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THE UNIVERSITY OF ALBERTA

THE DEVELOPMENT OF A MODEL INDUSTRIAL ARTS PROGRAM FOR KADUNA STATE, NIGERIA

by

Joseph Yakubu Maiyaki

A Thesis

Submitted to the Faculty of Graduate Studies and Research

in Partial Fulfilment of the Requirements for

The Degree of Master of Education

Department of Industrial and Vocational Education

Edmonton, Alberta

Fall, 1979

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "The Development of a Model Industrial Arts Program for Kaduna State, Nigeria," submitted by Joseph Yakubu Maiyaki in partial fulfilment of the requirements for the degree of Master of Education in Vocational Education.

Dennis R. Young
Supervisor

Date 17 July 1979

ABSTRACT

The purpose of the study was to develop a contemporary industrial arts model program for use in Kaduna State, Nigeria secondary schools by adapting a contemporary innovative program in industrial arts. Parts of The Alberta Plan were found suitable for adaptation. At the time of developing the model program, however, there was in Kaduna State an existing program conceived as pre-vocational technical education consisting of metalwork, woodwork, and technical drawing. The pre-vocational program was viewed as not being suitable by the researcher because it did not introduce the prevalent materials and technologies of the society. Further to this view, the professional teachers in the Kaduna program that responded verified that the existing program was not adequate and recommended acceptance of the selection made for the content of the model program.

The study was based on library research. To develop a suitable and desirable industrial arts program that would better expose the students to the prevalent materials and technologies, the following studies were undertaken:

1) The Alberta Plan;
2) Research concerned with industrial arts in Alberta;
3) The Kaduna State pre-vocational technical education program;

4) Current concepts in industrial arts education;

5) Nigerian national goals and objectives of education and aims of technical education; and,

6) Nigerian economic development and technical skill manpower requirements.

Findings from the studies undertaken provided the criteria and content for the development of the contemporary model industrial arts program in Kaduna State.

The general objectives of the model industrial arts program were identified to compliment the Nigerian national goals and objectives of secondary education. They are:

1) To provide exploratory experience in technical occupational clusters for the various technologies prevalent in the Nigerian society to guide students in future career selection.

2) To provide students with courses that aid them to relate academic knowledge to technical competencies.

3) To provide students with the opportunity to develop their creative potentials both avocationally and vocationally.

4) To provide students with the opportunity to develop relevant technical competencies that will assist them to obtain further education, training, or employment.

The following aspects of the Alberta Plan were found suitable and were adapted for the model program:

Cluster	Fields of Study
1. Materials	Woods, Metals, Plastics, Concrete
2. Visual Communications	Drafting, Graphic Arts, Commercial Arts
3. Mechanics	Autobody, Automotives, Related Mechanics
4. Construction and Fabrication	Building Construction, Machine Shop, Welding, Plumbing, Sheet-Metal
5. Electricity-Electronics	Electricity, Electronics

To ensure the successful initial implementations of the program, the following form part of the recommendations that were made:

1) That a pilot study of the model be undertaken before implementation;
2) That the Department of Technical Education at the Kaduna Polytechnic, Kaduna, and the newly established Department of Vocational Education at the Ahmadu Bello University, Zaria be responsible for the training of qualified teachers for the program;
3) That for the initial implementation of the program and due to scarcity of qualified and trained teachers, professionals in each occupational area, or fields, of study be engaged to teach; and,
4) That a supervisor of Industrial Arts - Academic, and supervisor of Industrial Arts - Planning, be appointed.

For further studies, it was recommended that:

1) An occupational survey study be carried out when desired to determine fields of study to be included in, or eliminated from, the program; and,

2) Follow-up studies of graduates of the program be carried out to examine whether it is meeting the needs of the students and the society.

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PROBLEM

Orientation to the Problem

Presently, there is no Industrial arts in the secondary school educational system of Kaduna State, Nigeria. There is, however, a conceived program regarded as prevocational which is neither conducted as an industrial arts program nor a vocational education program. Though the program is conceived as pre-vocational, it includes only metalwork, woodwork, and drafting. These three courses do not adequately introduce the students to the basic technologies prevalent in the world of work. Furthermore, students who use these pre-vocational courses for their final secondary school certificate graduation have little need for them after graduation, the reason being that these pre-vocational courses are neither required pre-requisites for further studies nor employment.

Realizing these factors as setbacks, there is a need to broaden the school curriculum in this area to give a greater opportunity to students. The broadening of this curriculum should focus on the current concept of industrial arts. Industrial arts is conceived as a part of general

education which provides reinforcement to academic disciplines, interpret and provide exploratory experiences representative of a productive society.

In our age of rapid technological advancement, students of high school age need a broader foundation of the technologies prevalent in a productive society. In a research conducted by Ziel, H.R. (1971), and published in his book, Man, Science, Technology, he reports that:

> All students shall concentrate their first twelve years of education in an intellectualizing endeavor and not in an occupational preparation endeavor. Career preparation requiring science, mathematics and humanities is fundamental to the engineer, the business man, the politician, the scientist, the craftsman and every productive citizen.... We must recognize that the preparation for vocation requires first, a broad base and a command of the academic disciplines, keen awareness of human relationships, a skill of communicating and symbolizing and an understanding of the technologies that appear in our productive society as a result of the application of scientific research (pp. 4-5).

Upon observation of vocational and industrial arts education in Canada, there are aspects of secondary school industrial arts programs that, with modification, could be adaptable for Kaduna State, Nigeria. Canada is a developed country; and Nigeria is a developing country, within which is Kaduna State. Aspects of The Alberta Industrial Arts Program could be adaptable for a model industrial arts program for Kaduna State considering Nigerian economic and technological manpower needs necessary for rapid development.

Statement of the Problem

What aspects of "The Alberta Plan" industrial arts program could be adaptable to develop an industrial arts model program in Kaduna State, Nigeria?

Objectives of the Study

For the successful accomplishment of the problem, the following tasks constituted the objectives of the study:

1) To describe the Alberta Plan;
2) To review research concerned with industrial arts in Alberta;
3) To describe the Kaduna State Program;
4) To review related literature pertaining to current concepts in industrial arts education;
5) To review Nigerian national goals and objectives of education and aims of technical education;
6) To determine criteria for developing an industrial arts model program based on the Alberta Plan and literature reviewed; and,
7) To develop a model based on the criteria identified.

Significance of the Study

Through the study of The Alberta Plan industrial arts program, current concepts in industrial education and the Nigerian general goals of education and aims of technical education, a more suitable model program was found to

be a desirable substitute for the existing pre-vocational program in Kaduna State, Nigeria. The Alberta Plan was found to be contemporary, broad and flexible. Its broadness and flexibility allows students to decide or make a choice of whether to continue for further studies or enter the labor force for skill training in areas of their abilities or where they are best suited. Its contemporary nature is the fact that it introduces secondary school students to the basic technologies prevalent in the world of work. It was expected, therefore, that a suitable program for Kaduna State, Nigeria would be contemporary, broad and flexible to replace the existing pre-vocational technical education program in the secondary schools.

Limitations

Due to the lack of adequate related literature concerning secondary school pre-vocational technical education program in Kaduna State, Nigeria, The Industrial Arts Model Program was developed by studying The Alberta Plan, reviewing current concepts in industrial arts education, and identifying criteria for a contemporary program for Kaduna State on the basis of the Nigerian national goals and objectives of education, and the type of industrial establishments or technologies prevalent in the Nigerian society.

Delimitations and Selections of the Program

The researcher, in reviewing and comparing programs, had pre-established selection procedure. The pre-established criteria for selecting The Alberta Plan industrial arts program were:

1) That information concerning the plan selected for the study was easily accessible, or, available to the researcher either through official correspondence or interview;
2) That the program had been developed, implemented and in operation at least for the past ten years;
3) That the program was contemporary and validated; and,
4) That the program was suitable for the rapid technological and economic development in Nigeria.

Definitions of Terms

For the purpose of this study, the following definitions applied:

> Multiple Activity Program: It is an organizational device by means of which a variety of exploratory experiences can be presented with a minimum of room and equipment. The laboratory is organized into a number of different sections representing the fields of study. Each section is large enough to accommodate 4 to 6 students (Alberta Department of Education, Junior High Industrial Education Guide, 1976, p. 4).
>
> Multiple Activity Laboratory: A laboratory where three or more activities are in progress at the same time (p. 3).
>
> Field of Study: The general title given to the basic technologies represented, e.g. Materials, Visual Communications (p. 3).

Module: A module consists of from 15 to 25 hours of work in a field. There may be several modules to complete a field, e.g. Woods, Metals, Plastics, Earths in the Material Field (p. 3).

Industrial Arts: It provides the opportunity for the students to explore, reason, experiment and discover the reality of the technological society in which they live. The content of the program deals with industry, its organization, materials, processes, products, occupations, and the problems resulting from the impact of a technology on society (Alberta Department of Education, Handbook in Industrial Education, 1976, p. 2).

Industrial Arts Program: It consists of courses that provide a continuum of experiences, starting with exploratory experiences and activities in the development of skills in career fields, and culminating in on-the-job experience (p. 2).

Industrial Education: Industrial Education is a program consisting of courses that provide a continuum of experiences, starting with exploratory experiences and activities in the elementary and junior high school, expanding in the high school to the development of skills in career fields, and culminating in on-the-job experience (p. 2).

Methodology

The study was based mainly on library research and consisted of all the activities specified in the objectives of the study. The content for the model program was identified on the basis of the need for such fields of study in Nigeria and was validated by teachers who had taught, or were teaching, in the Kaduna State pre-vocational technical education program.

Content for the model program was adapted from The Alberta Plan. To identify the content, a comparison of The Alberta Plan to the Kaduna State pre-vocational technical

education program was made. Aspects of The Alberta Plan that were found adaptable were the areas needed and desired for a rapid economic manpower development. To identify the areas needed, the Nigerian economic sector, as classified and categorized during the Nigerian Third National Development Plan 1975-80 period, was reviewed.

Assumptions

For the purpose of this study, the following assumptions applied:

1) That the team of experts to review the model industrial arts program adequately responded;
2) That the model developed was not regarded a final program of instruction to be implemented; the intent was to propose a further study of the model before a pilot-test was made by the Kaduna State Ministry of Education to ensure its practicality and suitability;
3) That the responses of the selected experts provide suitable professional criticism that would provide adequate analysis by the researcher; and,
4) That the model would yield valid objectives by motivating the Kaduna State authorities to respond to it as a challenge to the existing program.

CHAPTER II

REVIEW OF LITERATURE

THE SELECTED INNOVATIVE PROGRAM IN INDUSTRIAL ARTS - THE ALBERTA PLAN

Introduction

During the early 1960's, innovative programs in industrial education sprang up in North America specifically in the United States and Canada. Due to rapid technological developments, automation and other economic factors, there arose a need to provide students with a wider range of experiences, programs to satisfy life needs, and activities directed at an understanding of society. These were the basis for which these innovative industrial education programs were developed.

It would, however, be realized that, though many innovative programs came to birth in the 1960's, most of them have been discontinued. Some significant causes for their discontinuity have been the costs of implementing and maintaining these programs, their relevancy in terms of content, teaching methods, and in relation to the technological society. Leslie H. Cochran, in his doctoral thesis at Wayne State (1963) and in his book, Innovative Programs in Industrial Education (1970), cited four basic factors that

affect any innovative industrial arts program; these are:

1) The advance of automation;
2) The disappearance of many occupational categories;
3) The increase in technological knowledge;
4) The obsolescence of skills (p. 14).

Due to these changing roles of occupations today, for an industrial arts program to continue to be effective, there must be a constant evaluation and review of the programs to meet these changing roles in our changing world. It should be realized that though there are several programs with varying purposes and intents, they all have two basic approaches. These two basic approaches are the unit shop system of instruction and the multiple activity system of instruction. The Alberta Plan is a multiple activity program.

THE DEVELOPMENT OF THE ALBERTA PLAN

Introduction and Rationale

The rationale of The Alberta Plan is concerned with the ability of industrial arts education to interpret a productive society. The curriculum is designed to:

> ...provide students with options and alternatives as well as the consequences of their selections upon themselves and society. Experiences with a multiplicity of materials, processes, and technologies, representative of our productive society, exposes the learner to the demands imposed by technologies as well as the institution employing these technologies (Ziel, H.R., Man, Science, Technology, 1971, p. i).

To achieve these broad goals, Dr. Henry R. Ziel, at the University of Alberta, Edmonton, developed "The Alberta Plan" which was introduced in the fall of 1964 as a high school curriculum. The proposed program designed and substantiated by research evidence shows:

> ...that a program of study is needed that will, through directed discovery and other methods, meet the often expressed needs of problem solving, individualized instruction, discovering one's own capabilities, and progressing at one's own speed. It is the intent of this program that students very rapidly recognize nomenclature scientific and mathematical concepts, the cumulative impact and subsequent effects of technological innovations upon their lives as they study, as they attempt to select a career goal and how they may function in our productive society (Ziel, 1971, p. 22).

Program Objectives

The Alberta Plan is designed to be a secondary school curriculum and conceived as a synthesizing educational process which operates in a multiple activity environment. Industrial Arts is regarded by The Alberta Plan as a part of general education which integrates the technological and industrial aspect of society by utilizing the most prevalent technologies. The general concept of the program is proclaimed upon the fact that no profession or occupation functions in a vacuum but is inter-related with others. The intent of this program, therefore, is to show these relationships (Ziel, 1966, p. 8-9). There are four main objectives of the program upon which it operates:

1) Reinforce academic disciplines;
2) Provide a synthesizing educational environment;
3) Interpret productive society; and,
4) Provide exploratory experiences for guidance in career pursuits (Ziel, 1971, p. 25).

Program Structure

Based upon the above objectives, the plan operates under four phases linked together and introduced sequentially from grade seven through twelve. Figure 1 is the breakdown of the plan.

Phase I

This is designed for grade seven students and is aimed at making students develop the appreciation of tools, machines, materials, and processes. Specific areas included in this phase are: Ceramics, Graphic Arts, Plastics, Woods, Metals, and Electricity. Activities included in each of the areas utilize a pre-selected product matrix to optimize learning and are designed to include a description of the most prevalent industries in the field, the extent of occupational opportunities and the requisite education for these occupations (Ziel, H.R., Research Report I - Industrial Arts in General Education, 1966, p. 10).

Metal Materials Area

The Metal Materials area includes the following sample processes: Machines covering shaping, lathe, and

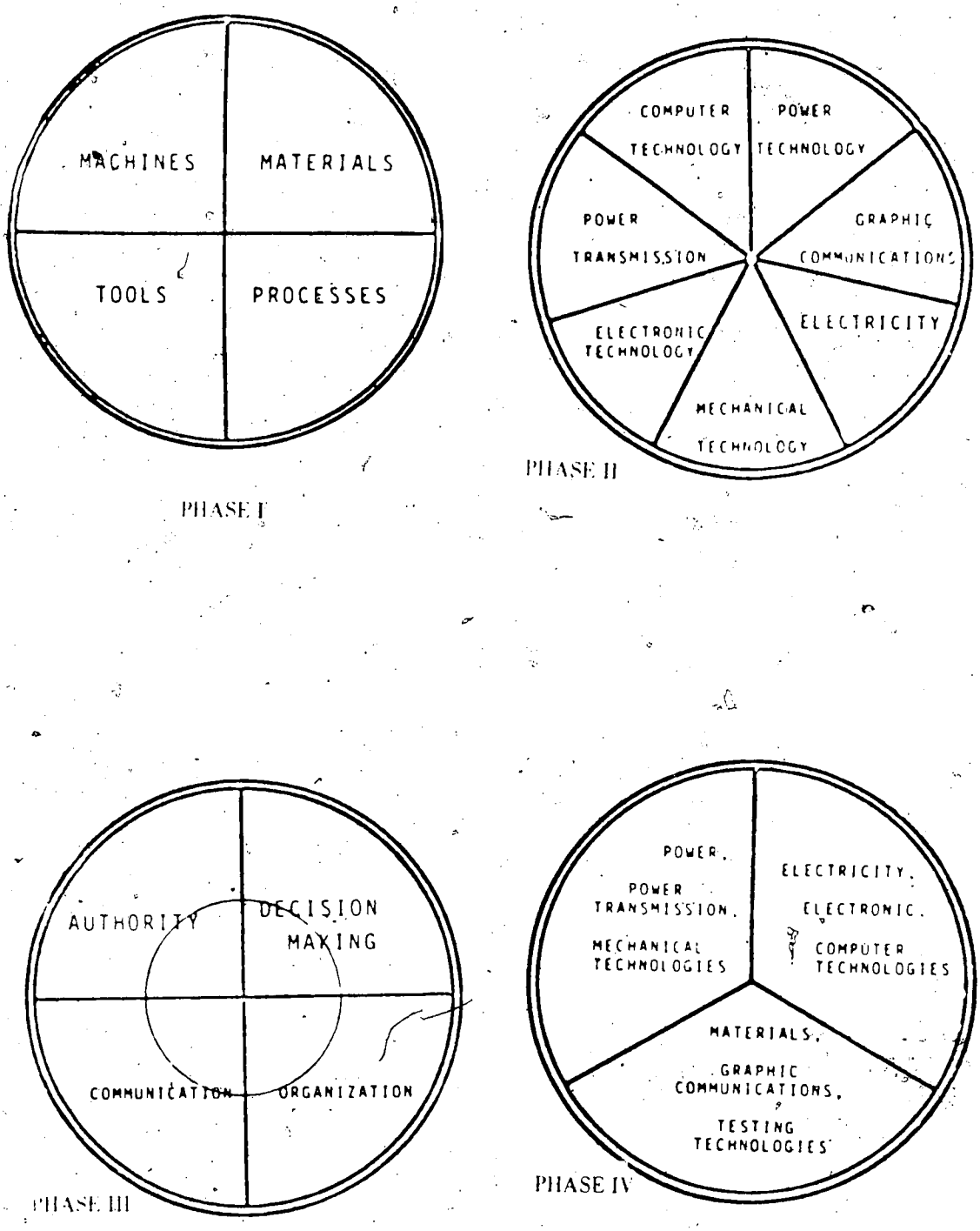


Figure 1. The four Major Phases in The Alberta Plan (Reproduction with permission from Research Report 1 - Industrial Arts in General Education by H.R. Ziel, University of Alberta, Edmonton, Alberta, Canada, 1966, pp. 8-9)

milling; Powdered Metals; Electrical discharge; Sheet metal; and, Welding. In all these areas the most modern methods of production and techniques are employed rather than the conventional methods. The intent for this practice is to expose the student to the actual situations found in the industry. Due to automated techniques of production, the need, for example, to make students file a piece of metal is not necessary:

> ...therefore, it is no longer valid in industrial arts to require a student to spend extensive and valuable learning time in how to properly file a metal surface or thread on a lathe, when all these operations, because of quantities and price and the requisite use of unique turning tools and tolerances, are better performed on screw machines, electric discharge machines and equally sophisticated metal shaping and forming equipment (Ziel, 1971, p. 42).

