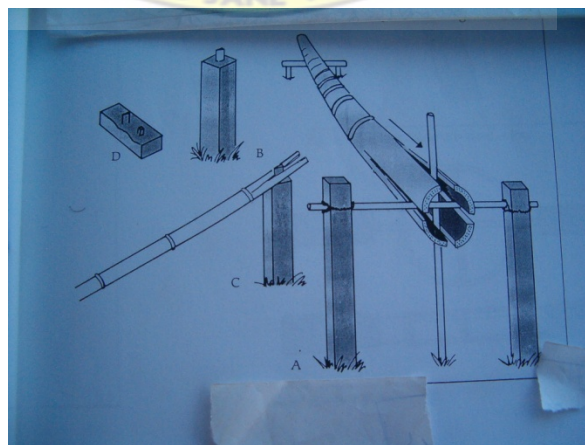


Figure 8. Cross iron splitter

Again, learners were made to understand that a radial knife can also be used, either by hand or in a machine. Depending on the diameter of the Culm and the width of the required strips. Knives with different numbers of blades are used.

Hidalgo (1992) as in INBAR.



Figure 9. Radial knife for splitting bamboo

3.18.5 Secondary processing:

Researcher: Secondary processing involves bleaching, dyeing, carbonation, and colouring with acid for bamboo to attain colour. Learners were taken through these processes.

Bleaching: Bleaching is done on strips or splits of bamboo by immersing them in solution of bisulphate. This is done so that colouration from the presence of gums, resins or oily substances will not mar the appearance of the splits. (Kallapur 1989) as in INBAR.

Dyeing: This is the use of vegetable dyes obtained from different plant materials to dye splits by boiling them and the bamboo splits to assume a particular colour.

Carbonation: This is done by putting bamboo splits inside a steam boiler for about 20 – 30 minutes at 5kg/cm^2 (150°). This results in bamboo attaining a uniform colour.

Colouring with acid: This is useful for making flower vases, lamps, etc. The bamboo is cut into desired length and the outer skin thoroughly scraped off. Hydrochloric acid is then applied by brush and the bamboo placed in an oven. The colour will turn brown.

Finishing:

Researcher: Learners were taught that based on the type of end-use and the specific product different finishing methods are used, these methods vary from place to place.

Smoking:

I explained to them that finished bamboo product can be subjected to prolonged smoking over a fire place. The colour becomes a very dark brown. (Ranjan et al. 1986).

Lacquering:

Learners understood the fact that ready-made synthetic lacquer can be used on bamboo wares as finishing. Lacquering is done either by spraying or by brushing. To get a special luster, finish, cashew lacquer (1 part cashew nut oil in 5 parts of turpentine thinner) is used (Anonymous 1983b).

Painting:

The researcher took pains to elucidate how bamboo wares are painted. Articles such as fans, lamps shade, etc. are finished with varnish readily available in the market.

Polyurethane varnish is currently popular because of its durability and scratch resistance. Depending on the product, varnish can be applied by brushing or spraying.

