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PROPOSED CURRICULUM GUIDE FOR SCHOOL OF  
IRRIGATION AGRONOMY BAKURA, NORTHERN NIGERIA

by

BARTHOLOMEW OCHIGBO OGBOLE

613-8301

B.Sc., (Agriculture) Ahmadu Bello University, Zaria, 1968

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## Chapter 1

### INTRODUCTION

Nigeria, a country in West Africa, lies between latitudes  $4^{\circ}$  and  $14^{\circ}$  north of the equator and longitudes  $2^{\circ}$  and  $14^{\circ}$  east of the meridian facing southward on the Gulf of Guinea.<sup>1</sup> Politically, the country is comprised of twelve states, of which North Central, North Eastern, North Western, Kano, Benue-Plateau and Kwara constitute the six states carved out of the former Northern Region of Nigeria. The country occupies 356,669 square miles and has a population of about 72,000,000, with an annual growth rate of 2.7 percent.<sup>2</sup>

### BACKGROUND

Nigeria is an agricultural country. Agriculture, including live-stock production, forestry and fishing is by far the most important economic activity. It directly supports more than four-fifths of the population and generates between 55 and 60 percent of the gross domestic product. Nearly 85 percent of the total merchandise exports in 1963 were agricultural commodities.<sup>3</sup> The cash crops grown are groundnuts (Arachis hypogaea (L.)), cotton (Gossypium hirsutum (L.)), soybeans (Glycine max (L.)), benniseed (Sesamum indicum (L.)) in the north, and cocoa (Theobroma cacao (L.)),

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<sup>1</sup>Food and Agriculture Organization, "Agricultural Development in Nigeria, 1965-1980," (Rome, 1966), p. 10.

<sup>2</sup>United States Department of Agriculture, "The Agricultural Economy of Nigeria," (ERS-Foreign 329, Washington: March, 1972), p. 4.

<sup>3</sup>GATT Programme for Expansion of International Trade, "First Six-Year Plan of Nigeria," (The Contracting Agreement on Tariffs and Trade, Geneva, 1966), p. 16.

palm oil (Elasis guineensis (L.)), rubber (Nevea brasiliensis (L.)), coffee (Coffee robusta (L.)) and kola-nuts (Cola acuminata (L.)) in the south. Tobacco (Nicotiana tabacum (L.)) is grown in both north and south and consumed locally. The food crops grown include yam (Dioscorea alata (L.)), cassava (Manihot exculenta (L.)), rice (Oryza sativa (L.)), maize (Zea mays (L.)), guinea corn (Andropogon sorghum (L.)), millet (Pennisetum spicatum), cowpea (Vigna sinensis (L.)), onions (Allium cepa (L.)) and sweet potatoes (Impomea batatas (L.)).

The climate is tropical. The mean annual rainfall in Nigeria varies generally from about 10" in the extreme north to over 160" on the coast in the Southeast. Rainfall is concentrated in the wet season from May to October. In the northern three-fourths of the country the rainfall period is of 5 months or less duration. In addition, the date of beginning of the wet season varies from year to year.

The principal drainage basins of Nigeria are the Niger River system, Lake Chad and Cross River. The River Niger, which rises in Sierra Leone, flows for about 850 miles across Nigeria in a south southeast direction to empty its waters in the Gulf of Guinea in the southern Atlantic Ocean. With its principal tributaries, the Benue, Kaduna, and Sokoto rivers, it drains an area of 222,000 square miles, or about three-fifths of the country.<sup>4</sup>

Nigeria is the world's largest producer of palm oil and kernels, African yams, cowpea, kolanuts, and the world's largest exporter of ground-nuts. In 1969, agricultural exports from Nigeria totaled ₦213 million (\$320 million) accounting for 48 percent of all exports of ₦447 million (\$671 million). Major farm exports were cocoa beans and products, valued at

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<sup>4</sup>R. Rowat, "Water Resources and Irrigation Development," (Food and Agriculture Organization, Rome, 1965), p. 22.

₦86 million (\$129.0 million), groundnuts and products worth ₦78 million (\$117.0 million), oil palm produce ₦22 million (\$330 million), and rubber (\$19.5 million).<sup>5</sup> Agriculture's share in total exports has decreased from that in earlier years because of the rise of petroleum. Besides providing national revenue, agriculture serves as a means of employment for more than three-quarters of the population, and makes Nigeria self-sufficient in food crops. The country only imports proteinaceous food such as milk.