Plastic Materials Area

The Plastic Materials area includes the following sample processes: Injections; Extrusion; Centrifugal; Heat and Pressure; Blow and Vacuum Form; and Cellular. As in the Metals area, the most modern techniques and machinery prevalent in the actual job market are recommended to be applied.

Wood Materials Area

The Wood Materials area includes the following sample processes: Wood shaping, bandsaws, lathes and jigsaws; Vacuum Press; Chemical Impregnation; Laminates; and Compressors. Wood is the most common and prominent material

in industrial arts. For this reason, the various uses of tools to shape this material should be indicated because they are also utilized with some modification in other material areas. As in the Metal Materials area, it is recommended that power tools should be utilized instead of hand tools as dictated by the predominance of power tool utilization in the productive society.

Ceramic Materials Area

The Ceramic Materials area includes the following sample processes: Extrusion; Hand Forming; Slip Casting; Compression; Glazing; Glass Making; and Firing. The most prevalent techniques realized in this area are recommended. Creativity and design should be emphasized as this area of material is artistic (Ziel, 1971, p. 57).

Graphic Arts Materials Area

This area includes the following sample processes: Hand Press; Offset; Rubber Stamp; Embossograph; Decal; Engraving; and Block Sign Press. Exploratory experiences with the various communication processes and materials most commonly in evidence in our productive society are recommended emphasis.

Materials Testing Area

The sample testing properties for this area are: Chemical; Thermal; Electrical; Physical; Mechanical; and Radiant. The variety of materials encountered within

Phase I are recommended to provide the test pieces for this area. At this stage, materials to be encountered within Phase II are also recommended as an introduction to the phase.

Phase II

It is designed for eighth and ninth graders and introduces the various technologies dominant in the world of work. The learning activities in this phase reinforce the academic disciplines by synthesizing the interdependence of the technologies in the Productive Society. Major areas of study include Power; Graphic Communication; Mechanical; Electronics; Electricity; Power Transmission; Testing; and Computer Technologies. The learning activities emphasize development and awareness of the application of scientific knowledge by utilizing laboratory equipment.

Electrical Technology

The sample experimental situations recommended to be engaged by students include Simple Lighting; Complex Lighting; Simple Alarms; Complex Alarms; General Controls; Simple Industrial Controls; and Motor Control. These units of engagements are designed principally to emphasize the distribution of energy, its limitations and unique characteristics that contribute to more effective systems uses. The learning experiences are designed to include a series of experiments with pre-wired and pre-assembled alarms, lights

and controls, to acquaint the student with everyday life of these applications and to reinforce the basic scientific concepts of such applications.

Power Technologies

Sample experimental situations for this area of study includes: Two-cycle Engine; Four-cycle Engine; Diesel; Wankel; Pulse Jet; Electric Motor; Fuel Cell; and Solar Cell. The main theme of this area is to provide a learning environment so that students would understand the differences among the various power systems and the result of applications of power systems to more complicated systems in a productive society. It is not the intent, however, to develop skills in these areas, but to provide the general understanding and concepts of these basic power technologies.

Mechanical Technology

The sample experimental situations include: Simple Gearing; Simple Rotation; Change Rotation; Complex Gearing; Simple Combinations of Gear Problems--observe complete system cutaway; Simple Machines; and Complex Machines. The objective here is to recognize and differentiate the various mechanical systems and their specific functions.

Graphic Communications

Experiments for this area include: Simple Mechanical Drawing; Simple Layouts; Uses of Chemical and Electrostatic Copiers; Simple Still Photography; Video Tape; Simple

Dummy Layout; and Complex Dummy Layout (p. 87). The purpose is to transmit ideas and meanings and emphasize the need for understanding the units of graphic communication technology.

Computer Technology

Experimental systems include: Minox; Arky; Bitran 6; P.D.P.8; 360 Terminal; and C.A.D. Instruction. In 1979, a micro-computer system was included. Computer technology is introduced to reinforce and show its relationship to mathematics and science. Due to differences among manufacturers, computer language is recommended to be introduced as a unit of instruction for the basic understanding of the various models of computers available.

Electronics Technology

The experimental situations include: Phonograph; Radio Receiver; Radio Transmission; Transistorized Systems; and Television Transmitter. The intent is to make students become involved in understanding and recognizing the various electronic systems so prevalent in the productive society.

Power Transmission Technology

Simple Controls; Complex Controls; Drill Press; Punch Press; and Automatic Press are the sample experimental units of this area. The purpose is to show the various transmissions that produce and transmit energy or force.

Phase III

It exposes grade ten students to the major roles and functions imposed on man by organizations of an industrial setting. The learning activities include simulated industrial organizational structures such as authority, decision making, organization and communication as existing in each technology. Specific emphasis might include the function of line and staff requirement, quality control and union, and supply of goods and services (Ziel, 1966, p. 12).

Phase IV

This phase provides grade eleven and twelve the opportunity for independent study and research activities which gives the student the opportunity to pursue two or three (or a combination) of any of the technologies surveyed in earlier undertakings. The areas of study are determined through student ability, interest, and performance and the teaching activities emphasize experiments with photo-type. This phase is based on occupational clusters.

THE IMPLEMENTATION OF THE ALBERTA PLAN BY THE PROVINCE OF ALBERTA

General Objectives of Alberta Education

The general objectives of education in the Province of Alberta (1977) are as follows:

1) Develop competence in reading, writing, speaking, listening and viewing.
2) Develop basic knowledge and skills in mathematics, the sciences, and the practical and fine arts.
3) Develop the learning skills of finding, organizing, analyzing, and applying information in a critical and objective manner.
4) Develop knowledge, skills, attitudes and habits which contribute to physical, mental, and spiritual health and safety.
5) Develop basic knowledge and skills in social studies and an understanding of the meaning, responsibilities, and benefits of active citizenship at the local, national and international levels.
6) Develop the knowledge, skills, attitudes and habits required to respond to the opportunities and expectations of the world of work (Alberta Department of Education, Alberta Education and Diploma Requirements, 1977, p. 8).

Based on the foregoing objectives, provincially, Industrial Arts in Alberta is designed towards career developments. It is conceived as an education program that must provide considerable flexibility so that students have an option of several career choices. It must provide broad education so that each student learns what he needs to know about a new job for a rapid and successful specialization.

The task of secondary school, therefore, is "to provide students not only with entry skills for several careers but to orient the program to meet social and cultural goals."

(Alberta Department of Education, Handbook on Industrial Education Guide, 1976, p. 1). The courses or disciplines are interrelated and flexible to provide teachers the opportunity to demonstrate these relationships. From these intents of the industrial arts in Alberta, the program is designed upon the following objectives.

Objectives of Industrial Arts

The objective of industrial arts is the development of an informed citizenry in a highly industrialized society --a society that must learn to use and control the technologies. Industrial arts is to introduce students to all aspects of a productive society with the following specific objectives:

A. Personal Growth

1. To provide opportunities for the individual growth of the student through the development of acceptable personal and social values necessary in a productive society.
2. To provide a technical environment which motivates and stimulates individuals to discover their interests and develop personal and social responsibilities.
3. To assist in the development of positive attitudes towards safety.
4. To assist in the development of positive attitudes towards conservation and ecology.
5. To assist in the development of consumer values.

6. To assist in the development of positive attitudes towards the dignity of work.

7. To assist in the development of good work habits.

8. To foster the development of vocational interests and skills.

B. Career Exploration

1. To provide students with experiences which will assist them in making realistic career choices.

2. To provide students an opportunity, within a technical environment, to become acquainted with the general occupational characteristics of a variety of career fields.

3. To relate their own interests, abilities, likes, and dislikes, and values to several career fields.

C. Occupational Skills

To developing basic competencies, integrating cognitive and psychomotor skills related to families of occupations.

1. To provide safe exploratory experiences in the use of tools, energy, equipment and materials appropriate to various technologies prevalent in a productive society.

2. To develop an understanding of the interrelationship of various technologies.

3. To provide a technical environment which permits students to synthesize their accumulated knowledge in the solution of practical problems, and to assist the student to

develop habits that will be conducive to the establishment of a safe environment (Alberta Department of Education, Junior High Industrial Education Guide, 1976, pp. 1-2). The name, industrial arts, is changed to Industrial Education.

Program Structure

The four-phase approach developed by Ziel was not adopted by the Department of Education, but the multiple activity strategy was accepted (Ross, 1976, p. 10). The industrial arts curriculum is arranged to include the materials and technology areas suggested by the Department of Industrial and Vocational Education. The University of Alberta has the responsibility of preparing teachers who are expected to be capable to teach industrial arts content as prescribed by the Alberta Department of Education Curriculum Committee (p. 11).

The Alberta curriculum in industrial arts extends for six years of study starting in Grade Seven through Twelve. During the first three years (Grades 7, 8, 9) students engage in a minimum of three different units each year, but could be extended to more than three with the provisions of adequate facility and teacher. At the Senior High School (Grades 10, 11, 12) there are two programs to choose from, identified as "General" and, the other, "Cluster". The industrial arts program--general route--is flexible and versatile and allows schools with one or multiple laboratories to plan maximum use of their facilities.

Programs in the cluster route are local decisions;

determined by the individual school in the locality the school serves. Priority and sequence is left to the teacher and students, provided the required amount of time is spent for the course.

Junior High School Industrial Arts Program

Industrial arts at this level is regarded and conceived as the exploratory phase of the total program. It is organized to provide the opportunity to students to explore, reason, experiment and discover the reality of the technological society. The content deals with industry, its organization, materials, processes, products, occupations, and the problems resulting from the impact of technology on society (Industrial Education Guide, 1976, p. 2). To provide a variety of exploratory experiences, the Junior High School program is divided into four fields of study.

Fields of Study	Areas Covered
1. Power Technology	Power Mechanics Hydraulics
2. Materials Technology	Earths Lapidary-Art Metals Leather-Textiles Metals Plastics Woods
3. Visual Communication	Graphics Photography-Drafting
4. Electricity	Electricity Electronics Computers

In addition to the four fields of study, the program

also involves a testing area and an instructional materials area. A research and development unit is included for the teacher to examine and research into new additional content. The addition of the new content area must be approved by the Provincial Consultant of Industrial Education and the principal of the particular school.

Below is the breakdown of courses and the level at which they are offered during the three-year period.

Grade 7	Grade 8	Grade 9
Graphic Arts	Graphic Communication	Electronics
Plastics	Wood	Power Mechanics
Ceramics	Electricity	Metals

Contents included in each field of study represent the most prevalent technologies in Canada.

Senior High School Industrial Education Program

At the completion of Phase I--exploratory phase--junior high, a student may select courses of a more general nature in the I.E. 10 series, or take an introductory course related directly to a career field. From here, a student may advance to a more specific course which prepares him for a career. All industrial arts programs in this phase place emphasis on practical work and applied theory.

Industrial Education General: 10, 20, 30

It is intended for students who had no previous knowledge in industrial arts at the junior high. The

content is broad, extending the knowledge received in the junior high. This course could also be taken by students who intend to continue with vocational courses after Grade Ten. The program is organized in the following manner:

I.A. General 10	I.A. General 20
Basic Electricity - Electricity	Electronics (Systems)
Wood	Metals
Drafting	Photography
Internal Combustion Engine	Production Science

I.A. General 30

Plastics
Other Power Sources
Hydraulics
Hot Metals

The courses are made up of about sixty modules to choose from, with about an equal number from each of the fields of study as listed in Appendix 1.

Industrial Education Clusters: 12, 22, 32

This second program is called "cluster" program and is intended to provide time to students to acquire a greater depth in a field of closely related technologies. The clusters are designed in four major areas:

a) Electronics - electricity, electronics, computer;

b) Materials - wood, metals, plastics, earths;

c) Graphic Communications - drafting, printing, photography, lithography; and,

d) Power Mechanics - power sources and transmission.

For complete breakdown of related technologies offered in each cluster, see Appendix 2.

A student who intends to enter into a career field is expected to have taken a "12" level course designated for that career field, or two "10, 20, 30" series related to the anticipated major area. The student then may advance to the "22" or "32" level courses regarded as the majors. For course organization, matrix, see Appendix 2. Part of the training includes on-the-job experience in each field of study.

Other Alternatives

To cater for students' educational choices, certain students could be allowed to select portions from both the General and the Cluster programs.

STUDIES CONDUCTED RELATED TO THE ALBERTA SCHOOL INDUSTRIAL ARTS EDUCATION PROGRAM

Manuel (1968) conducted a study to investigate the claim that industrial arts in Alberta reinforces academic disciplines. The study was conducted and limited to grade nine science achievement. The sample constituted of a control and an experimental group. The hypothesis was that the experimental group would achieve similar results to the control group. Statistical analysis supported the hypothesis. Manuel identified the method for the random sampling as a weakness and which may have been the cause of the

reliability of the study because the groups were poorly matched.

Leblanc (1968) undertook a study to measure the understanding of Alberta industry by the Junior High school industrial arts students. The sample was drawn among boys and girls in grades 7, 8, and 9. The sample constituted a control and an experimental group of students in grades 7 and 8 who had significantly better knowledge of Alberta industry, but no significant difference was observed among grade 9 students. The instrument developed for this study was recommended to be a useful aid to evaluate the teaching of an understanding of the world of work.

Wright (1970) conducted a study to identify the strengths and weaknesses of the manner the Alberta Junior High school graphics curriculum area was implemented. The study showed that teacher misinterpretation of the planned curriculum resulted in the low student achievement observed. Wright recommended specific behavioural objectives be included in the curriculum guide and the teaching methodology to be used and concepts to be taught clearly stated.

Liu (1970) conducted a study to test the effect of industrial arts on grade nine girls' mathematics achievement. The sample consisted of girls from four randomly selected high schools. The sample had a control and an experimental group. Students' grade nine mathematics results statistically revealed that there was no significant difference between groups. Observation was made that the failure to

confirm that industrial arts had a positive effect on mathematics achievement was due to:

1. The girls chosen for the sample were not exposed to all the areas within the industrial arts laboratories;
2. The students only received industrial arts education for a short time period (seven months or less); and,
3. The teachers involved in the study may have lacked experience in teaching industrial arts to female students (Ross, 1976, p. 34).

Anderson (1972) undertook a study to test the hypotheses that the majority of students taking the electricity component within the Junior High school curriculum had apathy towards that area. The study revealed that many activities were research oriented rather than practical oriented. The researcher suggested the direct use of applicable knowledge in the teaching of Junior High school electricity concepts.

Leblanc (1972) and Ible (1974) observed that the program graduates perceived that their teacher preparation at the University of Alberta, Department of Industrial and Vocational Education, was inadequate in developing the skills needed to teach industrial arts in the schools. A similar study conducted by Haywood (1975) concluded that teachers ranked skill as highly desirable competencies for industrial arts teachers in the use of tools, machines and teaching strategies.

CHAPTER III

RELATED LITERATURE

This chapter deals primarily with current concepts in Industrial Arts; Nigerian national goals and objectives of education; and, the criteria for the development of a contemporary industrial arts program in Kaduna State, Nigeria.

CURRENT CONCEPTS IN INDUSTRIAL ARTS

The Development of Industrial Arts in North America

From the latter part of the nineteenth century, and since adapting the concept from the Russians, industrial arts in North America, particularly in the United States, has passed through three significant distinct phases since its introduction. Though there have been distinct differences, no demarcation can be drawn between them. These phases have been: Manual Training, Manual Arts, and presently, Industrial Arts.

Manual training was considered the basis of the training of *hand and eye*, and eventually when emphasis of manual arts was introduced, the basis of the training was *design* or the *application of art* to the shop project.

Currently, industrial arts is conceived as an *integral part of general education*. Basically, industrial arts is regarded an important part of general education, and conceived as an answer to the problem of educating young children to live in a world characterized by technological innovations and developments.

The Role of Industrial Arts in General Education

The basic purpose of general education is to transmit ways of life of the society to the younger ones; to provide for the improvement of the culture; and, education as the meeting of needs (Wilber and Pendened, 1969, pp. 3-10). For these purposes of the concept for general education, the role of industrial arts in the present day of technological culture must be to educate every student to appreciate, understand, and function effectively in the society. Democracy preaches that "each individual must assume the responsibility not for his own development but for that of his fellow man" (Wilber and Pendered, 1969, p. 3). Therefore, the responsibility of transmitting complex knowledge is the concern of the society entrusted to educators, and must not be left only to parental decision and teaching.