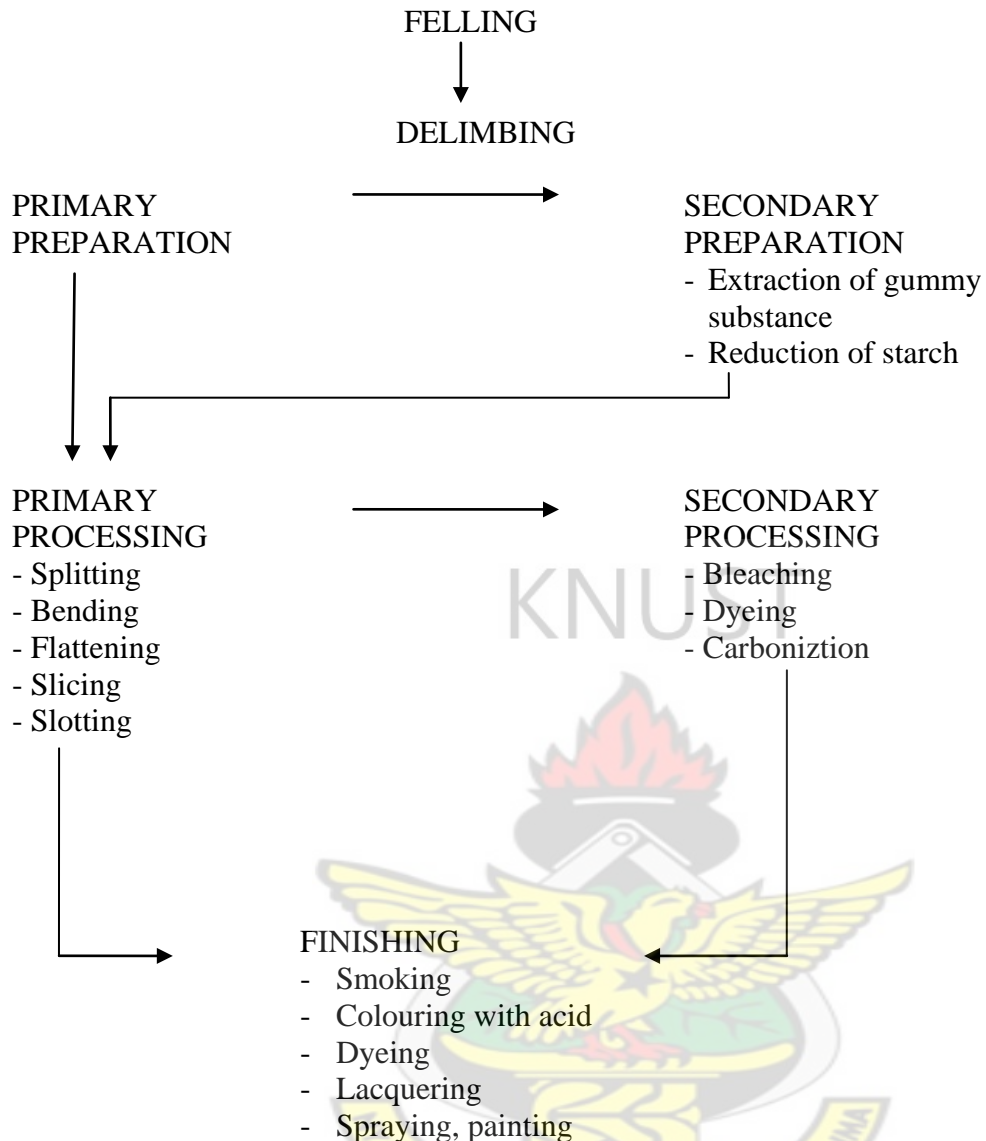


Figure 10. Sequence of operations in processing bamboo

3.18.6 Evaluation:

- 1) Mention any 3 of the sequences of operation.
- 2) Describe fully finishing process.
- 3) Explain primary and secondary preparation.
- 4) What are the following terms.

- a) Bleaching
- b) Smoking
- c) Lacquering
- d) Carbonation
- e) Dyeing

5) Illustrate a simple cross-bar device for splitting bamboo.

Remarks: Lesson comprehensively exhausted.

3.19.0 Lesson Seven:

Date: 2nd April, 2009

Time: 2:30pm – 5:30pm

Topic: Designing and construction of bamboo curtain.

Objective: Learners will be able to design and construct a curtain using bamboo.

Tools and material: Hack saw, jig saw, nylon thread (twine), cowries, needles, sand paper, sanding sealer, plant seeds, lacquer, bamboo branches, plastic container.

Previous knowledge: Learners at this moment have some skill in the under listed processes.

Construction Procedure:

- a) Harvesting of bamboo branches.
- b) Preparation of branches
- c) Designing process
- d) Measuring process
- e) Cutting process
- f) Sanding process
- g) Organization
- h) Finishing

3.19.1 Harvesting and Preparation:

I instructed the learners to harvest bamboo branches a week before the lesson.

This was done to ensure that the removal of nodes and other tiny branches are done. Sharp tools were involved in the harvesting. Upon an instruction, branches were cut to sizeable lengths.

Abban: Are we going to keep them in chemical for treatment?

Newlove: For preservation, I think we have to keep them in an oven to kill already infested borers.

Researcher: Make a solution of Dursban 4E in the plastic container and soak the branches overnight.

All these preparation were done a week before the main instructional period.

Designing:

Since learners have been designing before construction in the previous lessons, when the topic was given, several design of curtains were put on

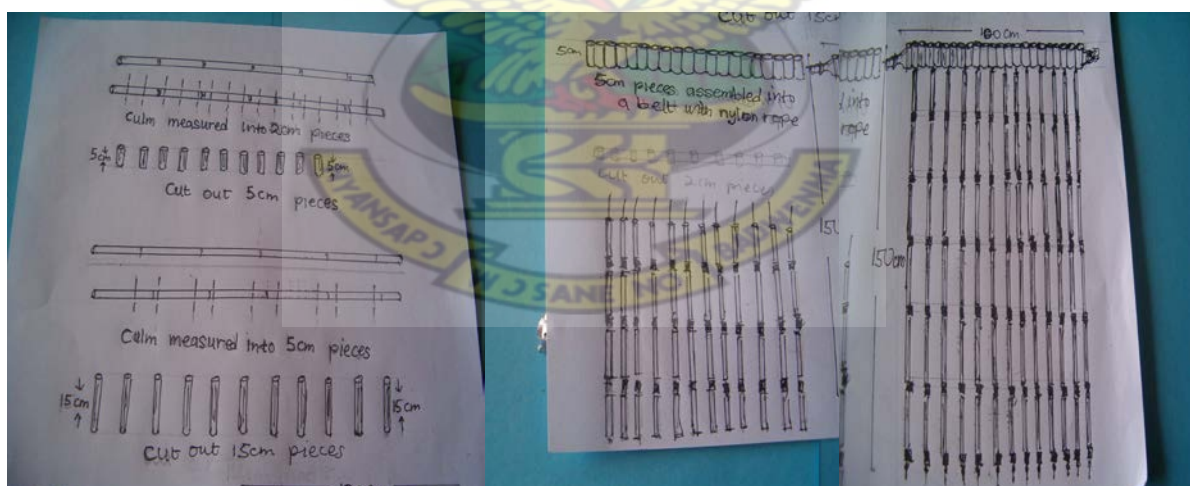


Figure 11: Sketches of curtains during designing

There are some of the processes that results cannot be ascertained instantly in class. Such processes, throughout the project were given out days before lesson period.

3.19.2 Measuring Process:

Researcher: Learners having brought the treated branches to the working table, on job division of labour was resorted to. Two groups were formed. One group was assigned with measuring 5cm sizes of the bamboo while the other group restricted to the measuring of 15cm sizes. Supervision was done to ensure accurate sizes. Measurement was done between nodes.

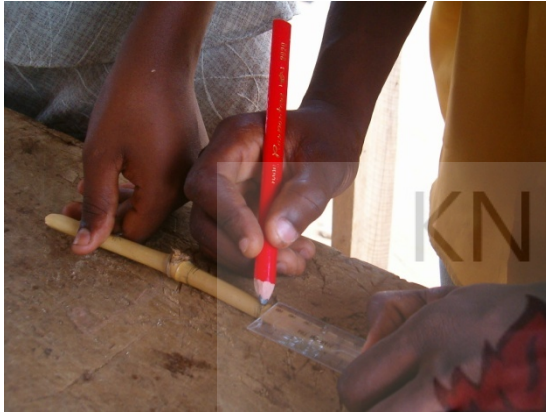


Plate 38. Group A measuring 5cm pieces



Plate 39. Group B measuring 15cm pieces

Cutting Process:

Dominic: Sir, I will do the cutting all alone.