#### Irrigation in Nigeria

Irrigation is not new to northern Nigeria. Along river banks and "fadamas", vegetables and food crops are grown during the long dry season. People have been carrying out irrigated farming in the Niger and Lake Chad basin areas. Each farmer operates about two to three acres using human labor. Water is obtained from its source by means of a "shadoof", and directed to the fields by means of narrow earth canals. The farmers use the small level basin method of irrigation, and checks are sometimes prepared by constructing levees. Land preparation, planting, cultivating and harvesting are done with hand tools. The main tools used are the short-handed hoe, the cutlass and the sickle. The areas that can be irrigated are not of sufficient magnitude to have noticeable effect upon the overall economy. The farmers besides producing food crops make some money from the production of vegetables, with this money, they pay their taxes.

From the results of experimental and the demonstrational units, the yields indicate that irrigation is practical, and that a variety of crops can be produced. Then, the government establishes projects such as Yobe River Project (Chad Basin), Ebeje River Project and Rima Sokoto Project.<sup>6</sup>

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<sup>5</sup>United States Department of Agriculture, op. cit., p. ii.

① <sup>6</sup>Food and Agriculture Organization, op. cit., p. 14.

This increases the area of land cultivated and makes possible the introduction of new crops such as wheat. It is hoped that irrigation will increase agricultural production by making it possible to grow crops during the dry season, thus doubling the productive capacity of the land. Then, the greater productivity of the lands will permit farmers to grow the necessary food crops to feed their families and to have more land and resources available for growing cash crops for sale. This area of irrigational potential is the center of groundnuts and cotton production, the main export crops of northern Nigeria. Therefore, irrigated farming in the long run, will lead to increased export crop production, which will have definite impact upon the national economy, increase the farmer's income and raise the standard of living in the project area and the general vicinity.

Certainly irrigation antedates recorded history. It was practiced in the Nile Valley between 3,000 and 2,500 B.C.<sup>7</sup> Early rulers of Egypt were instrumental in developing the elaborate irrigation systems upon which their culture was based. Technical developments which were used included artesian wells and great canal systems for irrigation. In northern Nigeria as in Egypt, irrigation has been practiced by means of a "shadoof" along river banks for growing vegetables and corn during the dry season.

Owing to the lack of capital and technology to build dams to store water modern irrigation is thought of as new in Nigeria. This has delayed the full exploitation of the agricultural potential of Nigeria as ground water resources are present in the Niger and Lake Chad basin areas. The drier areas of the Northern States bordering the fringes of the Sahara desert possess irrigation potential. If irrigation schemes could be developed they

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<sup>7</sup>L. M. Cantor, A World Geography of Irrigation (New York: Praeger Publishers, 1967), p. 12.

could be the largest single factor in increasing agricultural production as noted in an F.A.O. study:

The development of irrigated agriculture in Northern Nigeria will mean a radical change in farming practices . . . and will increase the national income, and will result in individual financial benefits, which will directly raise their standard of living.<sup>8</sup>

Following this report the governments of the Northern States began to think seriously about irrigated agriculture. As a result, over 27,000 acres of land were under irrigation by 1970. The 1970-74 National Development Plan of the Northern States has set a target of 134,000 acres of irrigated land by 1974 and over 1,000,000 acres under irrigation by 1985.<sup>9</sup>

The normal procedure followed is for the government to develop the irrigation project and then lease out portions of the developed acreage to individual farmers for production of crops such as wheat, rice, cotton, groundnuts, guinea corn, maize and vegetables. As the farmers have only the experience of shifting cultivation they lack the knowledge and techniques to manage irrigation operations. They have problems maintaining the soil fertility necessary to sustain crop production of the high level required to make irrigation farming economically feasible.

For a productive, profitable and permanently successful irrigated agriculture attention must be given to providing a sufficient water supply as well as sound soil and water management practices. Selecting productive crop varieties and utilizing all beneficial cultural practices are also necessary. As farmers have no knowledge of modern farming they must be given

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<sup>8</sup>Robert H. Maxwell, and Warren L. Prawl, "Agricultural Education at the Intermediate Level," Report of a West African Conference held in Nigeria at Ahmadu Bello University December 13-18, 1971 (Zaria: Institute for Agricultural Research, Ahmadu Bello University, 1972), p. 50.

<sup>9</sup>Ibid.



technical advice concerning irrigated agriculture. The government must assume the responsibility of providing advice. This means irrigation agronomy extension workers must be trained to advise farmers.

Thus the governments of the six northern States requested the Division of Agricultural and Livestock Services Training of Ahmadu Bello University, which serves the States in training agricultural extension workers in basic technical knowledge in agriculture, to train irrigation agronomists who will give technical advice to farmers in the field.