Planning industrial arts for the future, educators and planners will have to look upon the needs of the child broadly and concertedly. To plan for such a relevant and meaningful curriculum in an evolving technological society,

planners must take into consideration such factors as: automation; disappearance of some occupational categories; increase in technological knowledge; and, obsolescence of skills.

Importance of Industrial Arts in General Education

In a presentation paper titled A Fresh Look at Industrial Education, to the American Industrial Arts Association's (AIAA) thirteenth Annual Convention in Minneapolis (1968), Marshall observed three accomplishments the American educational system must achieve:

> First, it must transmit to the young what its scientific-technological society is like, its values, its beliefs and its moves. Second, it must meet the needs of the individuals under its care; and third, it must build within the society a mechanism to re-create the society so it will grow in the direction of a better life for its citizens. The beliefs about industrial arts mesh inextricably with these basic purposes of education. Therefore, it is necessary for all who live in a technological society to acquire an understanding of industrial arts through the systematic study of the subject matter (AIAA, New Concepts in Industrial Arts, 1968, p. 2).

Marshall further outlined the importance of industrial arts programs in a society. Through the acquisition of some knowledge and understanding of properly organized industrial arts programs, a student's behaviour should change.

> One of the most important is the change of attitude and understanding about industry and technology, and the realization that this pervasive force has the capacity to raise man to

> greater heights or destroy him by the misuse of technology--or of the arts of industry (AIAA, 1968, p. 2).

Industrial Arts should develop in students the ability to make wise choices of industrial products, appreciate workmanship, and to appreciate consumer value on goods purchased.

Another significant importance of industrial arts education is helping students make better career choices. If taught in the proper manner, knowledge, skills, understanding and attitudes acquired by students would directly apply to most occupations and professions. Another important aspect of industrial education often overlooked is the provision of the opportunity and the ability to interact in meaningful ways with different types of materials to create new technical things that contain some amount of the individual's personality.

Marshall, stressing the emphasis of industrial arts as viewed by other nations, contended that such emphases are placed upon:

> ...developing an understanding of technology; aiding the learning process by providing for direct student environment and feedback; developing an appreciation for work; encouraging study of economic education (production and consumption of goods and services); and providing the vehicle to integrate subject matter. Of particular interest is the general shop idea (p. 5)

Planning a Relevant Industrial Arts Program

Making Industrial Arts education relevant to the society it serves is an important factor in the planning stages and also a difficult task to achieve. The point is to make industrial arts education relevant to the needs of business so that graduates from the program would be able to take up jobs upon graduation and become productive assets to their employers. To achieve this, the planning of programs should be done by finding out what business and industry needs. For students' selection of a career, educators must be certain that such a student has the personality and talents needed for the job, and that there will be job opportunities for which he would be trained.

Clague (1964) had this to say about making education relevant:

> The education, training and the career choices of the nation's youth are a vital concern not only to the young people themselves, their parents, teachers, and counsellors, but also to business, government, community, and labor leaders.
>
> Young people preparing for a lifetime of work need to know where the jobs are now, what kinds of jobs there are, which have the most promising future, and what education and training are required to qualify for the jobs they want. They need to know more--that industries and occupations are constantly changing and that they must be prepared to learn things throughout their working lives (New Direction for Industrial Arts, 1964, p. 10).

Turner (1968) similarly stressed that:

> The young person wonders what career lies ahead for him. The employers are concerned with finding qualified help--young people with

> sufficient training to be productive workers when they first start the job, able to meet people and carry on intelligent conversations with them, willing to learn and adapt themselves to the demands of the job, and, of course, a pleasing personality is always an asset.
>
> Our jobs, yours and mine, is to bring the student and the employer together in the frame of reference that will enable each to improve himself--the student his ability, the employer his production or services--to the end that society also is benefitted by improved goods and services (AIAA, 1968, p. 16).

Students in industrial arts education should be taught to develop a sense of dedication and independence of judgement. This need be done through placing equal importance during instruction and emphasizing the development of good judgement and intelligence, personality and the ability to get along with others. The importance of this ability is also observed by Turner:

> Right-thinking young people do not subscribe to the philosophy that the world owes them a living. A free society nurtures the individual not alone for the contribution he may make to the social effort, but also and primarily for the sake of the contribution he may make to his own realization and development (AIAA, 1968, p. 17).

Clark (1964), in observing the relevance of technical education to the world of work, had this to say:

> The educational system is asked to provide the specific expertise needed by the young worker for entry into the market, or to provide the general sophistication upon which the expertise can be constructed, or preferably, both. One qualifies for work through education, much more than in earlier times, and the educational threshold, the educational qualification for work rises (Ziel, Education and Productive Society, 1967, p. 31).

For these factors, the need for a relevant industrial arts education program is very important and significant to the society it serves and the individual student concerned.

Research Concerned With Industrial Arts Education Programs in North America

Though industrial arts is conceived as an integral part of general education, it is interpreted and approached differently. The approaches differ according to the curriculum relevancy for the community each program serves. Cochran (1968), in his doctoral thesis at Wayne State University, studied twenty innovative industrial arts programs. In organizing and synthesizing these programs, he categorized and grouped them into four distinct programs: (1) integrative programs; (2) interpretation of industry programs; (3) occupational family programs; and, (4) technology-oriented programs.

1. The rationale for integrative programs generally, is on the basis of making education a unifying experience. This approach makes it possible for students to:

   i) perceive relationships between different subjects

   ii) make an easy transition from school to work;

   iii) observe natural relationships within the field; and,

   iv) obtain a realistic view of career development (Cochran, 1971, p. 22).

The programs studied with this concept, some were found to

focus on providing unified activities within the field, and secondly, others were found to focus on the degree of co-relation with other subject areas.

2. The objectives of programs designed to interpret industry are primarily concerned with providing experiences which will help the student to understand modern industry with the rationale that no other curriculum area does so. Industrial arts, it is emphasized, should "develop in every student an ability to interpret industrial materials, methods of production, and the role of industry (p. 38). Emphasis on specific areas focus on marketing, materials, production, servicing, research and design, and the organizational patterns of industry.

3. Occupational Family Programs have their primary approach upon the use of occupational families as the basis for industrial education with the rationale that youth should have the knowledge about and also develop competencies needed in broad occupational areas.

> The diversity of industry, automation, and other technological factors necessitate a shift from preparation for specific job titles, as was promulgated during the earlier part of the century, to a broadly based program. As a result, occupational family programs stress basic factors that are common throughout a particular cluster. In this way, the student develops salable skills that are applicable to related occupations (p. 57).

4. The role of Technology-oriented Programs is to interpret technology as a part of man's culture as a way of life of a society. The objective of such programs is to

develop the student awareness to technology as a dominant and important aspect of general education in an industrial culture with a rationale to project the role technology has played throughout man's history. Programs within this concept have varied emphases on the technological aspect, some, for example, tend to use "technology primarily as a source of content to more accurately interpret industry" and some utilize "manufacturing to relate the rôle of technology in our society." (pp. 73-74)

Metcalf (1968) reviewed eleven new approaches to industrial education curriculum in the United States. The study showed that: (1) the cluster approach seems to be the approach most new programs emphasize; (2) all programs emphasize flexibility; and, (3) guidance is a built-in function of each of the plans studied. The only difference in the programs was the manner in which the three findings were accomplished.

NIGERIAN NATIONAL GOALS AND OBJECTIVES OF EDUCATION

National Policy on Education

Historically, education has received a high priority in Nigeria's development planning. Since 1962, the nation adopted a systematic economic planning as an instrument for the effective management of the national economy based on a five-year National Development Plan. In the first National

Development Plan (1962-1968), education ranked fifth priority judged by the magnitude of financial resource allocation accounting for 10.3 percent of the gross public sector investment. In the second Plan (1970-74), the rating by the same criterion, education received more emphasis and ranked second accounting for 13.5 percent of the gross public sector investment. During the current third Plan, it attracts first priority with the introduction of the National Free and Compulsory Primary Education (Universal Primary Education-(UPE)), accounting for about 15 percent of the gross public sector investment (Federal Ministry of Economic Development (FMED) Third National Development Plan, 1975-1980, Vol. 1, p. 237).

Nigeria realizes that the general shift in emphasis and the orientation which better fulfills the socio-economic needs of the nation was a good thing for the nation (p. 237). It also recognizes that a well-oriented educational system would provide a means for a fuller assessment of what needs to be done and devises a rationale and systematic approach to solving educational problems. For these factors, education in Nigeria is no more a private enterprise, but a government venture in order to provide a better control on the sector. In adopting education as an instrument for effecting national development, the government stated that:

> For the benefit of all citizens, the country's educational goals in terms of its relevance to the needs of the individual as well as in terms of the kind of society is desired in relation to the environment and realities of the modern

> world and rapid social changes should be clearly set out (Federal Ministry of Information (FMI) Nigeria, National Policy on Education, 1977, p. 3).

With this view, it is realized that Nigeria regards education as a dynamic instrument of social and economic change. To achieve its educational goals, it emphasizes a constant review to ensure its adequacy and continued relevance to national needs and objectives of the nation's policy.

National Objectives of Education

During each National Development Plan period, Nigeria reviews its national objectives of education. The educational objectives for the Third National Development Plan Period 1975-1980 are stated as:

i) to expand facilities for education aimed at equalizing individual access to education throughout the country;

ii) to reform the content of general education to make it more responsive to the socio-economic needs of the country;

iii) to consolidate and develop the nation's system of higher education in response to the economy's manpower needs;

iv) to streamline and strengthen the machinery for educational development in the country;

v) to rationalize the financing of education with a view to making the educational system more adequate and efficient; and,

vi) to make an impact in the area of technological education so as to meet the growing needs of the economy (FMED, 1975, p. 245).

From these broad educational objectives during the current Plan period, the broad aims of secondary education are set as:

1) preparation for useful living within the society; and,

2) preparation for higher education.

In specific terms, the secondary school should:

a) provide an increasing number of primary school pupils with the opportunity for education of a higher quality, irrespective of sex, or social, religious, and ethnic background;

b) diversify its curriculum to cater for the differences in talents, opportunities and roles possessed by, or open to, students after their secondary school course;

c) equip students to live effectively in our modern age of science and technology;

d) develop and project Nigerian culture, art, and languages as well as the world's cultural heritage;

e) raise a generation of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour, and appreciate those values specified under our broad national aims, and live as good citizens;

f) foster Nigerian Unity with an emphasis on the common ties that unite us in our diversity; and,

g) inspire its students with a desire for achievement and self-improvement both at school and in later life (FMI, 1977, p. 11).

The Need for Industrial Arts as A Secondary School Curriculum

With the foregoing broad aims and objectives of Nigerian secondary education, objectives (b) and (c) are found to have specific and direct implications for the need for the study of technology in the secondary school. Industrial arts, therefore, could serve this purpose. Ohikhema (1974), in advocating for the introduction of the study of

modern technology as a basis for development in Nigeria, stated that:

> In a young developing country such as ours, a general understanding of technological principles will create a favourable precondition for development. By developing curiosity and creativity in students, elementary technology (industrial arts) will serve as a basis for human development--by introducing elementary technology into secondary education, children will become aware of new challenges and hence develop new capacities for harnessing local resources for controlling the environment for human benefit. (West African Journal of Education, Vol. XVIII, No. 1, 1974, p. 25)

Another important observation made by Ohikhema is the importance of industrial arts in preparing students for the circumstances they will meet with in later life either in the pursuit for higher education or the labour market. Nigeria, therefore, needs a relevant educational system that would adequately introduce its citizens to the technological world culture. Ohikhema, realizing this need in the secondary school system, said, "In a technological world culture there seems to be no other way to fit secondary school learners to life than through technical education being made part of their general education." (p. 26)

In outlining the role of technical education in the comprehensive educational system in the northern states (particularly in Kaduna State), Dr. D.R. Young (1973) observed that, "The main advantage of comprehensive education is that leaners have increased options for further education or employment," and suggested the broadening and increasing of the school curriculum to give greater career

options to students. He further contended that, "ideally all students should be given the opportunity to be educated to the maximum of their abilities and talents."

The objectives of post-secondary technical training during the Third National Plan period is to expand technical colleges to attract and cater for increases in demand which would be experienced from the sudden increase of secondary school graduates. The introduction of industrial arts in schools plays a very important role by introducing the basic technologies prevalent in these technical colleges and the world of work. During the same period, the intent is to raise enrolment in post-secondary technical colleges from 8,856 in 1974 to about 36,455 by 1980 (FMED, 1975, p. 255). The adequate achievement of this goal would require an adequate introduction of the technologies at the secondary school level.

In Kaduna State alone, the projected total minimum secondary school enrolment by 1980 is estimated at about 97,500 (pp. 253-254). The state has since 1975 established a State College of Science and Technology and jointly owns the Kaduna Polytechnic with the other northern states. The projected enrolment at these colleges by 1980 is estimated at about 4,500 of the state's origin (p. 255). To achieve these projected goals with success, there is the need for an adequate base of secondary education to adequately cater for these projected enrolments.

Nigeria is aware of the shortage of adequate skill

manpower needs necessary for an effective economic development:

> A remarkable feature of our post-independence national development plans is the conscious and sustained effort to diversify Nigeria's economy. Though a large proportion of the nation's population is engaged in agriculture Nigeria realizes that in order to attain an accelerated growth in her economy, she must embark on a bold programme of industrilization (Federal Ministry of Information, Nigeria Handbook, 1977, p. 144).

Nigerian Industrial Development

The aims for the expansion and the creation of more technical institutions are specifically designed to cope with the expansion in the industrial sector of the economy. The Development Plan 1975-80 realizes that the nation's economy is faced with the challenge and the opportunity of creating an industrial base that would guarantee growth:

> This challenge is great but so is the potential. Nigeria is richly endowed with the physical as well as the human resources necessary for industrial development (FMED, 1975, p. 147).

In Kaduna State, Nigeria, the importance of industry in the development programs of the state cannot be overemphasized. During the current Development Plan:

> ...its contribution to the economic and social development of the state has been increasing over the years; and today it is second only to agriculture in terms of output and generation. In recognition of this, the government will accord industry a prominent place in the Third National Development Plan. The principal objectives of industrial development during the Plan period will include: (a) the evidencing of the State's industrial base; (b) the promotion of linkages between manufacturing and dispersal of industries (p. 169).

In the state there are at present twelve major industrial enterprises. Out of this number, there are six textiles industries, a car assembly plant, a petroleum refinery plant (under construction), Nigerian breweries, and a fertilizer company. These companies are in shortage of adequately trained personnel (p. 171).

The Identification of Suitable Technologies For Secondary School Curriculum In Kaduna State, Nigeria

Review of the Nigerian Economic Sector

During the Third National Development Plan 1975-80 period, the Nigerian economic sector was classified in the following categories: Agriculture, Livestock, Forestry, Fishery, Mining and Quarrying, Manufacture and Crafts, Power, Commerce and Finance, Transport, and Communication.

Agriculture

The following form the major products of the sector: Maize, Millet, Sorghum, Rice, Wheat, Yam, Cassava, Pulses, Sugar, Cocoyam, Melm Seeds, Beef, Goats, Mutton, Poultry, Pigs, Offals, Eggs, Milk, Fish (FMED, 1975, p. 68).

A summary of the major problems confronting the sector include: shortage of qualified manpower in key areas; inadequate supplies of agricultural inputs; inadequate extension service; poor conditions of feeder roads and other transport facilities; inadequate or lack of effective supporting services; diseases and pests; labor shortage;

lack of appropriate or complete packages of technology for many food crops; drudgery in farmwork and low returns from agriculture which forces rural youth to migrate to urban areas; and labor shortage at peak period during farming seasons (p. 65). The document stresses that with the availability of improved technology, potentially applicable to major crops which, if adapted, could significantly raise productivity in agriculture (p. 65).

Livestock

The major products of the sector are: Beef/Dairy Cattle; Poultry; Piggery; Sheep; Goats (FMED, 1975, p. 93-94).

One of the major problems affecting the sector is poor infrastructure which raises costs, causes waste and restrains development programs. This includes: animal diseases, lack of credit, land tenure, lack of qualified manpower, lack of adequate incentive, cattle tax, inadequate market information system, inadequate supply of feed/water during dry seasons (p. 94).

Forestry

The major products include: Sawnwood production; Fuelwood production; Pulpwood production; Wildlife; Gum Arabic; Sheer Butter; Tanin Materials (p. 111-112).

Some of the major problems include scarcity of fast-growing species of trees, acute shortage of technicians, for example, in sawmilling, specialists in forestry management, silviculture wood preservation and wildlife management to

mention a few (p. 112).

Fishery

There are two major means of fish supply. These are Industrial Fishery which mainly is marine and capital intensive and Artisonal Fishery which is labor intensive (p. 123).

Some of the major problems include: inadequacy of capital for fisheries development, lack of adequate fishing terminals, shortage of trained manpower at various levels, inadequate supply of inputs, poor communication network in the production areas, and lack of effective fishermen organization in the artisonal sector (p. 124).

Mining and Quarrying

Petroleum and other Minerals products, Coal, Iron and Steel, Tin and Columbite (p. 137).

The major problem is the low level of indegenous technology and shortage of indegenous high-level professional manpower. The problems extend from geological survey to the production or extraction of the products (p. 137).

Manufacturing and Crafts

The major classified industries include:

> Fishing, Mining, Canning Dairy, Animal and Vegetable Oil Processing, Grain Milling, Bakery, Sugar Estate and Refinery, Food Processing, Soft and Alcoholic Drinks, Fertilizer, Textile Spinning, Weaving and Apparel Manufacture, Carpets and Rugs, Leather Training and Fishing, Footwear, Saw Milling Industry (Plywood and Veneer Manufacture), Furniture (Wood and Metal), Paper and Packaging, Printing and Publishing, Basic Industrial Chemicals, Fertilizer and Pesticides,

> Paints, Varnishes and Lacquers, Drugs, Soaps, Perfumes, Cosmetics and other Toilet Preparations, Polishes, Candles and Matches; Petroleum Refining, Rubber and Plastics Goods, Pottery, China and Earthwares, Glass and Glass Products, Cement, Roofing Sheets, Tiles, Asbestos Goods, Iron and Steel Fabrication, Radio and Television Assembly, Boat Building and Ship Repairs, Motor Cycle and Bicycle Assemblies, Motor Vehicle Assemblies and Spare Parts Manufacture. (Nigeria High Commission, London, Nigeria: The Basic Facts, Undated, p. 25).