Cynthia: I will do it instead.

Researcher: Since bamboo curtain involves a lot of cutting pieces, each group was charged to cut accurately as others in the group did the measuring. Cutting of the thistles was done between nodes. No nodal joint was needed for each branch Culm.



Plate 40. Learners cutting short thin Culm



Plate 41. Learners cutting long thin culm

Sanding Process:

The other members in each group were caught in serious sanding of the cut pieces. Sand papers of various degrees were used to ensure smooth feel of the cut pieces. Cut ends were rubbed directly on spread sand paper to smoothness.



Plate 42. Learners sanding 5cm cut pieces



Plate 43. Learners sanding 15cm cut pieces

Sanding sealer was painted on cut pieces and then dried for sometime.

The use of sanding sealer maintains the colour of the bamboo quite apart from its sealing effect.

3.19.3 Organization / Assemblage:

Because curtains dangle on ropes, nylon rope and twine were used for the weaving and arrangement of the cut pieces and other integrated materials that have holes through them. Learners were shown how to run needle and thread through the holes of the thin Culms.

Researcher's demonstration enabled learners to arrange the 5cm pieces first on nylon rope. That was done in a tight bond with rope running through each hole, in that order to form a lattice belt of bamboo which prescribed the top part of the curtain.



Plate 44:. 5cm strips being assembled by group A

Plate 45: 15cm strips being assembled by group B

As that was going on, others were taught to mount the 15cm pieces by the help of long needle nylon ropes with a big nose at one end. When the needle ran through one 15cm piece it was interspaced by 2cm smaller dyed cut pieces of bamboo or cowries. In all, learners made twenty long strips. Each strip held ten of the 15cm pieces interspaced by two pieces of the smaller dyed 2cm pieces.

Cynthia: I have mounted fifteen pieces of the 15cm cuttings.

Fordjour: No! Sir did not ask us to mount fifteen but ten.

Researcher: For proportion, all strips should be of the same dimension. Each strip should be about 180cm long.

Lestowel: How do we hang these long strips on the belt? Are we going to glue them together?

Researcher: Who has an idea?

Fordjour: I think we will run the unused part of the nylon rope into the holes of the belt and tie them together.

Researcher: Excellent, the belt of the 5cm pieces was put horizontally on the working bench. Learners were instructed to hang all the twenty strips through the holes of the belt with the interval of 5cm apart to dangle loose on the horizontal belt.



Plate 46. 5cm strips assembled by learners



Plate 47. Long strips hanged on to 5cm belt



Plate 48. Learners constructed bamboo curtain

3.19.4 Finishing:

Researcher: Group B how did we finish the previous bamboo works?

Cynthia: We can spray or paint with lacquer.

Alice: We can paint in enamel colours.

Researcher: Learners were told to paint the curtain with lacquer and allowed to dry. A beautiful bamboo curtain was constructed



Plate 49. Finishing curtain

3.19.5 Evaluation:

- 1) Explain cutting process on the construction of bamboo curtain.
- 2) How do you measure and cut thin Culms for curtain making?
- 3) What is organization in bamboo technology?
- 4) Mention six tools necessary for bamboo curtain construction.

Learners Remarks:

Alice: Sir, I will specialize in only bamboo curtain making. I have really enjoyed the lesson.

Dapaah: Now people call us “the bamboo people”. Many troop into our houses for the same items.

Abban: I have no problem again. I will go into bamboo soon after this program.

Researcher Remarks: Learners are now fast and skillful. By the look of things they are improving fast

- Evaluation:
- [1] What are fruit trays used for?
 - [2] Bamboo fruit trays can be integrated with Rattan.
Discuss.
 - [3] How did you carve grooves on you work?
 - [4] Describe five tools used in the construction of bamboo fruit tray.

Remarks: Learners skill improved.

3.20.0 Lesson Eight:

Date: 18th April, 2009

Time: 10:00am – 1:00pm

Topic: Design and Construct a Bamboo Fruit Tray

Specific Objective: By the close of the lesson learners will be able to design and
Construct fruit tray in bamboo.

Previous Knowledge: Learners have been serving on fruit trays.

Tools and Materials: Hole saw, jewelers saw, ruler, pencil, sand paper, sanding sealer, Lacquer, brush, bamboo poles.

Researcher: What is fruit tray?

Sakina : It is the container in which fruits are served.

Dominic: It is a flat ware on which fruits are carried.

Researcher: Fruit trays are containers in which fruits are arranged or served.
They can be made in variety of media yet it can a made from bamboo as a material.

3.20.1 Designing process:

Researcher: Each learner was instructed to design a bamboo tray with the dimension 45cm by 4cm. Preliminary sketches were supervised by the researcher. Some drawings were selected and pasted on the board for criticism. Learners' designs inspected and marked.