The Division is comprised of the Schools of Agriculture at Kabba and Samaru, the Livestock Services Training Centre, Kaduna and the School of Irrigation Agronomy, Bakura, is autonomous within the overall administrative framework of the University. The Schools are responsible for the training of intermediate staff for the extension advisory services of the government in the fields of agriculture, livestock, range management and home economics. The School of Irrigation Agronomy is responsible for offering courses in basic technical knowledge in irrigated agriculture. Successful graduates accept positions as extension workers to give technical advice to farmers. In addition, graduates are expected to gather hydrological data and information on which future planning can be based, supervise construction of simple field installations and also supervise staff of a lower grade assigned to the project in accordance with accepted principles of personnel management. To obtain extension workers of the calibre required to perform the above mentioned duties adequate technical knowledge in general irrigation agronomy, extension methodology, rural sociology, soil and water management, basic farm management, basic agricultural economics, and practical farm experience with an emphasis on irrigation must be provided. Hence the need for a comprehensive curriculum which will provide well trained persons to meet the aspirations of the government.

## THE PROBLEM

The School of Irrigation Agronomy is to provide a course of study for a period of 12 months (4 terms) leading to a certificate in Irrigation Agronomy. This will train Irrigation Assistants for the six northern States. The school is new, and there is no adequate curriculum for the course. Therefore, there is an urgent need for an effective curriculum guide for the school.

### Statement of the Problem

I am a member of the staff of the Division, and I shall join the school to teach Irrigation Agronomy. Then, my purpose of this study is to develop a curriculum guide for the school, and present it to the Director of the Division of Agriculture and Livestock Services Training.

### Limitations

Questionnaires could not be used to gather information and opinions so this study is based upon a review of literature, professional and personal experiences of the investigator and discussions with administrators and technical specialists in the fields of irrigation agronomy and education. Based on the information available a curriculum guide covering the various courses to be offered would be developed. It was not possible to develop complete lesson plans for every subject but examples of certain lesson plans have been prepared. Some of these are used in the text with the remainder placed in the Appendix.

### Definitions

Definitions used here are provided by the investigator who was formerly an employee of a Ministry of Natural Resource.

In the study, the following terms are defined as they are applied and used in the Northern Nigeria governmental circles.

Division refers to a department of government organization.

Officer identifies a person occupying an administrative/technical position which normally requires a Bachelor of Science degree.

Chief Agricultural Officer, abbreviated C.A.O. is the technical officer in charge of extension and services. He is responsible to the Permanent Secretary who is the administrative and policy officer in charge of the Ministry of Natural Resources.

Principal Agricultural Officer, abbreviated P.A.O., is the officer in charge of the provincial extension program and is responsible to the Chief Agricultural Officer.

Agricultural Officer, abbreviated A.O., is the officer in charge of the divisional extension program and is responsible to the Principal Agricultural Officer.

Agricultural Superintendent, abbreviated A. S., is the person in charge of various aspects of the divisional extension program and is responsible to the Agricultural Officer.

Irrigation Superintendent, abbreviated I.S., is the person directly in charge of irrigation agronomy operations in a division.

Assistant Irrigation Superintendent, abbreviated A.I.S., is an intermediate staff member concerned with irrigation operations on a particular project and is responsible to the Irrigation Superintendent.

Irrigation Assistant, abbreviated I.A. identifies a junior staff member concerned with irrigation extension education and services. He works directly with farmers.

Local Authority, abbreviated L.A., is the lowest level of administrative authority charged with administration of a given area by the

Government with a Chief or natural ruler as the administrative head. The L.A. is responsible for collecting taxes and other assessments for handling most of the minor administrative matters and policies on irrigation projects.

Package Demonstration<sup>10</sup> refers to the result demonstration utilizing the recommended materials and practices necessary for the growing of a particular crop, from planting to storage. A local farmer serves as the demonstrator. The production of the crop grown under supervision of the extension worker is known as a package demonstration or result demonstration and the plot is called the result demonstration plot.

Method Demonstration<sup>11</sup> refers to teaching farmers how to perform a particular skill or technique such as how to dress their seeds with chemicals before planting or/and how to apply fertilizer to their crops in the correct manner.

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<sup>10</sup>A. H. Saville, Extension in Rural Communities (New York: Oxford University Press, 1970), p. 61.

<sup>11</sup>Ibid.

## Chapter 2

### REVIEW OF RELATED LITERATURE

An educational program should have clearly defined purposes or goals. To attain these goals the institution involved will have certain functions to perform, such as: (1) to transmit culture, (2) to reconstruct the society, and (3) to provide the fullest development possible of the individual. The purpose of the School of Irrigation Agronomy at Bakura will be to provide the fullest development of the individual. As a result graduates' ways of thinking, beliefs, understanding, attitudes and feelings will be properly orientated as the result of having been exposed to the experiences provided at the school. To provide the essential educational experiences one must develop an effective curriculum. In developing an effective curriculum the writer would endeavor to answer the following questions:

1. What educational experiences can be provided that are likely to attain these purposes?
2. How can these educational experiences be effectively organized?
3. How can we determine whether these purposes are being attained?<sup>1</sup>

Curriculum development was necessary to satisfy the demands and requirements of culture and society. Culture dealt with what individuals have, believe, think and value whereas society consisted of organized groups of individuals who would think of themselves as distinct groups. Therefore culture is different from society as stated by Smith, Stanley and Shores:

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<sup>1</sup>Ralph R. Tyler, Basic Principles of Curriculum and Instruction (Chicago: University of Chicago Press, 1970), p. 1.