The major constraints affecting the manufacturing sector include: Infrastructural constraints which comprise of both the availability and cost of water, communication facilities, electricity, transport, port facilities, etc.; restrictive industrial policy; shortage of industrial manpower and the ministeries; increasing construction capacity; lack of indegenous contractor acquiring necessary equipment, skills, competence, confidence and dedication to good work; management problems; capital restructuring; the need for effective transport planning units; and road traffic regulation and enforcement not effectively administered (FMED, 1975, p. 202).

Communication

There are many problems affecting this sector of the economy. The most significant is the cumulative underinvestment in facilities with which it is affected. "Existing facilities are grossly inadequate to meet the requirements of the rapidly expanding industrial, commercial and administrative sectors for efficient and reliable communications." (FMED, 1975, p. 229) The major contributing

constraint is adequately trained manpower at both engineering and technical levels.

> The number of engineers is grossly insufficient to properly sustain the present telecommunications network, and even allowing for a rapid rate of expansion of training programmes, the availability of these groups and especially the middle level technical staff is likely to constitute a serious constraint on the maximum size of the system can be installed, maintained and serviced (p. 230).

Power

There is a rapid growth of industries commerce and urbanization across the country which make the present power supply inadequate. The demand for power " is far from being met in most areas of the country even without taking into consideration the high-level of suppressed demand" (FMED, 1975, p. 175). The rate at which the supply system can be expanded to cope with the growth is limited by the long lead time between project initiations and completion. For this reason, there are plans to build two more power generating dams to supplement the existing Kainji Dam. Another major constraint, and in view of the expansion program, is the shortage of adequately equipped system planning, operating and maintenance staff (p. 176).

Commerce and Finance

Some of the major constraints of this sector include: recurring shortages of essential commodities and the high and rising prices of foodstuffs and other essential commodities; shortage of hotel accomodation; inadequate

information about the situation and practices in the sector; inadequate skill manpower; weakness of business promotion (FMED, 1975, p. 186).

Transport

The major problems of the sector could be summarized as: lack of executive capacity for implementing the relatively modest transport sector programs; inadequate staffing of executing a suitable educational program to suit the economic development planning of the nation.

The review of these sectors of the economy reveals that there is one basic and common major constraint affecting each sector. This problem could be summarized as inadequate skill manpower at all levels. To minimize or offset this problem requires relative inattractiveness of manufacturing to indegenous businessmen, and the slow implementation of the public sector manufacturing projects (FMED, 1975, p. 152).

The Sector Distribution of the Nigerian Domestic Product

The Gross Domestic Product (GDP) is defined as "the measure of current production at home attributable to factor services supplied by people normally resident in the country." The Gross National Product (GNP) is similarly defined as "the measure of current production at home and abroad, attributable to factor services supplied by people normally resident in the country." (FMED, 1975, p. 44)

Table 1

Gross Domestic Product at 1974-75 Factor Cost
Percentage Distribution

Per Cent

Sector	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
1. Agriculture, Forestry and Fishing	23.4	22.6	21.9	21.0	20.1	19.0
2. Mining and Quarrying	45.5	44.6	43.2	41.5	39.6	37.5
3. Manufacturing and Crafts	4.7	4.9	5.2	5.7	6.2	6.9
4. Electricity and Water Supply	0.4	0.4	0.5	0.5	0.6	0.7
5. Building and Construction	5.7	6.1	6.7	7.3	8.1	9.0
6. Distribution	6.7	6.9	7.0	7.2	7.2	7.3
7. Transport and Communication	2.3	2.4	2.5	2.7	2.9	3.2
8. General: Government	6.3	6.7	7.1	7.8	8.5	9.1
9. Education	2.6	2.9	3.2	3.6	4.0	4.4
10. Health	0.9	1.0	1.1	1.2	1.3	1.4
11. Other Services	1.5	1.5	1.5	1.5	1.5	1.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Table 2

Annual Sectoral Growth Rates of the Gross Domestic Product at 1974-75 Factor Cost

Per Cent

Sector	1975-76	1976-77	1977-78	1978-79	1979-80	Average Annual Growth Rate 1975-80
1. Agriculture, Forestry and Fishing	3.5	5.0	5.5	5.5	5.5	5.0
2. Mining and Quarrying	5.1	5.2	5.4	5.5	5.6	5.3
3. Manufacturing and Crafts	10.4	15.9	18.7	21.2	23.8	18.0
4. Electricity and Water Supply	15.5	18.0	23.0	24.7	25.5	21.0
5. Building and Construction	14.4	18.6	20.5	23.0	24.0	20.1
6. Distribution	10.0	10.3	11.6	12.0	12.5	11.3
7. Transport and Communication	12.5	15.9	17.5	20.0	21.5	17.5
8. General: Government	15.0	15.0	20.0	20.0	20.0	18.0
9. Education	19.0	21.0	22.0	23.0	24.0	21.8
10. Health	18.0	19.0	21.0	21.0	21.0	20.0
11. Other Services	8.4	9.0	9.6	10.2	10.8	9.6
12. Aggregate Annual Growth Rate	7.2	8.5	9.8	10.6	11.5	9.5

Table 1 and 2 reproduced from FMED, Third National Development Plan, 1975-80, Vol. 1, Central Planning Office, Lagos, Nigeria, 1975, p. 49.

Table 3

Nigeria Structure of Manufacturing by Value Added and Employment

Per cent

Industry Group	1965		1971		1972	
	Value Added	Employment	Value Added	Employment	Value Added	Employment
Meat Products	0.9	1.5	1.6	1.1	1.4	1.6
Dairy Products	0.3	0.4	0.4	0.2	0.4	0.3
Fruit Canning and Preserving	--	0.7	--	0.2	--	0.2
Vegetable Oil Milling	5.4	6.3	3.1	4.1	2.6	6.0
Grain Mill Products	3.3	0.8	2.4	1.0	1.7	1.0
Bakery Products	1.4	2.5	1.3	3.3	1.0	3.0
Sugar and Sugar Confectionary	1.7	5.4	1.8	3.6	3.1	3.2
Miscellaneous Food Preparations and Animal Feeds	13.9	3.0	0.8	0.5	0.3	0.4
Spirits, Distillery and Beer	14.6	3.0	14.7	2.5	12.7	2.5
Soft Drinks	1.3	1.0	1.3	0.5	2.4	0.8
Tobacco	--	--	9.7	3.9	8.7	2.5
Textiles	10.9	15.0	17.5	22.4	12.6	22.1
Made-up Textile Goods (Except Wearing Apparel)	1.0	2.1	1.1	2.7	1.1	2.1
Knitted Goods and Woven Carpet	--	--	0.4	1.3	1.8	2.6
Wearing Apparel	0.4	0.6	0.3	1.1	1.5	1.2
ning	0.8	0.7	0.4	0.6	0.5	0.6
vel Goods	0.2	0.4	--	0.5	--	0.4
Footwear	1.3	1.9	1.1	2.0	0.3	1.4
Sawmilling	1.4	5.8	2.1	6.7	2.3	5.4
Wooden Furniture and Fixtures and oth. Wood Products	2.4	4.8	0.6	3.7	1.0	3.5
Conta. rs, Boxes of Paper and Pape. Board	--	--	1.0 0.7	1.0 1.0	1.0 1.0	1.0 0.9
Paper Products	1.0	1.0	0.7	5.4	2.6	6.0
Printing	2.8	6.5	3.0	0.4	0.4	0.2
Basic Ind. Chemicals Fertilizers and Pesticides	0.3	0.3	1.1	0.4	0.4	0.2
Paints	1.0	0.4	0.9	0.5	1.1	0.5
Drugs or Medicines	--	--	0.4	0.6	0.8	0.8
Soaps, Perfumes, Cosmetics and Other Cleaning Preparations	--	--	5.2	2.7	5.4	3.1
Other Chemical Products	6.4	4.0	0.9	0.9	0.9	0.9
Products of Petroleum and Coal	--	--	8.3	0.3	9.4	0.3
Tyres and Tubes	2.3	1.8	2.3	1.2	2.4	1.8
Other Rubber Products	--	--	0.5	2.9	1.0	2.8
Plastic Products	--	--	1.8	2.0	1.3	2.4
Pottery and Glass Products	0.3	6.0	0.5	1.1	0.3	0.9
Bricks and Tiles	--	--	0.1	0.2	0.1	0.4
Cement	4.7	3.6	2.2	2.1	2.6	1.9
Concrete Products	--	--	0.7	1.5	1.6	1.7
Basic Metal, Cutlery, Handtools and General Hardware	7.0	8.3	0.9	1.6	0.5	0.4
Metal Furniture and Fixtures	--	--	1.2	2.2	1.4	2.9
Structural Metal Products	--	--	2.0	2.7	2.3	3.1
Fabricated Metal Products	--	--	3.5	5.2	7.0	4.6
Manufacture of Agricultural and Special Ind. Machinery	--	--	0.1	0.2	0.2	0.2
Machinery and Equipment except Electrical	--	0.2	--	0.2	--	0.1
Manufacture of Radio and TV and Communication Equipment	--	--	0.7	0.5	0.8	0.6
Manufacture of Household Electrical Apparatus and Supplies	1.0	0.9	0.3	0.6	0.4	0.7
Transport Equipment, Motor-body and Shipbuilding and Repairs	9.7	14.3	0.3	0.6	--	0.3
Manufacture of Watches and Clocks and Jewelleries	--	--	0.1	0.2	--	--
Manufacturing Industry not yet classified	1.9	1.8	0.6	1.3	0.5	1.2
	100	100	100	100	100	100

There is a significant relationship between the GDP and the GNP. During the Second National Plan 1970-74 period, the GNP accounted for about 95 percent of the GDP (p. 44). Table 1 gives the projected GDP during the current plan period, while the Annual Sectoral Growth of the Gross Domestic Product is given in Table 2.

Table 2 indicates that the projected Sector Distribution of the GNP is dominated by the Economy Sector. It constitutes 89.7 percent during 1974-75; 87.9 percent in 1975-76; 87.1 percent in 1976-77; 85.9 percent in 1977-78; 86.9 percent in 1978-79; and 83.6 percent in 1979-80. However, Table 2 indicates a faster growth rate within the service sector than in the economic sector.

Table 3 gives the relative shares of the various industrial groups in total value added and employment within manufacturing and crafts sector of the economic sector in 1965, 1971, and 1972.

Nigerian National Aims and Objectives of Technical Education

Nigerian Technical Education is defined as "that part of education which leads to the acquisition of practical and applied skills as well as basic scientific knowledge" (FMI, 1977, p. 19). The Nigerian national aims of technical education are:

a) to provide trained manpower in applied science, technology, and commerce particularly at sub-professional grades;

b) to provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development;

c) to provide people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man;

d) to give an introduction of professional studies in engineering and other technologies;

e) to give training and impart the necessary skills leading to the production of craftsmen, technicians, and other skilled personnel who will be enterprising and self-reliant; and,

f) to enable our young men and women to have an intelligent understanding of the increasing complexity of technology

(FMI, 1977, p. 19).

THE PRE-VOCATIONAL TECHNICAL PROGRAM IN KADUNA SECONDARY SCHOOLS

Program Objectives

The general objectives of the technical pre-vocational program in Kaduna State, Nigeria, complements the aims and objectives of the secondary school. These aims and objectives of the secondary school are discussed in Chapter III.

Specifically, the technical pre-vocational program is conceived as a part of the general education provided in the secondary school. The technical pre-vocational program is not intended to prepare its candidates for the job market, but intended to introduce students to the various technologies prevalent in the Nigerian Colleges of Technologies, Polytechniques, Universities, and other institutions of higher learning.

Program Structure

Presently, secondary education in Kaduna State is a five-year program. The first two years are considered junior secondary and the last three years are senior secondary. While attending the junior secondary, all students explore all the courses offered in that school. At the completion of the junior secondary, students are guided and counselled for the major courses of study they would enrol in towards a career during the three years according to their abilities

and interests.

Specifically, the technical pre-vocational courses offered in the technical wing of every secondary school are Metalwork, Woodworking, and Technical Drawing. The courses are organized in unit shops. The following is the breakdown for each course at each level of study.

Junior Secondary (Forms 1 and 2)

Metalworking

1. General Shop Safety and First Aid
2. Basic hand and bench tools
3. Benchwork
4. Sheetmetal
5. Metals
6. Measurements

Woodworking

1. General Shop and First Aid
2. Basic hand and bench tools
3. Basic Woodworking joints
4. Woods
5. Measurements

Technical Drawing

1. Drawing Instruments
2. Sketching
3. Geometrical Construction
4. Projections

Senior Secondary (Forms 3,4, and 5)

Metalworking

1. Benchwork
2. Measurements
3. Machines: Shaping, Lathe, Grinding
4. Sheetmetal
5. Forge/Welding
6. Metals
7. Design

Woodworking

1. Woodjoints
2. Woods
3. Measurements
4. Machines: Bandsaw, Jigsaw, Lathe
5. Laminates
6. Basic Construction Design

Technical Drawing

1. Sketching
2. Geometrical Construction
3. Projections
4. Design

At the junior secondary, all students spend an equal amount of time in each field of study. At the senior secondary grades, a student chooses either Metalworking or Woodworking. Technical Drawing is, however, common to both areas. A student taking either Metalworking or Woodworking must take Technical Drawing. Technical Drawing is intended to reinforce the design construction, or blueprint reading aspects, required in either Metalworking or Woodworking..

Though Technical Drawing is common to both specific fields of study, the contents of design and geometrical construction are different and related to either Metalworking/ Mechanical Drawing or Woodworking/Construction/Architectural Drawing. Because these courses are regarded applied sciences, physics and mathematics are made compulsory for any student in the technical pre-vocational program.

The Role of the Kaduna Pre-Vocational Technical Education Program

With the review of the existing Kaduna State pre-vocational program, the economic sector, the national objectives of secondary education, and the national objectives of technical education, in the existing program has indicated that it is unsuitable. The program which only constituted metalwork, woodwork, and technical drawing does not adequately expose the students to the prevalent technologies of the society. The program does not adequately satisfy the national economic and skill manpower requirements. "The

system remains unable to meet the economy's manpower needs particularly in the middle and higher level manpower categories" (FMED, 1975, p. 240). The program does not, according to the national objectives of secondary education, and the national objectives of technical education, satisfy their aims.

The national enrollment ratios are very low for all levels of the educational system. In 1971, one of three children of primary school age was in school; for secondary education it was one in sixteen. For higher education only about three out of ten graduating secondary students gain entry to Universities and other colleges of higher learning. (FMED, 1975, p. 245) "Government has made Primary Education free and universal in September 1976 and proposes to make it compulsory by September 1979" (FMI, 1977, p. 7). The government, in making it compulsory and universal, realizes that "since the rest of the education system is built upon it, the primary level is the key to the success or failure of the whole system" (FMI, 1977, p. 7). To accommodate these students there is a massive expansion and construction of secondary schools.

With the increasing complexity of technology in the Nigerian society, a suitable industrial arts program is desirable to expose students to the contemporary technologies. Such a program, as a part of general education, must have the ability of integrating the technological and industrial aspects of the Nigerian society by utilizing the known technologies prevalent in the society. In view of the fact

that there is a very low enrollment after the secondary education into higher education mainly caused by insufficient higher institutions, it is therefore desirable and suggested to plan a program of industrial arts that would also include the development of entry level skill requirements.

COMPARISON OF THE ALBERTA PLAN I.A. AND THE KADUNA STATE PRE-VOCATIONAL TECHNICAL EDUCATION PROGRAMS

With the intent of adapting the Alberta Plan Industrial Arts Program, it is desirable to compare the two so as to identify areas of studies that could be adaptable for Kaduna State. The rationale for adapting suitable fields of study, or broadening, is strictly in light of the areas required and desired to meet the Nigerian economic manpower needs for development. With reference to the sector distribution of the GNP, the economic sector is dominant. For this reason a suitable educational program needs to be carefully and cautiously planned to offset the existing skill manpower shortage. The areas identified are envisaged to contribute in providing an effective role of the industrial arts program in Kaduna State.

The Alberta I.A. Program	The Kaduna Pre-vocational Technology Education Program
1. Materials Technology	
a) Woods	Presently available but requires expanding of the curriculum
b) Metals	do
c) Plastics	Not currently available but is desirable and required
d) Concrete	do
e) Lapidary-Art Metal	Not available but not very desirable due to the scarcity and none producing of such materials
f) Leather-Textiles	Presently available under the home economics program. Needs expansion
2. Visual Communication	
a) Graphic Arts	Not available but is desirable and required. Some fine arts is however provided under the Fine Arts Department
b) Commercial Arts	Not available but desirable
c) Drafting	Presently available but requires expanding of the curriculum
3. Mechanics	
a) Autobody	Not available but desired
b) Automotives	do
c) Related Mechanics	do
d) Aircraft Maintenance	Not available but not very desirable as this employs only a small portion of the work force and so not a common technology

The Alberta I.A. Program	The Kaduna Pre-vocational Technology Education Program
4. Construction and Fabrication	
a) Building Construction	do
b) Machine Shop	do
c) Welding	do
d) Sheet Metal	Some introduction is given under Metalwork. Expansion is desirable
e) Piping	Not available. The plumbing part of this section is desirable but the rest not necessary as home heating is not desired
5. Electricity-Electronics	
a) Electricity	Not available but very desirable and required
b) Electronics	Not available but desirable. Computers however may not form a part of the society's technology utilization, but with the fast pace of development it might soon be desirable.