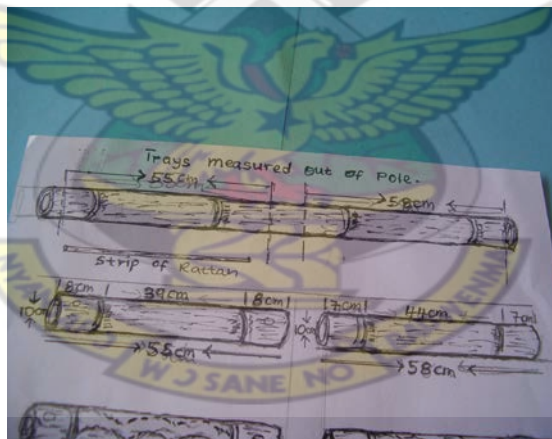


Figure 12 :Dimension of the designed trays of plate 57

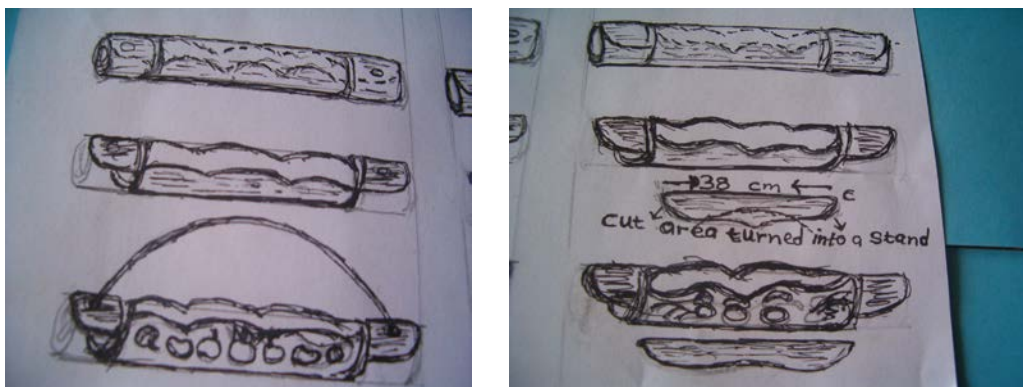


Figure 13. Preliminary designs of group A and B

3.20.2 Measuring process:

Researcher: Stephen, take us through measuring as applied in bamboo technology.

Measuring can be said to be the dimension that a product will have to take during construction .

Akwasi: It is the art of using a measuring instrument to work out for given proportion.

Researcher: Measuring entails a specific size of an article. It is an important process in construction. It guides artisans to honour what is specified in an order. Learners were charged to take measurement of their culms according to the dimension of their preliminary sketches.



Plate 50. Learners taking measurement of tray from culms

Culms cutting process:

Learners were asked to use appropriate cutting tools to cut out the given dimension. Bamboo culms clamped in vices and clamps as straight cutting were done.



Plate 51. Learners cutting culms from bamboo poles

Cut out culms were sent to the lathe machine for lathing indicating the fact that bamboo can be worked on using lathe machine.

3.20.3 Sanding process :

Researcher: How is sanding done?

Panford: By first using rough sand paper thoroughly on the culm to clear the initial roughness and later sand to smoothness with smooth sand paper.

Researcher: All learners were given fifteen minutes to sand their works after which preparation was made to transfer designs onto the main sanded culm.

3.20.4 Transfer of designs:

Researcher: One from each group to tell us how designs are transferred onto the culm .

Newlove: In bamboo technology, design transfer is done either by tracing or by look and draw method.

Alice: Please, what is look and draw?

Newlove: It is the connection between the eye contact and the hand in drawing.

Abban: Transfer of design is getting what you have on your final sketch onto the main work.

Researcher : With this in mind, learners were instructed to transfer their designs onto the their work.



Plate 52. Learners transferring design unto the Culm.

Carving Process

Researcher: A demonstration to set learners to on the job training was done by carving along the outline of the design transferred onto the culm using the V-gouge and hitting gently with the mallet.

Alice: Why are chisels not appropriate tools for carving outlines?

Researcher: Outlines are thin margins to be made into grooves, hence the use of the V-shaped gouge modified at the cutting end for scooping.

Learners were supervised during the carving process for accuracy and aesthetics. Learners were also cautioned not to hit the cutting tool too hard with the mallet.

Listowel: Can we do sanding when grooves are found to be rough?

Researcher: Yes, smooth sand paper can be used to sand rough grooves.

Beautiful fruit trays were constructed by learners



Plate 53. Fruit tray in groove carving

3.20.5 Finishing:

Researcher: The three groups were given different finishing methods for their finish.

Group A was charged to spray their work with varnish. With a spray gun, varnish was sprayed for several times.

Group B sprayed their work with SPL to a perfect luster.

Group C was asked to paint their work with lacquer.

Alice: Why didn't we use the same finisher?

Researcher: For you to compare the effect of each finisher on bamboo.



Plate 54. Finished bamboo trays

Some other products in bamboo technology



Plate 55: Bamboo tissue roller



Plate 56 :Bamboo trays

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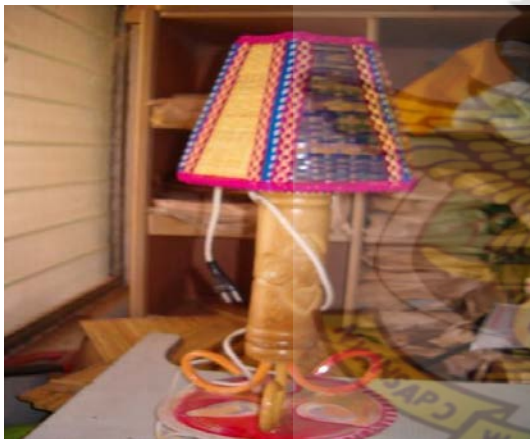


Plate 57: Lamp shade in bamboo (integrated with metal)



Plate 58 : Flower vase

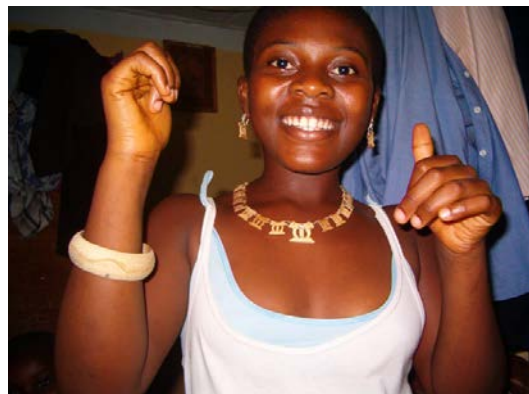


Plate 59: A girl adorned with bamboo jewels



Plate 60: Bamboo organizer



Plate 61: Lamp shade in bamboo



Plate 62: Table Wares



Plate 63: Bamboo Jewels

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

5.1 Having taken a group of Senior High School Visual Arts Leavers, through a six months period of bamboo technology training, the chart below (figure 15) reveals the findings that were ascertained during the training. A pre-intervention test was conducted in the first month to weigh learners' skill levels through a drawing assignment. Their performances were marked over hundred percent as shown under pre-intervention score in the chart below. A post- intervention test was again conducted in the fifth month to check the impact of the training as shown under post –intervention as shown in the chart below.