A society is not a mere aggregate of individuals, for . . . do not recognize themselves as a distinct social unit. To be a society, a collection of persons must have something in common . . . a set of loyalties and . . . sentiments, which induces the individual under certain circumstances to subordinate or even to sacrifice himself for the good of the group.<sup>2</sup>

In a society education was the process or means by which individuals acquired the ways, beliefs and standards of that society. Schooling is a specialized aspect of this social process but in primitive societies the individuals acquired learning by associations with adults in their daily activities. In Nigeria, a little girl carrying a cornstalk doll tied to her back with her "rapper" was imitating, and therefore learning, a whole chunk of the culture she would live in. On the other hand, instruction in groups had become a specialized function in literate societies. This led to a sequence of potential experiences provided in the school for the purpose of disciplining children and youth in their ways of thinking and acting. This set of experiences might be referred to as the curriculum. The curriculum defined: "all the experiences which are offered to learners under the auspices or direction of the school."

In clarifying the concept of curriculum some educators had suggested that the curriculum is:

. . . really the entire program of the school work. It is the essential means of education. It is everything the students and their teachers do, and the effort of the school to bring about desired outcomes in school and out of school situation.<sup>3</sup>

Over the years four significant changes had taken place. First there was emphasis on memorization and mental discipline to emphasize the purpose, meaning and goal seeking in the learning process. Second, there

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<sup>2</sup>B. O. Smith and others, Fundamentals of Curriculum Development (New York: Harcourt, Brace & World, Inc., 1957), p. 4.

<sup>3</sup>Smith and others, op. cit., p. 3.

was reliance on tradition and subjective judgement to the use of scientific methods and findings as the basis for educational objectives. Third, was the idea that how people learned was as important as what they learned. Fourth, there was a change in the pattern of curriculum building in which subject specialists who selected and organized teaching materials according to the specific fields of disciplines, to that in which teachers, pupils and the community were involved in identifying the needs and objectives to be achieved and ways to reach them. This showed that curriculum was planned according to the opinions of supporters of either student-centered, society centered or subjected. Then, balanced curriculum would be developed on the resources which those foundations provided. Virgil Herricle observed:

There are only three basic referents or the development of distinctive curriculum patterns and in making pivotal curriculum decisions. These three referents are (1) man's categorized and preserved knowledge . . . the subject fields. (2) Our society, its institutions and social processes and the individual to be educated; his native needs and developmental patterns. These three referents are the sources from which curriculum development and theorizing spring. They are also the source for the ancient controversies over the subject-centered, social-centered and individual centered curriculum.<sup>4</sup>

Then under various commissions of the Progressive Education Association in the 1930's, including the Eight Year Study, foundations were laid for a theory of curriculum planning. The studies of these commissions indicated the necessity for studying students as groups of individuals, for examining the needs and developmental sequences surrounding learning in school. They emphasized the importance for analyzing the nature of society and its demands on individuals as a basis for curriculum development. Hence Taba wrote:

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<sup>4</sup>James B. Macdonald and others, Strategies of Curriculum Development (Columbus: Charles E. Merrill Books, Inc., 1965), p. 4.



During this period, and largely as a result of the evaluation studies, there emerged the concept of behavioral objectives of education a concept which encompassed goals that went beyond acquiring knowledge and academic skills and differentiated the learning processes appropriate to each objective. These studies also provided the first glimmer of differentiation between kinds of learning goals that constituted general education and those that represented the mastery of specialized knowledge.<sup>5</sup>

The pronouncements of policy and philosophy were optimistic of the beliefs of the part interaction would play in child needs in learning. As expressed by a Philosophy committee for the St. Paul (Minnesota) Public Schools:

We recognize the intrinsic worth of the individual child his inherent and inalienable rights, and his consequent responsibilities to himself and to society. So far as it is possible, he must be provided with the basic knowledges, skills, habits, understandings, methods of attack on problems, action patterns and appreciations that are necessary for his individual welfare and his services as a citizen.<sup>6</sup>

John Dewey, writing about the confusion in curriculum planning, pointed out that some people had the idea that different studies represented separated kinds of values and therefore the curriculum should be built by gathering together various studies till a sufficient variety of independent values had been cared for. Thus he wrote:

Memory is trained by most studies, but by languages and history; taste is trained by the more advance study of languages and still better by English literature, imagination by all higher language teaching, but chiefly by Greek and Latin Poetry; observation by science work in the laboratory through some training is to be got from the earlier stages of Latin and Greek; for expression, Greek and Latin composition comes first and English composition next, for abstract reasoning, mathematics stands almost alone, for concrete

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<sup>5</sup>Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace & World, Inc., 1962), p. 4.