Based on the previous information presented, the following are the feasible areas adaptable for the model industrial arts program for Kaduna State as listed below. The development of the program is dealt with in the next chapter.

Cluster	Fields of Study
1. Materials	Woods, Plastics, Metals, Concrete
2. Visual Communication	Drafting, Graphic Arts Commercial Arts
3. Construction and Fabrication	Building Construction, Machine Shop, Welding, Plumbing, Sheet Metal
4. Mechanics	Autobody, Automotives, Related Mechanics
5. Electricity-Electronics	Electricity, Electronics

THE CRITERIA FOR A CONTEMPORARY INDUSTRIAL ARTS PROGRAM FOR KADUNA STATE

In reviewing the literature to identify the criteria for developing a suitable program for Kaduna State, it was found companionable to use items developed by Leslie H. Cochran for his doctoral thesis at Wayne State University in 1968 and later published in his book Innovative Programs in Industrial Education in 1971. Only statements found relevant to current concepts in Industrial Arts Education were considered and adapted. Those found to contradict were therefore rejected. The statements below served as the criteria for developing a contemporary industrial arts model program in Kaduna State, Nigeria.

A. Statements Pertaining to Objectives

1. The program should be based on selected experiences that would provide for an understanding and appreciation

of industry and its workers.

2. The program should provide for both male and female students.
3. The program should provide occupational guidance by helping students assess their occupational potential, interests and capabilities.
4. A student should be allowed to choose an area of concentration according to his interests and abilities.
5. Consideration should focus on the development of an appreciation for good design and craftsmanship.
6. The program should be directed toward providing exploratory experiences in selected industrial type activities.
7. The development of desirable work and safe habits should be integrated into the courses of study.
8. The program should be designed to provide the student with basic technical skills and occupational guidance information on a prevocational basis.

B. Statements Pertaining to Content

9. Content should be organized so that the major emphasis is placed on manipulative type activities (operational rather than informational).
10. The content in industrial education courses should closely correlate with subject matter taught in other departments in the areas of science, mathematics, and English.
11. The program should provide occupational information about job requirements, working conditions, salaries,

and how to get a job.

12. The content should be pre-determined by the teacher along with problems selected that relate to the needs of students and the community.
13. The program should provide practical applications of scientific principles.
14. The program should provide for instructions in the use of common hand and machine tools used in industry.
15. The program should focus on a study and the use of industrial materials and processes.
16. Industry should be studied by concentrating on the production of goods and the servicing of products.
17. The program should consider industry in its totality, including labor, capital and distribution.
18. The program should provide experience with selected basic manufacturing process.
19. The dominant technologies, such as mechanical, electronics, and electrical, should be the basic source of content.
20. Content should be classified under such instructional areas as woodworking, metalworking, and drafting.
21. A study of industry should be made by concentrating on the construction and manufacturing industries.

(Adapted from Leslie H. Cochran, Innovative Programs in Industrial Education, Bloomington: McKnight & McKnight, 1970, pp. 94-95.)

CHAPTER IV

A CONTEMPORARY INDUSTRIAL ARTS MODEL PROGRAM FOR KADUNA STATE, NIGERIA

INTRODUCTION

> All levels of education must quickly move to assume greater responsibilities for preparing men and women for entry into the changed and changing world of technological work (Venn, 1970, p. 23).

Part of the Nigerian national aims and objectives of education during the current Plan period (1975-80) focuses on:

> The acquisition of appropriate skills, abilities and competences both mental and physical as equipment for the individual to live in and contribute to the development of his society (FMI, 1977, p. 4).

Nigeria is fast becoming an industrialized nation. With the fast pace of introducing modern technology as a part of Nigeria's culture and as a way of life, Nigerian education, therefore, must focus itself towards equipping students to live effectively in that society. The basic purpose of general education in a society aims at equipping its citizens to live and contribute effectively in that society. An effective system of general education in Nigeria must have the ability to transmit the society's ways of life to the young ones; provide for the improvement of

the culture; and meeting the needs of individuals.

As a technology oriented society, the need for Nigeria to have an adequate system of education for effective citizenry is paramount. Industrial arts as a part of general education in the secondary school curriculum is a desirable approach towards achieving this goal. Industrial Arts as a curriculum area in the secondary school introduces students, both boys and girls, to the technologies prevalent in the Nigerian society. This curriculum area must also have the ability to interpret the productive society to the young potential worker and contributor. As in the Alberta Plan, a model industrial arts program for Kaduna State should provide for, learning experiences that are representative of tasks in industry, indicative of the kinds of knowledges in business enterprises, and examplory of interrelationships present in a productive society (Cochran, 1971, p. 74).

Based on the literature reviewed pertaining to the role of the Kaduna pre-vocational technical education program, it was realized that the program was unable to meet the economy's manpower needs. Furthermore, it was also realized that about seventy (70) percent of the graduating students from the secondary school system join the labor market, while the remaining thirty (30) percent continue on for further education. An educational program is desired to fully cater for the needs of these students.

OBJECTIVES OF THE MODEL PROGRAM FOR KADUNA STATE

Rapid technological developments and changes are a major educational problem in societies today. Every major technological invention influences man's culture and man must learn to adapt to live with it effectively and comfortably. Industrial arts is intended to teach our students to adapt and cope with these sudden cultural shocks imposed on society by these developments.

> A program of study is needed that will, through directed discovery and other methods, meet the often expressed needs of problem solving, individualized instruction, discovering one's own capabilities, and progressing at one's own speed. It is the intent of this program that students very rapidly recognize--subsequent effects of technological innovations upon their lives as they study, as they attempt to select a career goal and how they may function in our productive society (Ziel, 1971, p. 22).

The general objectives of The Model Industrial Arts Program for Kaduna State, Nigeria compliments the aims and objectives of the national secondary education. The general objectives of The Model Industrial Arts Program are stated below:

1. To provide exploratory experiences in technical occupational clusters for the various technologies prevalent in the Nigerian society to guide students in future career selection.
2. To provide students with courses that aid them to relate academic knowledge to technical competencies.
3. To provide students with the opportunities to

develop their creative potentials both avocationally and vocationally.

4. To provide students the opportunity to develop relevant technical competencies that will assist them to obtain further education, training, or, employment.

Program Structure

At the present time, the term pre-vocational technical education is used in Kaduna State. The name Industrial Arts is suggested as a substitute. The multiple activity system of instruction is more desirable than the unit shop system of instruction at the Junior Secondary--Introduction to Materials and Technologies--and the Senior Secondary--General Industrial Arts. The unit shop approach is intended to be used at the Senior Secondary--Clusters. The following is the breakdown of the Industrial Arts Model Program which extends for five years.

Introduction to Materials and Technologies--Junior Secondary (Form 1 and 2)

The course introduces students (boys and girls) to the basic materials and technologies prevalent in the Nigerian society. As an exploratory course, students are given guidance in making career selection or choice. After the completion of this course, students may select Industrial Arts--General--or, Industrial Arts--Clusters. These courses extend from the third year through five, the termination of the secondary school studies.

The basic intent of Introduction to Materials and Technologies is to provide students with the opportunities to explore, synthesize, experiment and discover the reality of the materials and technologies they are exposed to. The content of the program deals with industry, its organization, processes, occupations, materials, products, and the problems resulting from the impact of technology on the Nigerian society.

Industrial Arts--General (Senior Secondary Form 3-5)

This part of the program is a further study in more depth of what was previously learned from Introduction to Materials and Technologies. The course is a general study in the technological clusters. For educational purposes, these clusters have been grouped into four; they are: Visual Communication; Electricity/Electronics; Materials; and, Power Technology, organized in multiple activity shops. Students in this program could pursue further studies in Universities or Colleges of Technology in areas of their choice and abilities, or, pursue an apprenticeship training in a specific field. A Nigerian Industrial Apprenticeship Training Board has been created to provide a systematic apprenticeship training throughout the country (Dikko, 1976, p. 3).

Industrial Arts--Clusters (Senior Secondary Form 3-5)

Following Introduction to Materials and Technologies, students may select to begin orientation studies in one cluster as a career field organized in unit shops. The program is designed for students who are vocationally inclined in any of the clusters selected. Students in this area could also pursue further education in Colleges of Technology or Polytechnics in the selected areas as technicians or technologists, or enter the job market to be trained in a specific occupational field within that cluster. The contents of each cluster place emphasis on practical work, applied theory and industrial organization.

THE CRITERIA FOR CONTENT SELECTION

For the content validity of the Model Industrial Arts program, the following were the criteria for which they were identified:

1. The type of industrial establishments operating in the State of Nigeria;
2. Professional responses to the selected technologies from teachers teaching, or, who have taught in the pre-vocational program in Kaduna State, Nigeria;
3. The Nigerian national aims and objectives of education including the objectives of secondary school education; and,
4. The content included the prevalent materials and technologies of the Nigerian society.

TIME ORGANIZATION

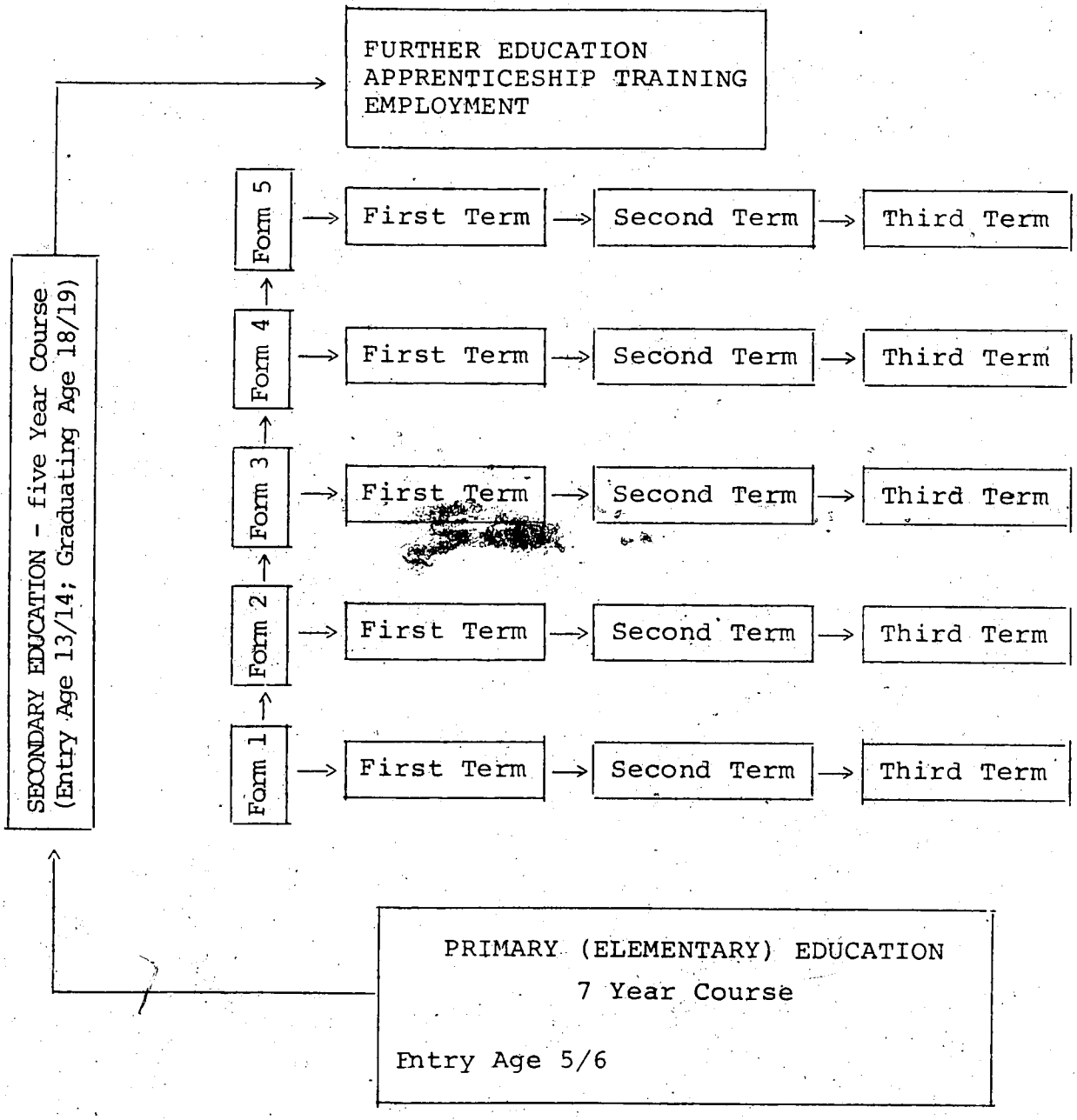
A term extends for a minimum of twelve weeks. The last two weeks of every term is normally devoted to end of term examinations. The learning modules to be designed from the matrixes, therefore, would be for a minimum of ten weeks of instruction. The rationale for designing the learning activities in modules is to provide the students and the teacher with a guide to organize their studies. The content for each module to be developed is included in this study. Each content outline for each field of study, unit, or topic must include objectives, concepts, learning tasks and references. For each year, the minimum instructional time is a minimum of thirty weeks. Schools operate on three terms a year. A period of instruction in most secondary schools last for a minimum of fourty five (45) minutes. Below is the time allocation for shop courses in Kaduna State:

Junior Secondary

The time allocation for each week is four (4) periods which are broken down into two (2) lessons. Each lesson lasts for two periods with a total time of one and one half (1½) hours. The total time allocation per week is equivalent to three (3) hours. In a term of ten weeks of teaching, this gives a total of thirty (30) hours and a total of ninety (90) hours a year.

Figure 2

Kaduna State Secondary School Structure



First Term: Mid September - Mid December
Second Term: January - March
Third Term: Mid April - Mid July

Senior Secondary

The time allocation for each week is nine (9) periods per week. Each lesson normally lasts for three (3) periods or two and a quarter (2¼) hours. The equivalent time allocation for each week is 6 3/4 hours and 77½ hours per term or 231½ hours per year.

Kaduna State does not operate on a semester basis, but on three terms each year; it also does not operate on a course credit system. Items adapted from the Alberta Plan, therefore, are reorganized to conform with the Kaduna State school organizational structure.

INTRODUCTION TO MATERIALS AND TECHNOLOGIES

Objectives

The objectives of the program are:

1. To provide students with the opportunity to acquire basic understanding and a degree of skill in the use of tools, machines, materials and processes of Nigerian industries.
2. To provide exploration and experiences to guide students in their future career selections in the technologies.

Table 4

Structure of Introduction to Materials and Technologies Matrix

	First Term	Second Term	Third Term
Form (Grade)	Module 1.1	Module 1.2	Module 1.3
1	Woods Metals Plastics Ceramics	Woods Metals Graphics (Drafting)	Graphics (Drafting) Woods Plastics
	Module 2.1	Module 2.2	Module 2.3
2	Metals Concrete Graphic Arts	Electricity Electronics Power Technology	Electricity Electronics Power Technology

Form One (Grade 8)

First Term - Module 1.1

The module introduces students, boys and girls, to woods, metals, plastics and ceramics as materials, and gives occupational information and guidance in each of them.

Woods/Metals/Plastics/Ceramics: The general content in each of these areas include: sources, processing, societal implications, identification, product planning, separation processes, forming processes, conditioning processes, combining processes, and occupational information.

Second Term - Module 1.2

The module introduces students to tools and machines as applied to each. Drafting is included to introduce students to the basic graphical representation as an effective means of introducing tools and machines.

Metals: Basic bench tools, theoretical knowledge of machines including the shaper, the lathe, the miller, and drilling machines.

Woods: Basic bench tools, theoretical knowledge of machines including the bandsaw, the lathe, and the jigsaw.

Drafting: Freehand sketching which includes an overview of the drafting area, drawing interpretation, image assembly, image transfer, and occupational information. This area particularly aids students to the understanding of the sketches and drawings done in the metal and wood areas and gives its relationship and importance to these areas.

Third Term - Module 1.3

The module deals with processes in woods and plastics and a further study in drafting.

Wood: Basic wood joints, laminates, nails and screws, glues.

Plastics: Basic introductory processes included in this area include injection, extrusion, centrifugal, heat and pressure, blow and vacuum form and cellular.

Drafting: As a continuation to freehand sketching, instrument drawing is emphasized here. Similar concepts in drawing interpretation, image assembly, and image transfer is done. As in freehand sketching, it reinforces graphical representation in woods and plastics.

Form Two (Grade 9)

First Term - Module 2.1

The intent of the module is to introduce students to metal and ceramic processes and also graphic arts.

Metals: It deals with simple benchwork such as filing, sawing, and introduction to lathe, shaper, and milling processes.

Ceramics: Processes in this specific area may include extrusion, hand forming, slip casting, compression, glazing, glass making, firing and glaze and clay mixing.

Graphic Arts: The coverage of this area includes an overview of offsetting, platen press, silkscreen, sign press and photo-silkscreen processes.

Second Term - Module 2.2

The basic purpose of the module is to introduce students to electricity, electronics and power technologies. The module specifically deals with the basic concepts and principles of each area. In addition, career guidance and information are emphasized.

Electricity: The contents include: a) sources of

electricity--theory and methods of generating; b) Circuitry --basic circuit, measurement, and types of circuits; c) Control--on-off switching, overload control, directional control, and control of the amount of electron flow; and, d) Magnetism--magnets and magnetic fields, electro-magnetism and uses.

Electronics: Content includes: a) Component function--components and color coding; b) Electronic sound generation--oscillator circuit components; c) Wireless transmission--regulations, communications, and operation of transmission devices.