Chart of leavers' successive skill levels development.

CODE	SKILL LEVELS TESTED BEFORE AND AFTER TRAINING	SCORES MEASURED IN 100%	
		PRE-INTERVENTION SCORE	POST- INTERVENTION SCORE
1.	Design aspect	10	50
2.	Tools and material handling	15	55
3.	Transfer of design	10	55
4.	Measuring of components	15	60
5.	Assemblage	20	60
6.	Finishing	5	55
7.	Accuracy/precision	10	50
8.	Supervision exposure	15	65
9.	Motivation	10	65

Figure 15: Chart of learner's skill level

In the course of the period of training three groups were made: Namely, Group A, Group B, and Group C each with a leader.

The reason for the groupings was to enable me to deduce the pace, strength and weaknesses of learners and also for me to give a close supervision to the various fragments to ensure skill development. Training started actually on 10th November, 2008 from 9:00am – 12:30pm and ended in 19th July 2009.

In all the various lessons, the researcher examined his actions critically as a player and teacher facilitator to improving upon the performances of the learners as required in action research.

This was done through demonstrations, thought provoking questions, leading questions and instant corrections after supervision. The chart above is interpreted as below:

5.2 Design Aspect: The topic for discussion was preliminary design with the sub-topic using circles to make a design. It was found out as the lesson progressed that; some of the learners hardly could draw or sketch from any natural or artificial source. Some of them gave an indication that, they were not even taught idea development in their schools as visual arts students. For example one of them asked, “Sir, does it mean we have to plan a work before execution?”

Planning of the work leads to design. Design leads to the combination of elements and principles of design. Design without which no product can be made is paramount.

It surprises one to note that, in the design class some members of group C found it difficult to draw perfect circles and other shapes with free hands. Some handled pencils during drawing as if writing with pen. There was a problem of eye-to-hand contact with learners during look and draw exercises.

In the subsequent lessons, Group A stood outstanding in designing, Group C happened to be intermediary. Some learners were found copying other group's work. All because they lack the skill to design. Hence, there was not uniqueness in terms of variety, all

because these artists remained copyists. The lack of design skill has contributed to why they did not produce artifacts in any medium for sale to make them self-employed. However, by the end of the six months intensive job related training, learners' design skill was positively affected. Because they could now design to a large extent in all the construction projects undertaken with them. That indeed increased the design skill grade from 10% to 55% as their present level according to my marking scheme. Performances were assessed over hundred percent.($P/100\%$) where P = marks scored.

5.3 Tools and Material Handling: Learners were found to be battling with tools and materials. In a drawing exercise I had with them for instance, the learner had a wrong way of holding pencils. Where pencils were not properly held shapes were created inaccurately. For example circles were not perfect as shoulders of curves were not sharp.

Handling of painting brushes was yet another problem found with learners. Some of the learners found it difficult to paint within margins. The reason was that learners' ability in handling brushes was such that brush marks were found beyond margins when they painted. This situation may have come from the fact that Visual Arts teachers treat the subject more theoretical than the real practical sense.

Initially, when learners were introduced to the use of cutting tools like gouges, saw, chisels, and so on it was difficult for them to transfer their skill in handling simple drawing tools into such cutting tools. Some of the girls remarked that, they could not handle the saw, forgetting that training leads to perfection. However, by the second month of the training learners were able to handle some of the tools with flair. That sort of cutting outside marked areas, a feature of their former skill was improved upon gradually with time in the programme.

It is worthy of mentioning that, tool handling contributes so much in ones ability to construct after design. And because some of these Visual Arts Leavers lack the acumen of tool handling there was no way they could construct art products and offer for sale to make

them self-employed. For now, most of them handle tools perfectly, giving rise to accurate cutting effect into production.

5.4 Transfer of Design: Symbols and motifs were used on artifacts as decorative patterns. These patterns were normally done on sketch papers before they were later transferred unto the main art piece

What I found out was that, learners' transfer of design from paper to artifact was associated with inaccuracy. Designs on paper seemed rather bigger or smaller than the transferred.

Motifs and patterns did not look alike as on artifacts. Repeated designs were not proportional and rhythmic. The products could not meet the marketing standard due to low level of decoration on artifacts. The fact was that learners drawing skill of look and draw was too minimal. Having ushered them into that period of one- on- one training, eye- to- hand contact of learners improved very fast that, artifacts produced later met standards.

5.5 Measurement of Components: Early in the programme, learners did not put any seriousness in proportion of work.

Even though, they had an idea of measurement, stricter dimensions for standardization were not so much of their concern. The course instilled into them the importance of proportion during construction. Learners after being made to measure every step from design stage to assemblage, gained a lot of experiences in component measurement.

Learners' horizon of measuring got broadened from the former lower level. In all the practical lessons I undertook with learners, special attention was indeed attached to each art piece.

5.6 Assemblage: One of the findings among the lot that stood outstanding was learners quick adherence to change in their old sense of assembling practical works. Initially, they arranged components without taking care of principles of design. By close of the programme, learners

considered principles like rhythm, balance, proportion etc. into their compositions, bringing practical pieces to the standard needed for the market.

5.7 Finishing: Learners were able to design and construct alright. But the ability to finish the work left much to be desired. Finishing being the final touch of an artifact demands a special treatment. This treatment given to learners on finishing has led to the production of good finishing in bamboo pieces that worth the price. Such techniques learners were taught were spraying, painting, polishing and smoking that gave artifacts glossy finish. Their finished pieces seemed rather appealing as compared to work done in the early stages of the programme. The indication that learners can produce good finishing in the subsequent attempt was the high level of performance in some of the works so produced after training.