<sup>6</sup>Albert I. Olive, Curriculum Improvement (New York: Mead and Company, 1968), p. 108.



reasoning the Greek and Roman historians and orators come first and general history next.<sup>7</sup>

Hence, the education could be complete, if it included Latin, one modern Language, history, English literature and science in curriculum. In Nigeria, the curriculum was comprised essentially of three R's: Writing, Reading and Arithmetic, by means of which pupils were taught how to read and write.

#### Religious Motive:

Although the strongest motives for curriculum development were societal in origin, the religious motive dominated curriculum development during the period of early settlement in America. They brought with them certain cultural ideas, in which religious heritage was the predominant and controlling factor, such as the Puritans who settled New England. The same applied to Nigeria. During the early colonization, the church mission schools first spread Western education. Until 1956, they were the only Western-style schools in Nigeria. The christian mission was always both church and school. Christianity and education went hand in hand in Africa. So, religion greatly influenced curriculum. By its influence Divine Will became the source of curriculum. With the result that it placed heavy reliance upon religious, moral and ethical teachings found in Holy Writ and church doctrine. Besides, the church brought education to Nigeria and even Africa as a whole.

Although with the missions religious training was naturally the first object, the country still owes to them a great debt of grati-

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<sup>7</sup>John Dewey, Democracy and Education (New York: Collier-Macmillan, 1966), p. 240.

tude for the work they have accomplished in laying the foundations of education in Nigeria.<sup>8</sup>

### The Political Influence

Although changes in economy, social life, political beliefs were occurring during the first century and a half of the nation's life, curriculum did not change. Before the American War of Independence, the curricula in schools were carbon copy of that of England. With Independence the colleges were no longer supported by the British government. Also the parochial and charity schools which were formerly supported from Great Britain were then supported financially from within the country. With the result that, owing to the influence of "nationalism", the colonial literacy was replaced by preservation of liberty and a new democratic form of government. This political motive was reinforced by two movements, the universal "adult suffrage" and the development of "rugged individualism".

In Nigeria, it was the contrary. Since the dawn of colonization the curricula of schools were carbon copies of those of Britain. The attempt to educate Nigerians within their environment was undermined by the use of British External examinations administered in London. British, or Europeanized, curriculum was demanded as:

Furthermore, the economic advantages, as well as the prestige derived from passing these tests, led Africans to demand the Europeanized curriculum and, in some instances, to regard African-oriented education as a European attempt to keep them in subjugation.<sup>9</sup>

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<sup>8</sup>B. Forman, and H. Forman, The Land and People of Nigeria (New York, Philadelphia: J. B. Lippincott Company, 1964), p. 63.

<sup>9</sup>D. Adams and R. M. Bjork, Education in Developing Areas (New York: David Mckay Company, Inc., 1969), p. 50.

The curriculum comprised mainly of literary education and remained unaltered since the attainment of Independence. So, in Nigerian curricula, with changes only in subject matter such as teaching tropical crops instead of temperate crops, geography and history of Nigeria instead of England, they remained British. The British System of education had stood the test of time after Independence:

The ambivalence of the African toward his own heritage; (2) the untoward effects of the examination system which is designed to protect one prong of this ambivalence; and (3) the failure of the universities and ministries to serve as knowledge centers or agents for educational change.<sup>10</sup>

This situation prevailed because the educators were conservative concerning the educational status quo, as were the most traditional of the colonialists. They were deeply concerned lest modified programs be viewed as being of lower stature and viewed as "watered down".

#### The Influence of Certain Theories on Development

Unlike in Nigeria, theories put forward by eminent philosophers have led to the development of new curricula in American schools. One of these was the Herbartian theory. He believed that the aim of education should be the preparation of people to live a good moral life in organized society. He believed that man's interests were his touch with things in his environment and his contact with human beings. This was social interaction. To achieve these educational aims he maintained that interest on the part of the pupil was a prerequisite of good teaching. Accordingly, he developed a doctrine of "apperception" which was the grasping and mastering of new

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<sup>10</sup>J. W. Hanson, Imagination and Hallucination in African Education (Michigan: Institute for International Studies-College of Education, Michigan State University, 238-IM-35-ST), p. 12.