Power Mechanics: Content includes: a) Small Gas Engines--identification of type, disassembly, assembly, running/analysis; b) Small Gas Engine Tune-up--trouble shooting, replacing tune-up parts; c) Carbon Powered Car--product planning, manufacturing, testing.

Third Term - Module 2.3

This module compliments Module 2.2.

Electricity: a) General utilization--the conversion of electrical energy into mechanical, heat, light and chemical energies; b) Telephone/Telegraph--the conversion of electrical energy into sound, for example, telephone and telegraph; c) Appliance Maintenance--safety, trouble shooting; d) Guidance--occupational information and senior secondary school programs.

Electronics: a) Radio-history, radio receivers,

systems; b) Phonograph--history, sound waves; c) Guidance--occupational information and senior secondary programs.

Power Mechanics: a) Model Rocketry--safety code product planning, manufacturing the rocket, launching; b) Fluid Power--forms of energy, input, control devices, transmission devices, output; c) Mechanical Power--forms of energy, input, control devices, transmission devices, output; d) Guidance--occupational information and senior secondary programs.

INDUSTRIAL ARTS - GENERAL

Objectives

1. To provide students with the opportunities to develop acceptable personal and social values necessary in a productive society.
2. To provide students the experience that will assist them in making realistic career choices.
3. To develop students' interests in the technical fields and applied sciences as an integral part of the students' general education.
4. To provide students the opportunities to develop basic competencies both cognitive and avocational psychomotor skills to pursue a family of occupations or further studies.

Structure

The four clusters included are given below with the breakdown of the units in each.

Electricity/Electronics (E/E)

1. Electricity
2. Electronics
3. Power Supplies
4. Amplifiers
5. Audio
6. Radio
7. Television
8. Electric Wiring
9. Design and Construction

Materials Technology (MT)

1. General Woods
2. Building Construction
3. Cabinet Making
4. General Sheet Metals
5. Machine Shop
6. Welding (Arc/Gas)
7. Foundry
8. Plastics
9. Ceramics/Concrete

Power Technology (PT)

1. Conventional Heat Engines
2. Automotives Tune-Up/Care
3. Mechanical Systems
4. Electro-Mechanical Controls
5. Electrical Systems
6. Non-Conventional Power Sources
7. Appliance Repair
8. Hydraulics and Fluidics
9. Pneumatics and Fluidics

Visual Communications (VC)

1. Principles of Lithography
2. Photography
3. Layout Design
4. Offset Printing Production
5. Mechanical Drafting
6. Topographical Drafting
7. Architectural Drafting
8. Relief Printing
9. Printmaking Techniques

The contents in the four fields of study constitute a three-year study program. The program is made up of nine (9) modules with three (3) modules undertaken each year. Each module is designed for a minimum of eighty (80) hours of study, and twenty (20) hours for each unit. The four units in each module are studied in multiple activity shops. Though a unit from each cluster is included in each module, they are intended to form a continuum of studies in the clusters. Relationships of the units in each module are taken into consideration. The table below constitutes the

modules and the content of each unit for the three-year program.

Table 5

Structure of Industrial Arts - General Matrix

		FIRST TERM	SECOND TERM	THIRD TERM
Year	Cluster	Module 3.1	Module 3.2	Module 3.3
3	E/E M.T. P.T. V.C.	Electricity General Woods Conventional Heat Engines Principles of Lithography	Electronics Building Construction Automotive Tune-Up/Care Photography	Power Supplies Cabinet Making Mechanical Systems Layout Design
		Module 4.1	Module 4.2	Module 4.3
4	E/E M.T. P.T. V.C.	Amplifiers General/Sheet Metals Electro-Mech. Controls Offset Printing Production	Audio Machine Shop Electrical Systems Mechanical Drafting	Radio Welding (Arc/Gas) Non-Conventional Power Sources Topographical Drafting
		Module 5.1	Module 5.2	Module 5.3
5	E/E M.T. P.T. V.C.	Television Foundry Appliance Repair Architectural Drafting	Electric Wiring Plastics Hydraulics and Fluidics Relief Printing	Design and Construction Ceramics/Concrete Pneumatics and Fluidics Printmaking Techniques

Form Three (Grade 10)

First Term - Module 3.1

The content of the module introduces the student to the basics in each of the four units and as a review to what has already been covered in Introduction to Materials and Technologies.

Electricity: The content is basic electrical theory, control of power of electricity and basic tool and instrument use.

General Woods: The content includes the safe use of tools and basic shaping and joining of wood.

Conventional Heat Engines: The content includes internal and external combustion engines, safety procedures, efficiency, control and energy utilization.

Principles of Lithography: This includes basic principles of the lithographic processes, simple layout, making masters and offset press operation.

Second Term - Module 3.2

Content includes: electronics, building construction, small engine tune-up and trouble shooting, line lithography.

Electronics: Introduction to test instruments and electric devices.

Building Construction: The study and practice of simple framing and safe tool use.

Small Engine Tune-up and Trouble Shooting: Basic operation principles, tool use, adjustments and minor repairs of small engines.

Line Photography: The use of process camera in line photography and the preparation of orthochromatic film to make masters.

Third Term - Module 3.3

Content of the module includes: power supplies, cabinet making, mechanical systems, layout and design.

Power Supplies: Using laboratory facilities the students will be guided to build a power supply to convert AC to DC.

Cabinet Making: The use of tools and equipment on exercises in shaping, joining parts of wood projects and finishing methods.

Mechanical Systems: Dismantling and re-assembling various mechanical systems to determine operating principles.

Layout and Design: The development of skill in layout and commercial and techniques.

Form Four (Grade 11)

First Term - Module 4.1

The content includes: amplifiers, general metals/sheet metal, electro-mechanical controls, offset-printing production.

Amplifiers: Content includes the understanding of

the theory of amplification and to assemble an amplifier.

General Metals/Sheet Metal: General Metals is intended to provide exploratory experiences in a number of metal forming and fabricating processes using both hand and machine tools. Sheet metal area gives the student the opportunity to learn simple layouts, the use of shaping tools, forming methods, assembling and fastening parts of sheet metal projects.

Electro-Mechanical Controls and Trouble Shooting: Conversion and control of energy as it applies to electric starters, generators and alternators. Safety and problem solving techniques are stressed.

Offset-Printing Production: Students plan a production run of a printed layout and in the process learn about: systems analysis, quality control, offset production, deadlines, wastage and consumer acceptance.

Second Term - Module 4.2

It includes: audio, machine shop, electrical systems and mechanical drafting.

Audio: Students learn about various audio systems and how they are assembled.

Machine Shop: Introduction to machine lathe, drill, grinder, and shaper. Correct procedures are taught for setting up and making basic cuts.

Electrical Systems: The production of electricity, amplification control and transmission. Ignition of both

single and multiple engines are included.

Mechanical Drafting: Basic drawing concepts are introduced to produce product representations through various projection methods. Students learn to use and take care of instruments.

Third Year - Module 4.3

The content of the module includes the following four units of study: Radio, Welding (Arc/Gas), Non-conventional Power Sources, Topographical Drafting.

Radio: Students become familiar with the actual workings of radio system(s) through practical activities.

Welding (Arc): Students learn to set the welding machine for various types of rods and metal weights. Basic techniques and welding forms are practiced. For Gas Welding --the safe procedures for setting up the equipment and making adjustments are learned. Basic oxy-acetylene procedures and techniques are practiced.

Non-Conventional Power Sources: Other sources of energy such as solar, chemical, wind, etc. are studied.

Topographical Drafting: Drawing up contour maps, the use of various projections, and dimensioning.

Form Five (Grade 12)

First Term - Module 5.1

The four units included in the module are: Television, Foundry, Appliance Repair and Trouble Shooting, and Architectural Drafting.

Television: The students are given the opportunity to become familiar with the actual workings of television system(s) through practical activities.

Foundry: Students are given the opportunity to try the different processes involved in foundry, from pattern making to finishing a casting.

Appliance Repair and Trouble Shooting: Trouble shooting procedures in undertaking repairs of typical appliance faults.

Architectural Drawing: Introduction to reading and drawing building plans and the study of housing standards.

Second Term - Module 5.3

The module consists of four units. These units are electric wiring, plastics, hydraulics and fluidics, and relief printing.

Electric Wiring: Basic wiring circuits to properly terminate various devices normally found in residential wiring.

Plastics: This unit deals with cutting, finishing and assembling plastic products as well as the construction.

Hydraulics and Fluidics: Assembling, operating and analysing different hydraulic systems and the efficiency of energy transfer.

Relief Printing: Principles of relief printing, its study and application to hand setting type and the use of a small platen press, sign press and rubber stamp machine.

Third Term - Module 5.3

This is the last module of the series in each of the four fields of study. Career and Occupational information is included. This information is very important to the graduating students who might pursue further studies, or apprenticeship training, in any of the clusters surveyed. The four units include design and construction, ceramics/concrete, pneumatics and fluidics, printmaking techniques.

Design and Construction: The unit is intended to give the students the opportunity to study the importance of planning, organization and quality control as they assemble their own project from their own layout. Further occupational and career information is also given to direct graduating students to making choices in Electrical/Electronics Technologies.

Ceramics/Concrete: The ceramics area provides the students the opportunity to learn about the manufacture of clay products and practice forming clay products using both hand and molding procedures. The concrete area concerns concrete mixing and forming methods. Placing, finishing, curing, reinforcing and coloring concrete are practiced.

Additional career and occupational information in Materials Technology is given.

Pneumatics and Fluidics: Design of a simple logical control system and assemble, operate and analyze several different pneumatics systems. Career and occupational information in Power Technology is given.

Printmaking Techniques: Handcut prints and the use of the photographic process for making prints will be learned. They will also learn how to construct and use their own equipment. Career and occupational information in Visual Communications is included.

INDUSTRIAL ARTS - CLUSTERS

Objectives

1. To develop a foundation of skills and knowledge related to materials and technical procedures in the selected cluster.
2. To develop a degree of competency that will assist students obtain further education, training, or employment.
3. To develop interests in the cluster and applied sciences as an integral part of the students' general education.

Structure

The content for each cluster constitutes a three-year study program. Each cluster is made up of three (3) modules with one (1) module undertaken each year. Each module is designed for a minimum of two hundred and twenty (220) hours. The fields of study in each module are designed to be conducted in a multiple activity environment within that cluster where possible. The time allocation for each unit depends upon the teacher's discretion and judgement. At the completion of each module (1 and 2), industrial work experience of not less than six (6) weeks should be followed during the long break of each year. The four clusters are: Visual Communications, Mechanics, Construction and Fabrication, and Electricity-Electronics.

A. Visual Communications

The Visual Communication cluster consists of drafting, graphic arts and commercial arts. Below is the breakdown of the content in each field of study.

Drafting	Graphic Arts	Commercial Arts
1. Introductory Drafting	1. Visual Communications	1. General Illustration
2. Machine Drawing	2. Duplication and Reproduction	2. Information Design
3. Architectural Drawing	3. Offset line and Half-tone	3. Design
4. Engineering Graphics	4. Letter press	4. Commercial Illustration
5. Advanced Drafting	5. Production Technology	5. Production Technology
	6. Advanced Graphics	6. Advanced Commercial Arts

Table 6

Structure of Visual Communication Matrix

FORM THREE Module 3VC	FORM FOUR Module 4VC	FORM FIVE Module 5VC
Introductory Drafting Visual Communication General Illustration	Machine Drawing Architectural Drawing Duplication and Reproduction Offset line and Half-tone Information Design Design	Topographical Drawing Engineering Graphics Production Technology Commercial Illustration Production Technology

Form Three (Grade 10) - Module 3VC

Introductory Drafting: This introductory course is intended to develop basic skills in the use and care of instruments, sketching, lettering, pictorial drawing, orthograhic drawing, dimensioning and career information.

Visual Communication: The course introduces students to occupational opportunities, basic drawing, composition and design, color theory, lettering, advertising layout, photography, platemaking, printing and finishing procedures.

General Illustrations: An introductory course to drawing and illustration as applied to commercial assignments. It includes constructive drawing (forms, perspective, etc.), expressive drawing (mature studies, human form, etc.), and an introduction to various painting techniques.

Form Four (Grade 11) - Module 4VC

Machine Drawing: The content includes machine drawing, shape descriptions, fastening methods and working drawings.

Architectural Drawing: Content of this unit includes design, materials, building standards and working drawings.

Duplication and Reproduction: Exploration of offset printing, platemaking, photography, silkscreening, and building techniques.

Offset Line and Half-Tone: Advanced work in lithography, photography, copy operation, film processing, plate making and offset printing.

Information Design: Introduction to the elements and principles of design as applied to two-dimensional design such as advertising layout and lettering.

Design: The unit stresses the techniques of advertising, design, lettering and merchandising.

Form Five (Grade 12) - Module 5VC

Topographical Drawing: An introduction to surveying, photogrammetry, interpretation of field notes and photographs, map drawing, symbols and map projections.

Engineering Graphics: The basic purpose is to develop the concepts already learned in machine drawing. The content includes multi-view drawings, auxilliary views, descriptive geometry, vector geometry, industrial systems, and

power transmission systems.

Letterpress: Consists of layout work for printing, letterpress printing and bindery. Some advanced work in these areas is also done.

Production Technology (Graphic Arts): Students organize and operate a small printing press on a project which consists of all the experiences previously gained. They learn about the interdependence of workers, machines and materials, divisions of labor, personnel organizations, research and development, and the problems encountered in an actual production operation.

Commercial Illustration: It is a continuation of information and design with more advance work on drawing and illustration in three dimensional design using various materials to create models for display on commercial assignments.

Production Technology (Commercial Arts): Students organize and operate a small advertising firm. They learn about labor problems, personnel organization, actual production operation and marketing.

B. Mechanics

The mechanics cluster consists of autobody, automotives, and related mechanics. Below is outlined the table of content in each field of study.

Autobody	Automotives	Related Machines
Introduction to Autobody	Introductory Mechanics	Electricity
Autobody I	Power Systems	Machine Shop
Autobody II	Power Train	Welding
Autobody III	Alignment and Brakes	Drafting
Autobody IV	Fuel and Tune-Up	Building Construction
Autobody V	Electrical System	

Table 7

Structure of Mechanics Matrix

FORM THREE Module 3M	FORM FOUR Module 4M	FORM FIVE Module 5M
Introduction to Autobody	Autobody II	Autobody IV
Autobody I	Autobody III	Autobody V
Introductory Mechanics	Power Train	Fuel and Tune-Up
Power Systems	Alignment and Brakes	Electrical Systems
Electricity	Machine Shop	Independent Study
	Welding	

Form Three (Grade 10) - Module 3M

Introduction to Autobody: An introduction to autobody and safety, use of tools and processes in body work, welding and painting.

Autobody I: The activities include estimating damage, alignment, welding and metal finishing.

Introductory Mechanics: The course is an introduction to all the major areas in the career field of mechanics. It deals with power sources and method transmission, work, energy, power, testing, disassembling and assembling of

machines, reading, research and analyzing and repairing minor engine problems.

Power Systems: A combination of theory and practice in the maintenance and repair of internal combustion engines. Activities include procedures in problem analysis, disassembly, repair and assembly.

Electricity: A study of the theory and application of electricity to residential wiring.

Form Four (Grade 11) - Module 4M

Autobody II: Trade terms, types of operations, shop design, more advanced work in alignment, jacking, welding and door repairs.

Autobody III: The study of management problems. Activities include: metal cutting, brazing, welding, bumper repair, frame repair, repairing dents and painting.

Power Train: Theory, practice and service of power trains components of clutches, transmission, drive line, rear axle, and introduction to automatic transmission.

Alignment and Brakes: Theory and service related to wheel alignment, brakes, tires and shock absorbers.

Machine Shop: The use of basic machine and hand tools required to shape metal as required in the repair and maintenance of farm machinery.

Welding: Theory and practice of oxycetylene and electric arc welding.

Form Four (Grade 12) - Module 5M

Autobody IV: Advanced work in assessing damage, writing up estimates, spray painting, fitting components and metal finishing.

Autobody V: Advanced work in management, painting, frame alignment and welding.

Fuel and Tune-Up: Study of fuel, ignition and exhaust systems, their components analysis and tune-up.

Electrical Systems: Theory of basic electricity and magnetism, sources of electrical energy and its application to the automobile.

Independent Study: Students may increase their competencies in any of the units of study previously undertaken either in Autobody or Automobiles under supervision.

C. Construction and Fabrication

Construction and fabrication consists of building construction, machine shop, welding, plumbing and sheet metal. Below is an outline of the content in each field of study.

Building Construction

Carpentry
Cabinet Making
Concrete and Form Construction
Sketching, Blueprint Reading and Estimation
Estimating
Exterior and Interior Finishing

Machine Shop

Introduction to Machine Shop
Benchwork, Machines
Advanced Machinery
Drawing, Sketching and Blueprint Reading
Metallurgy

Welding	Plumbing	Sheet Metal
Welding I	Introduction to Plumbing	Introduction to Sheet Metals
Welding II	Domestic Plumbing	Pattern Development
Welding III	Commercial and Industrial Plumbing	General Sheet Metalwork
Welding IV		Joining
Wleding V		Cabinet Work

Table 8

Structure of Construction and Fabrication Matrix

FORM THREE Module 3CF	FORM FOUR Module 4CF	FORM FIVE Module 5CF
Carpentry	Concrete and Form Construction	Exterior and Interior Finishing
Cabinet Making	Sketching, Blueprint Reading and Estimating	Metallurgy
Introduction to Machine Shop	Advanced Machinery	Welding IV
Bench work, Machines	Drawing, Sketching and Blueprint Reading	Welding V
Welding I	Welding II	Commercial and Industrial Plumbing
Introduction to Plumbing	Welding III	Sheet Metal Cabinet Work
Introduction to Sheet Metals	Domestic Plumbing	Sheet Metal Joining
	Pattern Development	
	General Sheet Metal	

Form Three (Grade 10) - Module 3CF

Carpentry: Theory and practice in the use of hand and power tools, planning and design, and materials. Activities include projects related to the theory.