5.8 Accuracy/Precision: Bamboo as a material is not as malleable to be shaped at ease. Yet, it takes a skillful bamboo artist to put it into various shapes. Learners were entirely new to the material, so precision was not obtained in the early parts of the programme.

But as lessons progressed, a reasonable amount of accuracy was exhibited in some work pieces by learners through sketching and working along outlines. Whatever pieces that were designed at least had resemblance to the source from which came the preliminary idea.

5.9 Supervision: Supervision in practical subject teaching is vital. Where learners' activities are constantly supervised their output happens to be great. Supervision leads to perfection because it ensures on the job training, an ingredient needed in vocational training.

When the efforts of the learners were supervised, even within that short period there was a progressive performances with respect to design and construction.

This reveals the fact that, learners activities back at school were not seriously supervised hence their inability to be self-employed, having graduated as Visual Art Student.

The three groupings that were constituted from the sample of twenty-two learners were given all opportunities of which supervision was one.

However, with regular supervision in all stages, improvement was seen to take place on the side of slow learners.

5.10 Motivation: It was found in the process that one reason for learners' incapacity to practice art after school was that, little was done as morale booster when they were in school. To get learners' efforts coordinated towards a specific objective, motivation is quite important. In the absence of that, learners attitudes towards work becomes minimal. In the training, motivation in the form of encouragement, praises, supply of banana and groundnuts and at times the provision of gari and sugar, learners were motivated. As such learners' zeal and aspirations were higher.

That alone gingered them to work hours un- end. As time was spent on pieces, standards were achieved whereas more and more pieces were produced.

In figure 5, it is clearly seen that there has been an impact of the training on learners. The abilities they had before the programme were not enough to let them produce art pieces for sale. However, after the six months training, learners abilities took a dramatic step ahead empowering them the skill to produce high standard artifacts.

Some sort of traditional influences and superstitions like days of felling bamboo or trees, days of crossings some river bodies and the negative idea of women using tools for carving in the locality were found to be hindrances for visual arts leavers to practice some areas in Art.

With persuasions and psychology, learners came to the realization that some of these superstitions and traditional adherence were enemies to progress. In view of that, the few girls amongst the group began to exhibit the best work effort. No wonder the work of one of

the girls whose father is a goldsmith was adjudged the best when it came to individual creation. She fashioned out jewels from bamboo and also ladies belt in bamboo. Another result about the project was that, there was a complete relationship between aesthetics and human environment.

When the training section was over, learners were asked to produce bamboo items of their own choice. In a matter of two weeks, items produced were meticulous. This drew a lot of people into the training centre to watch and buy the exhibits. Many of these items were patronized at the show room ranging from one Ghana cedi to six Ghana cedis. Some orders were also placed for some of the items. Some were also sent to National Centre for Culture in Kumasi for sale. The implication is that more interesting items can be produced from bamboo and when these are produced, a ready market exists for them. The fact that their work was sold was the best motivation they could have.

5.11 Test of Research Question

That when a group of Senior High School Visual Art Leavers are trained in bamboo technology, they will be self-employed is justified. Since the training given to the group equipped them such that, they were able to produce high standard bamboo artifacts that can be exported. Three of the learners namely Josephina Abban, Tsibu Darko and Newlove Amponsah have come together to produce bamboo items for sale. One exciting result of the training was that, one of the girls has taken to the production of only bamboo jewels. These people tell me, “Sir, we are thankful for helping us get something to do”.

Some other people have undertaken projects in bamboo but theirs did not seek to solve the unemployment situation of Senior High School Visual Art Leavers. Yet this project is subject to further research.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The introduction of the educational reforms programme of 1987 by the government of Ghana was to promote vocational training in support of her effect to reduce the unemployment situation and also to equipping Visual Arts Students to be self-sustained. This good initiative has been challenged by some factors that do not encourage the Visual Arts graduates from Senior High School to be equipped with the requisite job related training that leads to self-reliance .Some of these problems are that, the methodology adopted by some of the art teachers are basically theoretical,(lack of demonstration of skill to students, few practical oriented projects or assignments given, finished works are frequently not marked or criticized, absence of workshops or studios)The Visual Arts graduates still face the challenges of unemployment in spite of the fact that they were given practical oriented training. All because, some of the materials needed in the other vocation areas to start something with after school are difficult to come by.

Bamboo as a material grows abundantly in many communities in Ghana. It grows very fast and is cheap to produce. Varieties of beautiful products can be produced from it. Yet bamboo technology is not taught in schools. It is in the light of this that I have found it expedient to research into using bamboo technology to equip Visual Art Leavers to produce such meticulous items for sale to make them self-sustained. To achieve this, specific objectives were drawn for the project as below;

- To identify a group of Senior High School Visual Art Graduates.
- To build a syllabus for Senior High School Bamboo Technology.
- To equip them with bamboo technology to be self-sustained.

- To recommend bamboo technology to Ghana Education Service

Since the methodology adopted in the project is supporting a change or promoting development, the following areas were given a serious dimension to enable learners to equip themselves with technologies needed to benefit from a material that grows abundantly in the country and is cheap to produce. The under listed points were the problem areas with the learners at the beginning of the training. These were identified through assignments and other practical tests given them before the training.

- i. Design skills of learners not enough to be creative.
- ii. Problems of tool handling
- iii. Transfer of design problem
- iv. Measurement of component not seriously treated.
- v. Poor assembly technique
- vi. Finishing not well treated
- vii. No accuracy or precision of work.
- viii. Lack of supervision on previous works.
- ix. Learners were not motivated

The six month training took into consideration every bit of what it takes to design and construction. The points below were the improvement achieved having assessed their works at the close of the training.

- i. Design skill of learners was improved upon.
- ii. Proper ways of tools and material handling was taught.
- iii. Problem of transfer of design was solved.
- iv. Measurement of component was given prominence.
- v. Good Assembly technique taught.
- vi. Perfect finishing was encouraged.