knowledge in terms of the knowledge already acquired. The five Herbartian steps were developed as a system of methodology for the building up of concepts in the minds of pupils thus:

1. Preparation: Stating the aim of the lesson and taking other precautions to put the children in the right frame of mind for the material.
2. Presentation: Securing new data or experiences from readings, lecturing, conversing, experimenting, questioning.
3. Associating, comparison and abstraction: Discussing and interpreting new material relating it to previous experiences, comparing, classifying, arranging, noting common characteristics, perhaps reaching a vague feeling of general principles involved.
4. Generalizations: Formulating a statement of the general principles which have been worked up to in step three.
5. Application: Interpreting other situations or experiences (old or new) in terms of the generalizations reached, working particular problems, judging special cases of all sorts.<sup>11</sup>

The five Herbartian steps influenced the development of the new idea of correlation of subject matter and the unity of the learning process which are the core beginnings of curriculum.

The second theory that influenced curriculum development was John Dewey's "moral aim". He noted the content of a curriculum should consist of the conscious experience of man as classified according to some dominant typical aims or processes of social life. He proposed that the organization of the curriculum be such that the child's personal experiences would reveal to him the basic and typical aspects of social life. As a result he helped focus attention on the curriculum for system and order in selecting content and method. This was based on psychology and philosophy. Attention to the processes by which the child would acquire knowledge was common to all and

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<sup>11</sup>Many L. Seguel, The Curriculum Field: Its Formative Years (New York: Teachers College Press, Teachers College, Columbia University, 1966), p. 19.

all worked for a greater unity of a different kind. This would make the teacher an active participant in the curriculum and make teachers sensitive to the need for change, to free the child from a dull, mechanical role in learning and to capitalize on his vitality, activity and drive.

The scientific educators, such as Franklin Babbitt and Edward L. Thorndike, made significant contributions which particularly influenced thoughts on curriculum development. They formulated psychological bases for measurement. They had the common desire to modernize and streamline the educational enterprise. Franklin Babbitt and W. W. Charters succeeded in making the profession think about methods of developing curriculum in a fresh way. Therefore, the whole process of curriculum development was to be investigated and studied as a scientific method which would lead to the desired end: B. Franklin wrote:

1. As a foundation for all scientific direction and supervision of labor in the field of education we need first to draw up in detail for each social or vocational class of students in our charge a list of all the abilities and aspects of personality training for which the school is responsible.
2. Next we need to determine scales of measurement in terms of those many different aspects of personality that can be measured.
3. We must determine the amount of training that is socially desirable for each of these different abilities and state these in terms of scales of measurement.
4. We must have progressive standards of attainment for each stage of advancement in the normal development of each ability in question. When these four sets of things are at hand for each different social or vocational class then we shall have for the first time, a scientific curriculum for education that is worthy of our present age of science.<sup>12</sup>

As a result of the contributions of scientific educators and philosophers search for an adequate basis of information on curriculum

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<sup>12</sup>Babbitt Franklin, The Supervision of City Schools: Twelfth Yearbook of National Society for the Study of Education Part I (Chicago: University of Chicago Press, 1913), p. 40.

development pervaded the history of education. Talking about it Tyler wrote:

A comprehensive philosophy of education is necessary to guide in . . . so-called scientific study of the curriculum during the past thirty years has concerned itself with investigations that might provide a more adequate basis for selecting objectives wisely. The technical literature of the curriculum field includes hundreds of studies that collected information useful to curriculum groups in selecting objectives.<sup>13</sup>

Hence four schools of thought emerged concerning the choice of sources of objectives for curriculum development. The "essentialists" group of educational philosophers who thought that the large body of knowledge collected over many thousands of years, the so-called cultural heritage, should be the objective. This school of thought held the view that to achieve the aims of education certain subjects should be selected from the store of knowledge acquired to train the mind. The second school of thought was the "progressives" who favored the study of the student to determine: "what kinds of interests he has, what problems he encounters, and what purposes he has in mind." The information obtained would provide the basic source for selecting objectives. Apart from both essentialists and progressives some educational philosophers comprising a third school of thought recognized basic values in life which were transmitted from one generation to another and saw the school's aims as essentially a means of maintaining these basic values by transmission. Hence, educational philosophy could be another source of objectives for curriculum development. The fourth school of thought was the sociologists concerned with the problems of society, who thought that the needs of the society could form the objectives. Tyler wrote:

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<sup>13</sup>Ralph W. Tyler, Basic Principles of Curriculum and Instruction (Chicago: The University of Chicago Press, 1970), p. 4.