Cabinet Making: Theory and practice emphasizing design, materials, tools and processes in cabinet and furniture construction.

Introduction to Machine Shop: Theory and practice in layout and bench work, operation of the lathe, shaper, drillpress, power saw and grinder and, in addition, an introduction to metallurgy.

Benchwork, Machines: Theory and practice of advanced lathe work, the introduction of the milling machine and shaper.

Welding I: Provides occupational information, safety, and the theory and practice of arc and acetylene welding. Some repair work and projects are given.

Introduction to Plumbing: The theory and practice in safety measurement and layout, joining pipe, fittings and valves. Occupational opportunities and qualifications are studied.

Introduction to Sheet Metals: Introduction to the career of sheet metal worker, qualifications required and work organization. Theory and practice in layout, cutting, forming and pattern development.

Form Four (Grade 11) - Module 4CF

Concrete and Form Construction: Concrete as a material of construction, theory and practice in design, form construction and concrete replacement.

Sketching, Blueprint Reading and Estimating (B.C.): Detailed list of activities in sketching, drawing, describing and estimating the costs of materials, labour and overhead in constructing building.

Advanced Machinery: Precision measuring and machinery, cutting threads, tapers, keyways, gear cutting and heat treating.

Drawing, Sketching and Blueprint Reading (B.C.): Theory and practice of drawing instruments, orthographic and oblique projections, freehand sketching and obtaining technical information.

Welding II: Basic drafting techniques related to welding and the properties, classification and testing of metals.

Welding III: Advanced work in electric applications such as welding non-ferrous metals, hand surfacing and specialty welding.

Domestic Plumbing: Theory and practice in plumbing a house.

Pattern Development: Theory and application of the principles of sheet metal layout.

General Sheet Metal: Fabrication of rectangular, cylindrical and conical objects.

Form Five (Grade 12) - Module 5CF

Exterior and Interior Finishing: Provides the theory and practice in selecting materials, tool use, design and construction methods for windows, doors, roof, eaves, interior and exterior trim, stair construction and finishing with paints and varnishes.

Metallurgy: The theory and practice in metal

identification, composition, production and metalworking processes.

Welding IV: Fabrication and repair.

Commercial and Industrial Plumbing: Theory and application of the plumbing code to roughing in and setting the fixtures on a job.

Sheet Metal Joining: Mechanical joining methods, adhesive and cohesive methods.

Sheet Metal Cabinet Work: Fabrication of furniture or fixtures.

Major Project: A major independent study/project may be undertaken in one of the career fields surveyed.

D. Electricity and Electronics

The Electricity-Electronics cluster consists of electricity and electronics. Below is an outline of the content in each field of study.

Electricity	Electronics
Electricity-Electronics I	SW-MW/AM-FM
Electricity-Electronics II	Solid State and Integrated Devices
Residential Wiring	T.V. Receivers
Electrical Servicing	Instrumentation
Commercial Wiring	Advanced Electronics
Electro-Mechanical	
Advanced Electricity	

Table 9

Structure of Electricity-Electronics Matrix

FORM THREE Module 3EE	FORM FOUR Module 4EE	FORM FIVE Module 5EE
Electricity-Electronics I Electricity-Electronics II Residential Wiring	Electrical Servicing Commercial Wiring SW-MW/AM-FM Solid State and Integrated Circuit Devices	Electro-Mechanical T.V. Receivers Instrumentation Project

Form Three (Grade 10) - Module 3EE

Electricity-Electronics I: An introduction to basic concepts in the field of electricity-electronics. It covers occupational information, safety, nature of electricity, magnetism and electric-magnetism, electrical measurement, circuitry and electrical systems.

Electricity-Electronics II: The purpose is to provide basic theory necessary for advanced work in electricity and electronics. Topics include: alternating voltage and current, inductance, capacitance, circuitry, semi-conductors, transistors and power supplies.

Residential Wiring: Deals with the theory and skills required to wire a house. Includes basic electrical theory, code requirements, house circuitry, tool usage, practice in wiring a building.

Form Four (Grade 11) - Module 4EE

Electrical Servicing: Service equipment and tools, trouble shooting techniques, service procedures and practice in appliance repairing.

Commercial Wiring: Drawing plans for electric wiring, wiring methods, wiring hardware, tool and equipment use, control equipment and practical experience in all phases of commercial wiring.

SW-MW/AM-FM: Theory, application and practice related to radio transmission and reception which includes: power supplies, detectors, amplifiers, SW-MW/AM-FM equipment, components, test equipment and a study of an operating transmission and reception system.

Solid State and Integrated Circuit Devices: Review of transistors, a study of integrated circuits and solid state devices.

Form Five (Grade 12) - Module 5EE

Electro-Mechanical: The content includes theory of and practice with generators, A.C. and D.C. motor, and transformers.

T.V. Receivers: The unit covers: occupational information, T.V. signal transmission, T.V. circuitry, video signal and picture reproduction, antennas, trouble shooting and servicing a T.V. receiver.

Instrumentation: The theory and practice of

electrical and measuring instruments.

Project: A major project may be undertaken in any of the career fields surveyed.

EVALUATION OF THE PROGRAM

There are many contemporary approaches and models that could be applied to evaluate a variety of educational syllabi or programs. Though there are many of these models, their goals focus on one thing--to evaluate the worth of what is being measured. In curriculum evaluation, the goal of these models focuses on students' achievements. To conduct a curriculum evaluation requires the collection, processing and interpretation of data by the evaluator so that better decisions can be made about a particular program. Hastings had this to say about the purpose of evaluation:

> One of these concerns {is} collection of information to be used as methods.... The second main purpose of evaluation of educational innovation is to provide information as input for decision-making by schools about adoption of course improvement packages (Payne, 1974, p. 30).

Cronbach (1963) identified the following as the functions an educational evaluation performs:

1. Course improvement: to determine both strengths and weaknesses, and to indicate areas where change is required;
2. Decisions about individuals: to locate the needs of learners in order to plan the instructional process more effectively; and,
3. Administrative regulations: to discover the worth of an educational system and of its instructional staff (p. 16).

Cronbach proposed that the main objective for evaluation is to uncover durable relationships--those appropriate for guiding future educational programs.

Stake suggested three important questions that should be asked prior to drawing up an evaluation plan:

1. What is the entity that is to be evaluated?
2. Whose standards will be used as reference?
3. What subsequent decisions can be anticipated? (Payne, 1974, p. 27)

Some of the contemporary evaluation models reviewed here and those not, but found suitable, could be adapted to evaluate the program. The criteria for adapting any model would depend upon the purpose, scope, and cost for undertaking the evaluation.

Hastings and Scriven hold the same view on the purposes of an educational evaluation. These views are: (1) to determine adoption-rejection of curriculum and course-content improvement packages; and, (2) to determine the need for revision of further development of curriculum materials. These two views could be summarized as being summative and formative evaluation (p. 29). The distinction between the two is that formative evaluation is undertaken during the development of a program and summative evaluation is undertaken after the program has been developed and completed. The distinction between the two is not clear-cut as they interrelate each other except that such a distinction could be found between the users of the evaluation findings.

Scriven (1967) stressed that formative evaluation

focuses in locating the strengths and weaknesses of a teaching instrument at an intermediate stage in its development. Summative evaluation aims at providing the detailed information on the value of the total program being evaluated, which requires the making of value judgements. Summative evaluation concerns the examining of the entire curriculum package, and is not concerned with the identification of specific variables that may be responsible for course deficiency or improvement. Scriven does not support and is not in favour of comparative evaluation, but that it should be undertaken on the basis of the set broad objectives of the program.

Scriven has two basic approaches to educational evaluation. These are: (1) instructional evaluation; and, (2) consequential evaluation. Instructional evaluation includes: the teaching instrument with respect to content, goals, grading processes and the teacher attitudes; while consequential evaluation focuses on the effect that the teacher instrument has upon the learner which could be determined by a pre-test and post-test.

The Context-Input-Process-Product (CIPP) model was developed by Stufflebeam (1967). The model's key emphasis is rational decision making among alternatives by administrators. The CIPP is self-expressive of its functions. The model enables the following types of evaluation to be carried out:

1. Context Evaluation defines the environment where the change is to occur. This is achieved by identifying the discrepancies existing among the intended and the actual inputs and outputs and the causal relationship underlying each need. This type of evaluation aims at providing information for deciding on the setting to be served, the goals associated with meeting needs and the objectives associated with problem solving in a curriculum.

2. Input Evaluation determines the manner resources are used in meeting the goals and objectives of a particular program. This is achieved by listing the capabilities and goal achieving techniques available to the group initiating the project. This sort of evaluation study helps to determine, or gives information, in making the decision as to whether some external assistance is desirable in order to achieve the goals and objectives of the project. Decisions are based on project procedures, schedule, staff needs and budgets specified.

3. Process Evaluation gives feedback information designed for locating the defects in the procedures for implementing the project or program. The basic function of this type of evaluation focuses on predicting the outcomes of the program.

4. Product Evaluation focuses on the project outcomes by assessing the effectiveness through measurement and interpretation. The operational procedure is to measure the criteria associated with the objectives, comparing the

measurements with present standards and rationally analyzing the outcomes by referring to the recorded context, input and process data. Information from this method enables decisions to be made on whether to continue, terminate, modify or focus a change activity and to link that activity with other phases of the changed process.

Stake (1967) developed a model with its key emphasis focusing on gathering and processing of description and judgement data. The model identifies merits and demerits in an educational program by monitoring what goes in, what goes on, and what comes out of the program. The following constitute the descriptive characteristics of the model.

Antecedents are the entry behaviours prior to learning. They are the conditions existing prior to teaching and learning that relate to the outcomes. These entry behaviours before the lesson may include aptitudes, previous experiences, interests, willingness--what goes in.

Transactions are all the interactions during the learning process. These could be between the students and teacher, student with student and embraces all the engagements that necessitate the learning process--what goes on.

Outcomes are the effects upon the impact of instruction. These impacts could readily be measured or even until long after the instruction had been undertaken. Briefly, outcomes include all the consequences of educating, either immediate or long range, cognitive and conative, personal and community-wide--what comes out (p. 5).

Intents are made by limiting the variables to be studied. Observations are the methods through which the descriptive data are collected.

Standards, though not in common use, are the benchmarks through which references are made. Judgements are the comparisons or judging acts in deciding which set of standards to use for the evaluation study.

Contingencies and Congruencies. Contingencies are the relationships among the variables. The realization for these relationships permit the improvement of education. Congruencies are the achievement of the intended antecedants, transactions and outcomes.

Stake (1976) listed nine methods of contemporary approaches to educational evaluation. These nine approaches vary from one another and serve as an excellent reference to deciding which model to apply and for what purpose in evaluating any aspect of the program. Table 10 gives the list of the different approaches, their purposes, by elements, protagonists, risks and payoffs of each. Though they differ in principle they overlap one another in function.

Cook (1966), in developing the Program-Evaluation and Review Technique (PERT), identifies seven steps in any evaluative process. These are in a sequential order:

1. Specification, Selection, Refinement, or Modification of Program Goals and Evaluation Objectives;
2. Planning of Appropriate Evaluation Design;

Table 10

Nine Approaches to Educational Evaluation

Approach	Purpose	Key Element	Protagonists	Risks	Payoffs
1. Student Gain by Testing	To measure student performance and progress	Goal Statements; Test Score Analysis; Discrepancy between goal and actuality	Ralph Tyler Ben Bloom Jim Popham Mal Provus	Oversimplify educational aims; ignore processes	Emphasize, ascertain student progress
2. Institutional Self Study	To review and increase teachers' effectiveness	Committee work; Standards set by Staff; Discussion; Professionalism	National Study of Secondary School Evaluation; Dressel	Alineate some staff; Ignore values of outsiders	Increase staff awareness, sense of responsibility
3. Blue-Ribbon Panel	To resolve crises and preserve the institution	Prestigious panel; the visit; Review of existing data and documents	James Conant Clark Kerr David Henry	Postpone action; over-rely on institution	Gather best insights, judgement
4. Transaction-Observation	To provide understanding of activities and values	Educational issues; classroom observation; Case studies; pluralism	Lou Smith Partett-Hamilton Bob Rippey Bob Stake	Over-rely on subjective perceptions; Ignore causes	Produce broad picture of program; See conflict in values
5. Management Analysis	To increase rationality in day to day decisions	Lists options; estimates; feedback loops; costs; efficiency	Leon Lesinger Dan Stufflebeam Mary Atkin Alan Thomas	Over-value efficiency; Under-value implicits	Feedback for decision making
6. Instructional Research	To generate explanations and tactics of instruction	Controlled Conditions; Multivariate Analysis; Bases for generalization	Don Campbell Julian Stanley Mike Scriven Bill Cooley	Artificial conditions; Ignore the humanistic	New Principles of teaching and materials development
7. Social Policy Analysis	To aid development of institutional policies	Measures of Social conditions and administrative implementations	James Coleman David Cohen Card Weiss Mo Steller-Moyniham	Neglect of educational issues, details	Social Choices, Constraints Clarified
8. Goal-Free Evaluation	To assess effects of program	Ignore proponent claims, follow checklist	Michael Scriven	Over-value documents and record keeping	Data an effect with little cooperation
9. Adversary Evaluation	To resolve a two-option choice	Opposing advocate; cross-examination; the jury	Tom Owens Murray Levine Bob Wolf	Personalistic Superficial, time-bound	Info impart good; Claims put to test

3. Selection or Development of Data-Gathering Methods;
4. Collection of Relevant Data;
5. Processing, Summary, and Analysis of Data;
6. Contrasting of Data and Objectives; and,
7. Reporting and Feedback of Results.

Summary

Contemporary approaches to educational evaluation are reviewed. The intent is not to specify a particular evaluation model for the program as each one could be suitable depending on the need for such a study. However, nine approaches to educational evaluation are included. The criteria for adapting any of the nine or any other models for the evaluation of the program should depend upon the purpose, scope, and cost for undertaking the evaluation study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of the study was to develop a model industrial arts program for use in Kaduna State, Nigeria. The intent for developing the program was to provide a suitable secondary school curriculum that could replace the technical pre-vocational program existing in the state. The pre-vocational program consisted of metalwork, woodwork, and technical drawing, which formed part of the state's general education curriculum. The existing program was viewed by the researcher and supported evidences as not suitable. This unsuitability was the inability of the existing program to introduce students to the materials and technologies prevalent in the society. Furthermore, students had little use of the program because it could not provide them with the opportunity for further education or employment in the fields studied.

The study was based mainly on library research. To develop a suitable model program representative of the prevalent materials and technologies in Kaduna State, or Nigeria, and to cater to students' needs, it was found necessary to review contemporary industrial arts programs;

contemporary concepts in industrial arts education; the Nigerian national goals and objectives of education; and, the type of industrial establishments operating in Kaduna State, Nigeria. These aspects selected for study provided the criteria for the content validity selected for the model program. Further to the selection of the content identified, it was validated by eight teachers from eight separate schools and who were either teaching or had taught in the Kaduna State pre-vocational program. A team of professionals gave constructive criticisms and certified the content.

It was found desirable to adapt one of the programs reviewed as a model. The Alberta Plan industrial arts program developed by Ziel and introduced in 1964 was found suitable. The selection of The Alberta Plan was done through reviewing and comparing the programs studied with the following pre-established selection criteria:

1. That information concerning the plan selected for the study was easily accessible, or available, to the researcher either through official correspondence or interview;
2. That the program had been developed, implemented and in operation at least ten years from the time of the study;
3. That the program was contemporary and validated; and,
4. That the program was suitable for the rapid technological and economic developments in Nigeria.

Description of The Alberta Plan included its development, implementation, and studies carried out pertaining to the program. From these activities, it was observed that

the four phase approach developed by Ziel was not adopted by the Province of Alberta Department of Education, however, the multiple activity strategy was accepted.

Provincially, industrial arts in Alberta is designed towards career development and conceived as an education program that must provide considerable flexibility so that students have an option of several career choices. It provides broad education so that each student learns what he/she needs to know about a new job for a rapid and successful specialization. The model program developed for Kaduna State conforms with the design of the Alberta industrial arts program and the Nigerian national aims and objectives of education. Aspects of the Alberta program found suitable for the development of the model program were adapted to suit the Kaduna State school organization and the needs of the society.

CONCLUSIONS

The conclusions of the study were based on the literature reviewed and the content validation by the professionals and teachers that responded to the fields of study identified by the researcher as desirable for Kaduna State, Nigeria. The content included in the model program included the following:

1. Junior Secondary: Introduction to Materials and Technologies. The content for this part of the program was

designed to introduce students, both boys and girls, to the materials and technologies prevalent in the Nigerian productive society extending for two years of study.

The basic intent of the Introduction to Materials and Technologies was to provide students with the opportunities to explore, synthesize, experience and discover the reality of the materials and technologies students are exposed to. The content of the program dealt with industry, its organization, processes, occupations, materials, products and the problems resulting from the impact of technology on the Nigerian society.

2. Senior Secondary. Two parts were designed for this phase of the program. These included Industrial Arts--General; and, Industrial Arts--Clusters. These two programs had varied intents with each designed to extend for a period of three years of study.

Industrial Arts--General: It was designed as a further study in more depth to what was previously learned from Introduction to Materials and Technologies. The purpose was a general study in the technological clusters. The concept of the technological clusters was adopted from the Alberta industrial arts program. These included: Visual Communications; Electricity-Electronics; Materials; and, Power Technology, organized in multiple activity shops. Students in the program could have the opportunity to continue further education in Universities or Colleges of Technology in areas of their choice, or start an apprenticeship training

in specific areas.