- vii. Accuracy or precision assured.
- viii. High level of job supervision by instructor.
- ix. Deserved motivation given to learners

5.2 Conclusion

Many of the Senior High School Visual Art graduates are not self-sustained due to lack of technical skill needed in a specific vocational training such as in bamboo technology.

However, it is hoped that, with the job related training of skills in this project, learners will be equipped enough to be creative to produce standard exportable bamboo products for both local and external markets.

5.3 Recommendations

- Many Ghanaians appreciate the use of decorative pieces for homes, offices, and even for body adornment. Therefore bamboo technology should be taught in the Senior High School Visual Arts programme.
- The teaching of bamboo technology must be intensified in schools with emphasis on design and identification of new uses of bamboo to meet modern needs.
- Class size must be small enough to ensure one on one principle of teaching practical subject.
- Teachers and instructors of bamboo technology must be well versed in the use of tools and equipments. Simple tools can be adopted.
- Skill training must not only be in theory but must be backed by practical demonstration.

Workshops must be organized for teachers to gain knowledge through teaching and sharing of ideas.

REFERENCES

- Amennuke (1991). *Rationale for Visual Arts Education* ,Evans Brothers Limited 2A Portman Mansions, London W1M 1LE.
- Anku-Gollo, (1948). *Bamboo Craft*,unpublished M.A dissertation, KNUST – Kumasi
- Amin (2008) *Bamboo Processing*, Kumasi Logs and Lumbers, Kumasi..
- Broad head, (1991). *A Vision for Vocational Education*. Vocational Education Journal 66 (1) 22.
- Besona, (2001). *Bamboo Plantation* , Tokyo: D.K Publishing.
- Baah (2001) *Straw of guinea grass and other grasses*:Proceedings of the third conference of IRAI, Knust,Kumasi.
- Beardshaw, (1998). *Economics. A Student's Guide*:New York ,Fourth Edition,Horizon Press.
- CRDD, (2008) *Teaching syllabus for Senior High School Visual Arts* CRDD,Accra.(iv-vi)
- Cussack, Stewart (2000). *What Bamboo can do*, Journal of the new grass, San Diego, Academic Press,(pp.12-13)
- Carlye (1843). *Know thy Work and do it*: Princeton NJ, D.Van Nostrand Co.Inc.
- Crompton, (2006). *Ornamental Bamboos*: Vocational and Technical Edu.,Journal, Jujuan, Chinese Professional Publication,Inc.,65,23-24
- Prof. Fobi, *Stipulated National Youth Employment Situation*: (personal Communication, August 20,2008)
- Technology,(1984). In the New Encyclopaedia Britanica 15th Edition (Vol.3,p 648 Chicago: Encyclopaedia Britanica.
- Edwards (1998). *Evaluation of Research in Education*:Journal of Unemployment , 12 (1) 43-45.

Finnie, (1981). *Fields of Plenty. Fields of Lean: the early Labour Market out comes of* Canadian University Graduates by Discipline. Canadian Journal of Higher Education. 31 (1). 14 -31.

False, (1993). *Technology, Today and Tomorrow*, Toronto, McGraw Hill Company inc.

Feldman, (1990). *Technology at Work*: New York, New York Facts on File .

Farrelly, (1995). *A Comprehensive Guide to this Remarkable Plant, its used and History*. Massachusetts Harvard University Press.

Gnanaharan, (1997). *Technologies for Bamboo and Rattan*: BIC Indian Bull, 3(1) 1-6.

Geahigan, (1981). *Career Education in the Visual Art.*: Art Education Journal, 34 (4), 36 -40.

Haggerty (1935). *Art, a way of life*: Minneapolis, MN: University of Minnesota Press.

[Http://en. Wikipedia . Org / wiki / Vocational Education](http://en.wikipedia.org/wiki/Vocational_Education) 2003.

[Http://www. Training. Com au/aqtt](http://www.training.com.au/aqtt) 2007.

Hall, (1998). *Macro Economics 2nd Edition*: New York ,John Hopkins Press.

Inbar (1998), *Indigenous tools and Equipment*: (Unpublished), International Network of Bamboo and Rattan, New Delhi, India.

JMX Bamboo Homepage, (2006). *Bamboo Propagation*: New Delhi, Indian Journal of Forestry 6, 98-103.

Karwatka (1993). *Introduction to Technology*: Ottawa , West Publishing Company.

Kincheloe, (1999). *Good Work, Smart Worker and the Integration of Academic and Vocational Education*: New York, Peter Lang Publishing.

Klar, Winslow and Kirby. (1983), *Art Education in Principle and Practice*: Spring Field , MA Bladley.

Mensah (2003), *Visual Art Curriculum for Polytechnic*: Unpublished M.A Dissertation KNUST-Kumasi.

Nutifafa, (1986). *Elements of Economics for West Africa* :Accra, Gapo Publication.

Prestones and Singh (2001), *The Wonderful Plant*: Korean Journal of Mycology Vol. 3, p 164.

Pierce, (1993), *Introduction to Technology*: Ottawa, West Publishing Company.

Sheers (1998), *Building with Bamboo*: Japanese Journal of Botany 44(2) 15-20

Somekh, (2006), *Action research: A methodology for change and Deut.*

Mardehead, UK: Open University Press.

Suttan, Cardine (1981). *How Did They Do It?: Washington* DC, US Printing office.