They view the school as the agency for helping young people to deal effectively with the critical problems of contemporary life. If . . . the objectives of the school are to provide those knowledges, skills, attitudes, and the like that will help people to deal intelligently with these contemporary problems.<sup>14</sup>

These four schools of thought recognized that there were differences in belief, attitudes, values, feelings and skills between a child and an adult. These differences made the distinction between boyhood and manhood. The transformation of youth into an adult would involve the orientation of these ways of behavior. These differences would be the "gap" of which Tyler said:

. . . that need represents a gap between some conception of a desirable norm, that is, some standard of philosophic value and the actual status: Need in this sense, is the gap between what is and what should be.<sup>15</sup>

Concerning educational needs Knowles said that: " . . . is the discrepancy between what an individual (or organization of society) wants himself to be and what he is, the distance between an aspiration and reality."

Therefore, in developing a curriculum for formal education the objectives should be derived from studies of the students, contemporary life outside the school (society), educational philosophy of learning and the subject specialists (essentialists). Hence Tyler writes:

The point of view taken in this course is that no single source of information is adequate to provide a basis for wise and comprehensive decisions about the objective of the school. Each of these sources has certain values to commend it. Each source should be given some consideration in planning any comprehensive curriculum program.<sup>16</sup>

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<sup>14</sup>Tyler, op. cit., p. 7.

<sup>15</sup>Ibid.

<sup>16</sup>Tyler, op. cit., p. 5.



### Curriculum Patterns

The writer has made an attempt to define curriculum development and given a brief over view of its historical, theoretical and philosophical base. An attempt to point out how the theories and other factors contributed to or affected curricular patterns during certain periods in the educational history of America has been made. The brief account showed that many theories and factors had, within the course of time, led to the development of curriculum patterns which were believed might create an atmosphere to accentuate or facilitate learning:

Learning is the process by which one, through his own activity, becomes changed in behavior. Learning is an active process. One learns through his own activity, through what he does, and so, learning cannot be imparted or given to another.<sup>17</sup>

Learning could not be acquired by just doing or carrying out an operation alone. It requires some kind of direction or demonstration. Hence, teaching would come into the picture of the learning situation. According to E. Dale: teaching would be a kind of "communion, a meeting and merging of minds." To be able to do that, the teacher should be told what, where and when to teach. Throughout the history of education efforts had been made to answer the above questions by providing teachers with curriculum guides.

A curriculum guide defined as a less formal document for teachers which contains the objectives, aims and goals of instruction, the suggested desirable content, learning experiences, and teaching aids

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<sup>17</sup>Ralph E. Bender and others, Adult Education in Agriculture (Columbus: Charles E. Merrill Publishing Company; A Bell & Howell Company, 1971), p. 25.



that may be used to achieve them; and the evaluation techniques suitable for determining the extent to which they have been achieved.<sup>18</sup>

The curricular guides for teachers can be arranged in organizations called patterns--subject-centered, activity, and the core curricula.

### The Subject-Centered Curriculum

The oldest and most widely accepted form of curriculum organization is the Seven Liberal Arts. The Seven Liberal Arts consisted of "trivium"--grammar, rhetoric and dialectic (logic), and the "quadrium"--arithmetic, geometry, astronomy and music in the Middle Ages. In the modern period the trivium was further divided to include literature and history as distinct subjects while the trigonometry, geography, botany, zoology, physics and chemistry constituted the quadrium. In the last half century the number of subjects offered in the public schools increased by leaps and bounds so that by 1930 there were over 300 distinct subjects of instruction. Despite this enormous multiplication of subjects the Seven Liberal Arts continues to be the nucleus of the subject curriculum.

The subject curriculum may be referred to as an organization of the content of education into subjects of instruction. As man found out more and more about his world the point was reached where it became necessary to classify his learning in order to make reference to it more easily, to use it more effectively in further investigation of his environment and explain it to others. Also the content organized could discipline the students in

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<sup>18</sup>R. L. Neagley and N. D. Evans, Handbook for Effective Curriculum Development (New Jersey: Prentice-Hall, Inc., Englewood Cliffs, 1967), p. 5.

those classifications and arrangements of ideas that had proved most beneficial in locating and investigating new problems of specialization. This type of curricular organization would emphasize expository, discourse and techniques of explanation. Expositions would be a form of discourse in which ideas were stated and elaborated so they might be better understood. The main ideas were ordered and explored, and when convenient, illustrated. While the reasons for the truth of ideas were sometimes given in great detail student experimentation, except for formal laboratory work, was seldom set forth.

Neagley and Evans defined the subject-centered curriculum as:

The school subjects are the basis for the organizing and planning of learning experiences for children and youths. The educational objectives of the school program are largely concerned with the mastery of subject matter. In the most formal type of organization the typical day for an elementary school child consists of a succession of periods of varying length in which he studies and recites in subjects such as reading, arithmetic, history . . . on the assumption that the skills involved here have been adequately learned.<sup>19</sup>

Taba, speaking about subject-centered organization said that:

"simplicity of the sweep of knowledge could still be observed in the more modern statements of what the curriculum should cover."