Industrial Arts--Clusters: Students could elect to begin orientation studies in one cluster as identified in Industrial Arts--General, following Introduction to Materials and Technologies. The program was designed to serve students vocationally inclined in any of the clusters selected. The students could pursue further education in Colleges of Technology in the selected areas to become technicians or technologists, or enter the job market for training in a specific occupational field within that cluster. The content included practical work, applied theory and industrial organization.

The general functions or objectives of the model industrial arts program as a part of general education in Kaduna State, Nigeria were identified to compliment the Nigerian national goals and objectives of secondary education. The objectives identified were:

1. To provide exploratory experiences in technical occupational clusters for the various technologies prevalent in the Nigerian society to guide students in future career selection.

2. To provide students with courses that aid them to relate academic knowledge to technical competencies.

3. To provide students with the opportunities to develop their creative potentials both avocationally and vocationally.

4. To provide students with opportunities to develop

relevant technical competencies that will assist them to obtain further education, training, or employment.

For the evaluation of the program, a review of contemporary approaches in educational evaluation was done. Among the evaluation models surveyed, no specific model was recommended as they all had varied intents. Nine contemporary evaluation models with different purposes were included. The criteria for adapting any of the nine models for the evaluation of the program should depend upon the purpose, scope, and cost for undertaking the evaluation.

RECOMMENDATIONS

For the Ministry of Education, Kaduna State, Nigeria

For the successful implementation of Industrial Arts in Kaduna State secondary school curriculum, the following recommendations are suggested as possible courses of actions. The recommendations are not presented in order or priority.

1. It is recommended that a pilot research study of the model be undertaken before implementing the program at the State level.
2. It is recommended that the present Department of Technical Education at the Kaduna Polytechnic, Kaduna, and the newly established Department of Vocational Technical Education at the Ahmadu Bello University, Zaria be responsible for training qualified teachers for the program.

3. It is recommended that for the initial implementation of the program and due to lack of qualified teachers, professionals in each occupational area or field of study be engaged to teach.

4. It is recommended that a supervisor of Industrial Arts - Academic be appointed with the following duties and responsibilities:

a) to determine the content validity for the program to ascertain that it meets the State's and students' needs;

b) to determine what new fields of study need be included as desired;

c) to determine what new fields of study could be deleted or eliminated from the program as not meeting the desired needs;

d) to determine teachers' standards and qualifications to teach any aspect of the program;

e) to determine the most effective instructional materials for the program;

f) to determine students' class sizes, and teachers for each multiple activity laboratory; and,

g) to determine the evaluative criteria and procedure to be undertaken for any aspect of the program.

5. It is recommended that a supervisor of Industrial Arts - Planning be appointed with the following duties and responsibilities:

Buildings

a) to confer with the architect concerning the standards of the multiple activity shops to be designed. Basic in any standard laboratory should include:
   i) work and storage space, demonstration area, finishing room, and, a conference room;
   ii) adequate lighting and sufficient electrical power for the equipment installations;
   iii) locker facilities, display areas, audio-visual storage area, and drinking facilities; and,
   iv) office and filing space provided for teachers.

Equipment

a) to determine the quality, service, safety, and cost of any equipment to be purchased;
b) to determine and plan the relationship between the activity areas to each other; and,
c) to determine the safety devices to be installed in each activity area and the laboratory.

For Further Studies

1. From this study it is recommended that an occupational survey study be carried out when desired to determine fields of study to be included in or eliminated from the program.
2. It is recommended that follow-up studies of graduates of the program be carried out to examine whether it is meeting the needs of the students and the society.

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APPENDIX 1

INDUSTRIAL EDUCATION 10, 20, 30 MATRIX

INDUSTRIAL EDUCATION 10, 20, 30 Matrix

(Each module is 25 to 33 hours in length)

CAREER FIELD

A. Electricity-Electronics	B. Materials	C. Power Technology	D. Visual Communications
1. Electricity	1. General Woods	1. Conventional Heat Engines	1. Offset Lithography
2. Electronics	2. Building Construction I	2. Small Engine Tune-Up	2. Line Photography
3. Power Supplies	3. Building Construction II	3. Small Engine Overhaul	3. Black and White Photography
4. Amplifiers	4. Cabinet Making I	4. Automobile Care	4. Color Photography
5. Audio	5. Cabinet Making II	5. Automobile Tune-Up	5. Screened Photography
6. Servicing	6. General Metals	6. Mechanical Systems	6. Layout and Design
7. Radio	7. Sheet Metal	7. Electro-Mechanical Controls	7. Offset and Printing Production
8. Television	8. Machine Shop	8. Electrical Systems	8. Mechanical Drafting
9. Logic Circuits	9. Welding Arc	9. Nonconventional Power Sources	9. Topographical Drafting
10. Computer	10. Welding Gas	10. Appliance Repairs	10. Architectural Drafting
11. Electric Wiring	11. Foundry	11. Hydraulics and Fluidics	11. Relief Printing
12. Design and Construction	12. Plastics I	12. Pneumatics and Fluidics	12. Print-Machine Techniques
	13. Plastics II		
	14. Earths Ceramics	E. General Modules	
	15. Earths Concrete	1. Developmental	
	16. Textiles	2. Research	
	17. Foods	3. Production Science	

APPENDIX 2

INDUSTRIAL EDUCATION 12, 22, 32 MATRIX

INDUSTRIAL EDUCATION MATRIX

	CAREER DEVELOPMENT COURSES				
1. Exploratory Courses	2. CAREER FIELD	3. INDUSTRIAL EDUCATION INTRODUCTORY	4. INDUSTRIAL EDUCATION MAJOR	5. INDUSTRIAL EDUCATION MINOR	6. RELATED
Industrial Arts and Home Economics at the Junior High School Level	Visual Communications	Drafting 12 Visual Communications 12 Industrial Education 10	Drafting Graphic Arts Commercial Art	See charts Drafting. Commercial Art. Graphic Arts Performing Arts	Work Experience Industrial Ed. Business Education
	Mechanics	Mechanics 12	Automotives	Welding, Drafting, Machine Shop, Electricity, Auto Body, Aircraft Maintenance.	Work Experience Industrial Ed. Business Education
		Industrial Education 10	Aircraft Maintenance	Drafting, Welding, Machine Shop, Bldg. Const., Electricity Auto Body, Automotives.	
		Auto Body 12	Related Mechanics Auto Body	Drafting. Welding, Sheet Metal, [redacted] Aircraft Maintenance, Automotives.	
	Construction and Fabrication	Materials 10 Industrial Education 10 Bldg. Const. 12	Building Construction	Drafting, Electricity, Sheet Metal, Piping, Machine Shop, Welding.	Work Experience Industrial Ed. Business Education
		Machine Shop 12	Machine Shop	Drafting, Welding, Sheet Metal, Bldg. Const., Piping, Automotives, Auto Body.	
		Welding 12	Welding	Drafting, Machine Shop, Auto, Auto Body, Sheet Metal, Piping Bldg. Construction	
		Piping 12	Piping	Drafting, Bldg. Const., Machine Shop, Welding, Electricity, Sheet Metal.	
		Sheet Metal 12	Sheet Metal	Drafting, Bldg. Const., Machine Shop, Welding, Electricity, Piping.	
	Electricity-Electronics	Electricity-Electronics 12 Industrial Education 10	Electricity Electronics	Drafting, Automotives, Bldg. Const., Electronics. Drafting, Automotives, Bldg. Const., Electricity.	Work Experience Industrial Ed.
	Personal Services	Industrial Education 10			Work Experience Industrial Ed. Business Education
		Beauty Culture 12	Beauty Culture	Fashion and Furnishings, Health Services, Food Preparation, Visual Communications, Commercial Art.	
		Home Economics			Home Economics Arts & Crafts
		Fashion and Furnishings	Fashion and Furnishings	Beauty Culture, Visual Communications, Commercial Art.	
		Food Preparation 12	Food Preparation	Beauty Culture, Fashion & Furnishings, Health Services, Visual Communications, Commercial Art.	
		Health Services 12	Health Services	Beauty Culture, Food Preparation, Fashion and Furnishings	
	Performing Arts		Performing Arts T. V. Crafts	T.V. Crafts, Drafting, Fashion & Fabrics, Bldg. Construction Drafting, Electricity, Bldg. Const. Performing Arts, Welding	Work Experience Industrial Ed. Business Education
	Horticulture	Horticulture 12 Land and Life	Horticulture	Drafting, Automotives Drafting, Automotives	Work Experience Industrial Ed. Business Education

APPENDIX 3

LETTERS

FACULTY OF EDUCATION
DEPARTMENT OF INDUSTRIAL AND VOCATIONAL EDUCATION
TELEPHONE (403) 432-3678

THE UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA, CANADA
T6G 0Y1

May 30, 1979

Dear

As a teacher who taught in the Kaduna State pre-vocational technical program in the secondary school, I became interested in developing a model industrial arts program for the State. My basic concern is that the present pre-vocational program which consists of metalwork, woodwork, and technical drawing are regarded as a part of general education in the State does not adequately introduce students to the materials and technologies prevalent in the society and has little use to the students that enrol in the program. Because of this concern, I have selected for my thesis topic, "The Development of a Model Industrial Arts Program for Kaduna State, Nigeria". The purpose is to develop a program that would adequately introduce the students to the materials and technologies prevalent in the society and more useful to the students.

At the moment, I am enrolled in the Faculty of Graduate Studies and Research studying a Master of Education degree in the Department of Industrial and Vocational Education. Part of the requirements for the degree is the successful completion of a Master's Thesis.

The purpose for this letter is to seek for your professional response to the technologies I have identified as prevalent in Kaduna State or Nigeria. The basis for identifying these materials and technologies is the type of industrial establishments operating in the Country. Feel free to add or delete those necessary or unnecessary. Listed below are the identified fields of study for the model program to be developed. The clusters classification is adopted from the Alberta Plan Industrial Arts program.

..../2

.../2

Cluster	Fields of Study
1. Materials	Woods Metals Plastics Concrete
2. Visual Communication	Drafting Graphic Arts Commercial Arts
3. Mechanics	Autobody Automotives Related Mechanics
4. Construction and Fabrication	Building Construction Machine Shop Welding Plumbing Sheet Metal
5. Electricity-Electronics	Electricity Electronics

Thank you for your cooperation.

Yours truly,

Joseph Y. Maiyaki
Graduate Student

JYM/mlh

Technical & Vocational
Training Centre
P.M.B. 3081, Kano
KANO STATE, Nigeria

1979-06-04

Dear Joseph Y. Maiyaki,

With reference to your letter dated May 30, 1979, dealing with your thesis topic, "The Development of a Model Industrial Arts Program for Kaduna State, Nigeria."

I have read the letter and gone through the thesis content. I am happy to inform you that, to me, the materials included are quite comprehensive, adequate and will definitely be beneficial to the students of industrial arts, not only in Kaduna State, but in Nigeria as a whole.

Furthermore, the content reflects futuristic educational development of Nigeria.

I have nothing to add to delete from the content. Wishing you a happy, fruitful and successful stay in Alberta.

Thanks.

Yours sincerely,

Ibrahim Adamu

Saheda College
Zaria

May 15, 1979

Dear Joseph:

Having been in the teaching field of the so-called pre-vocational Education in our so-called Comprehensive Secondary Schools – for the past five years I do feel that new dimensions ought to be injected into the system.

Your attempting to review and advise on a more realistic and more involving programme in line with Nigerian growing Industrial needs has come or would come in good time. I am sure it would be accepted in good faith by the teacher, students and the community at large.

The technologi s you identified are quite ide l and totally acceptable to me.

Musa Markus
AEO (TECH)

M Markus

Govt. Sec. School
P. M. B. 1053
Zaria City
KADUNA STATE, NIGERIA.
4 | 6 | 79.

Dear Joe,

I was impressed to go through your letter dated 30/5/79 with the attached proposed programme for the Kaduma State schools. Having gone through the clusters and fields of study, to my opinion it is quite adequate and comprehensive enough to satisfy your intended purpose of meeting the students and the technologies prevalent in our Nigerian society.

It is a worthwhile topic and a wise selection. I wish you the best in writing your M Master's Thesis and hope it will be put into practice when you do come back to work with us here in Nigeria.

Congratulations in Advance.

Yours Sincerely,

Paul Sule Abui

P.O.Box 523 Sub 11,
University of Alberta,
Edmonton, Alberta
T6G 2E0
June, 18, 1979.

Dear Mr. Maiyaki,

In response to your letter dated, May, 30, 1979, seeking my professional response to the technologies you have identified as prevalent in Kaduna State or Nigeria for your Thesis " The Development of a Model Industrial Arts Program for Kaduna State, Nigeria."

As a teacher who had been involved in teaching pre-vocational education in Nigeria, I carefully checked your identified technologies and I do believe that you have made a good selection, there is nothing to be added or deleted. I do also believe that what you are trying to develop is exactly what Nigeria needs to replace the present pre-vocational education system in the Northern States.

Good luck.

Yours truly

Garba Hassan
colleaque

Government College
P.M.B. 2009
Katsina, Nigeria

Dear Joseph,

In response to your letter in which you sought for my professional comments regarding the topic you have chosen for your Masters Thesis "The Development of a model Industrial Arts program for Kaduna State, Nigeria," I feel too glad to write on that as a serving teacher in Kaduna State who is also concerned with the development of such education.

It is appropriate to bring to you attention the emphasis our various governments (both states and federal) attach to the development of technical education generally at this point of our development. The huge amount of money being spent both at home and abroad covering all the areas you are developing brings sharply into focus the importance of what you've chosen to develop as a model for Kaduna State. I believe you are, at this point, aware of the programme the country is pursuing all over the world in an effort to train technical personnel in the form of what we call "crash programme for development of technical education" in all fields of technology. This came as a result of the realization of the fact that our facilities are inadequate to meet our present, let alone our future, demands. In some ways, as you have pointed out, our present programme which we are pursuing in our secondary schools are narrow based and shallow in content and, therefore, do not adequately introduce students to the technologies and materials prevalent in our society.

Putting our population in mind, and the needs for decent roads and housing which have now boosted the building and construction industry, it has made apparent the importance of developing materials in this field. We now have more vehicles on our roads with corresponding increase in accidents; there is also greater need and use of electricity and electronic equipment. With more industries coming up daily, we can only hope to keep all these in good condition by introducing a similar model of technical education covering the areas you have listed.

Finally, I must say that the model you have chosen is relevant to our present needs in Kaduna State and Nigeria as a whole, bearing in mind our needs and potentials. Thank you.

Yours truly,

Shehu

Shehu Zakari

Barewa College
Zaria

June 4, 1979

Dear Joseph:

Having gone through your letter and identified the purpose for which you have written, I have become so much interested in your proposals and suggestions.

Having been teaching as a technical teacher in Kaduna State for some years now, I feel new dimensions such as those you have put down should be introduced into the present system.

Your realistic suggestion in attempting to review this programme would go a long way solving our problems we have been battling with for quite some time now.

As a growing nation, I feel Nigeria as whole needs this programme in our Secondary Schools and Technical Schools as it will give both the teachers, students and the community more insight into problem solving in all areas of technology. I have no doubt that your proposal will be accepted in good faith by the Government of Kaduna State.

The proposals are ideal and quite acceptable to me. I wish you success in your thesis and look forward to seeing you bring us into the right footing.

Bobai M. Sambo
AEO (TECH)

Barewa College, Zaria
Kaduna State, Nigeria

June 6, 1979

Dear Mr. Maiyaki:

Thanks for your letter dated May 30th, 1979, seeking for my professional response to your thesis topic.

I had my vocational teaching certification from National Technical Teachers College (N.T.T.C.) Yaba Lagos, Nigeria, a model college instituted by the Nigerian Government in collaboration with the United Nations Educational Scientific and Cultural Organization (UNESCO).

My experiences as regards to the content of curriculum, modules, and units of pre-vocational Education in Nigeria is wholesome for the following reasons:

(1) St. Finbars College Yaba Lagos is a high school that runs an inclusive pre-vocational programme. I had the opportunity during my training to examine their pre-vocational Education facilities on a monthly basis for one year. This college is in Lagos, the south western part of Nigeria.

(11) As part of my programme in the Technical Teaching Certification, I was opportuned to complete a full time 10 weeks practice teaching at the Government Secondary School in Ilorin - Kwara state of Nigeria. The School is in the middle Belt of Nigeria.

(111) As part of the National Youth Service; I taught at the Government Secondary - Technical school Abak - South Eastern state of Nigeri for one academic session.

(1V) I am presently teaching for the second year running at Barewa College Zaria, Kaduna State in the Northern part of Nigeria.

The experiences I enjoyed from these high schools were basically in the pre-vocational aspect of their Education. Armed with the experiences I have so far enunciated above, I strongly accept the cluster of technologies you've put forward, both in content and validity. The cluster is not over extensive for that level nor has it left out any of the important technologies needed by our society.

I therefore sincerely recommend to anyone without reservation the cluster of technologies listed in your thesis topic as very appropriate and covers the actual needs of the society not only in Kaduna state but in Nigeria as a whole.

I shall consider it an honour if at any time you decide to seek for my professional response.

Yours faithfully,

Ibrahim Haruna Galadima.

Government Technical College
P.M.B. 2095 Kaduna
Kaduna State, Nigeria

June 10, 1979

Dear Joseph Maiyaki:

With reference to your letter of May 30, 1979, I have to inform you that all the contents were precisely gone through and understood very well. I also do really advocate tremendously that all the fields of study for the model program to be developed mentioned in the letter will be of great importance, useful and beneficial to Kaduna State and Nigeria.

Yours sincerely,

Abdu Sani Faskari