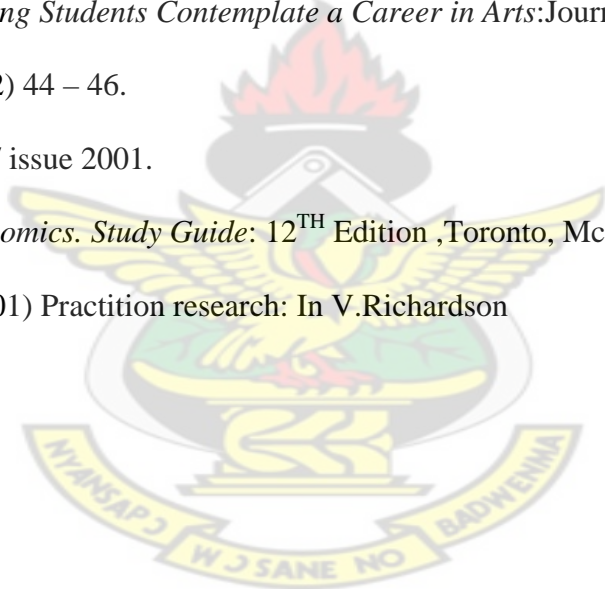
Steinbeack, (1939). *The grapes of wrath*; New York, Viking Press.

Ulbricht. (2001). *Helping Students Contemplate a Career in Arts*:Journal of Career Education, 7 (2) 44 – 46.

www. Politicises: UK / issue 2001.

Waldstad (2003). *Economics. Study Guide*: 12TH Edition ,Toronto, McGraw-Hill inc.

Zeichner, Noffice. (2001) *Practition research*: In V.Richardson



APPENDIX

TOOLS, MATERIALS AND EQUIPMENT

Bamboo is characterized by high strength and low weight. As a versatile material, it is easily worked on using simple tools. Tools necessary for wood carving are also used for bamboo carving.

Tools according to New Webster's Dictionary (1999) are pieces of devices which are used to help one to work with, especially, by using the hands to make or repair something. They are any hand or machine operated devices employed in manufacturing woodwork, metal work and for shapening or cutting wood or metal into parts. They do not form part of the work.

Tools used for this project include, gouge, saw, hack saw, machete, mallet.

Materials: These refer to the items used in making the physical and the visual products of the project.

Invariably, materials form part of the work. The following include the materials used in the project, wood glue, bamboo, sanding sealer, lacquer, vanish, sand paper.

Equipment on the other hand is necessary for a particular purpose.

1. **Tape measure:** This is a device for taking measurement.



Plate 65: Tape Measure

2. **Square:** A tool used for straightening the ends and corners built up of the work.
3. **Pencil:** This tool was used to draw sketches and outlines.
4. **Saw:** A tool with a long blade and a row of sharp points along one edge which was used to cut bamboo Culms



Plate 66: Saw

5. **Hack saw:** For cutting harder or thicker Culms
6. **Dividers:** For transferring measurement from ruler to metal by making marks to be cut.
7. **Protractor:** For measuring the diameter of a Culm for accuracy.
8. **Vanier caliper:** A tool used in measuring the circumference and the depth of a Culm.
9. **Plane:** This tool was used for dehairing and smothering of bamboo.



Plate 67 :Plane

10. **Hammer:** This tool consists of a piece of metal with a flattened end which is fixed on a long thin wooden or plastic handle for hitting nail

11. **Sanding machines:** They are machines under which abrasive papers are fixed to make wood surface smooth.

12. **Bench vice:** It was used for holding bamboo Culms in place to be cut with hack saw blade.



Plate 69: Bench Vice

13. **Lathe:** This is a turning machine that was used to hold and rotate bamboo Culm while a cutting tool shaped the material. It was also used to drill or bore holes in the work piece.

14. **Nail:** It is a thin piece of metal with a pointed end. It is driven into wood with the aid of a hammer for fastening pieces together.

15. **Sand paper:** This is abrasive sheet applied on bamboo to smoothen it.



Plate 70: Sand Paper

16. **Sanding sealer:** It is a watery chemical applied on bamboo Culm surfaces to seal pores spaces for a good finish.



Plate 71: Sanding Sealer

17. **Wood glue:** This was used to hold handles, pedestals and joints firmly together.



Plate 72: WoodGlue

18. **Chisels:** Chisels are tools with long metal blade that have sharp edges for cutting wood, stone etc. They come in different varieties in terms of shaped and sized. The chisels were used for carving some products in the project.



Plate 73: Chisels

Gouges: Gouges are chisels with concaves convex cross section for cutting grooves. Gouges used by bamboo carvers vary in their sweep or curvature of their cutting edges and thickness, where a sweep of the tools can be identified by pressing the edges of the tool into a piece of wood. The sweep leaves a mark that provides the shape of the tool. We have flat gouge also known as grounders. They are slightly carved, and they are named grounders due to their

function for cutting away backgrounds. Semi-circular sweep gouges are also called scroll gouges or quick gouges.

The bigger gouges with “U” shapes are known as flutters and the small ones are veimers.

Those with “V” shaped are used for blocking under cutting and cutting out designs.



Plate 74: Gouges

19. **Peg saw:** This tool was used to dig even peg slots, the depth of which is $\frac{2}{3}$ of the thickness of bamboo panels on the inner layer of the bamboo.

20. **Digging shade:** Tool used for removing the inner layer of bamboo.

21. **Mallet:** A long handled wooden hammer found in different varieties for striking chisel.



Plate 75: Mallet

22. **Clamp:** An engineer's vice which has two strong gripping jaws for holding works in the round.

23. **Jig saw:** A tool with an electric moter as a thin steel blade which is used for cutting curves in flat materials, such as wood or metal. It can cut angles, corners and shapes quickly and precisely.

24. **Brush:** It is an implement made of brittles, wire hair, fibre, hymen etc. set in wood
.Different kinds are used for sweeping floors, scrubbing, panting and grooming



Plate 76:Brushes

25. **Bondex glue:** A sticky substance which is used for joining things together permanently and it is often made by boiling animal bones and skins or by a chemical process.
26. **Varnish:** Preparation consisting of a resin dissolved in a solvent, which dries and leaves a glossy, transparent finish when applied to a surface such as wood.
27. **Lacquer:** A shining substance which is painted on wood or metal to create a protective surface.



Plate 77; Lacquer