The subject-centered curriculum is characterized by the fact that certain subjects might be required of all students and others treated as electives. The required and elective subjects would be determined in advance. The elective courses, differential assignments and special programs would care for individual differences in interest and ability. This

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<sup>19</sup>Neagley and Evans, op. cit., p. 6.

curriculum might be given deliberate social direction as it would be impossible to teach in a "social vacuum".

Historically the subject-centered curriculum was based on the following beliefs:

1. A belief in the theory of formal discipline which held that the mind is composed of faculties . . . .
2. A belief that all learning was competitive in nature. There was always room at the top.
3. A belief that everyone would achieve if he properly applied himself to the tasks of learning. Success was assumed if pupils only worked hard enough.
4. A belief that material could be learned best when it was organized in a logical manner.<sup>20</sup>

Any form of curriculum organization could be derived from the social orientation, psychological, philosophical thought and investigations which could influence how individuals learned. This could be controlled according to the goals of the institution. But, as new conceptions concerning society, educational psychology and philosophy emerged, the subject-centered curriculum which had stood the test of time became the center of criticisms. Owing to rapid increases in knowledge during the last century the curriculum had resulted in an instructional program so divided that all unity seemed lost. It became compartmentalized and fragmented. Teachers became specialistic oriented taking pride only in the knowledge of their own subjects and disclaiming discipline in, or responsibility for, anything outside of their own subject matter. Whitehead wrote:

There is only one subject matter for education, and that is life in all its manifestations. Instead of this single unity, we offer children--Algebra from which nothing follows; Geometry from which nothing follows, Science . . . ? The best that can be

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<sup>20</sup>Neagley and Evans, op. cit., p. 7.

said of it is, that it is a rapid table of contents which a deity might run over in his mind while he was thinking of creating a world, and had not determined how to put it together.<sup>21</sup>

So, due to fragmentary and compartmentalized character, it would be unlikely that the fullest development of the intellectual aspects of personality could be attained with this organization. It resulted in the emergence of narrow and static personalities. Furthermore this curriculum consisted of a collection of fragments of information selected to give the learner an orderly coverage of the various aspects of the different subjects not a body of knowledge unified by a dynamic purpose.

The organization ignored the interests and activities of the learner. The instruction would be directed to the mastery of the subjects, and as such, only those individuals who were either academically inclined or seeking social approval through marks and promotions showed much interest in the learning exercises. But this would be against the theory that emphasized that learning situations should be conducive to growth which involved the making of choices and policies of concern by the learner. This inability of the subject matter curriculum to provide for the learner divorced it from the interests of students who were to be manipulated as tools. With incorporation of inefficient methods of teaching, learning decreased which depended for the most part upon repetition and memorization. Hence James H. Robinson said:

When one has "gone through" a text book and safely "passed" it, he rarely has any further use for it. This is not because

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<sup>21</sup>A. N. Whitehead, The Aims of Education and Other Essays (New York: Macmillan Company, 1929), p. 11.

he has really absorbed it and so need not refer to it again, on the contrary, it is associated with a process to his deeper and more permanent interests. And it is usually found by those who embark in adult education that text books made almost no appeal to grown ups, who are free to express their distaste for them.<sup>22</sup>

Also this type of organization has an inefficient arrangement of content for learning and use. Although it was hoped that the subjects were logically organized and taught, an arrangement of ideas has proved most beneficial in locating and investigating new problems of specialized interest. Hence, such arrangements were not conducive to learning, nor would the order of teaching determine the way in which the content would shape up and function in the experiences of the learner. The order in which learning would occur would be different from the order given in the content when arranged for communication. So, John Dewey distinguished organization of instruction thus:

It maybe of use to distinguish and to relate to each other the logical and the psychological aspects of experiences—the former standing for subject matter in itself, the latter for it in relation to the child. A psychological statement of experience follows its actual growth; it is historic, it notes steps actually taken, the uncertain and tortuous, as well as the efficient and successful. The logical point of view, on the other hand, assures that the development has reached a certain positive stage of fulfilment. It neglects the process and considers the outcome. It summarizes and arranges, and thus separates the achieved results from the actual steps by which they were forthcoming in the first instance. We may compare the difference between the logical and the psychological to the difference between the notes which an explorer makes in a new country, blazing a trail and finding his way and the finished map that is constructed after the country has been thoroughly explored.<sup>23</sup>

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<sup>22</sup>James H. Robinson, The Harmonizing of Knowledge (New York: George H. Doran Company, 1924), p. 67.

<sup>23</sup>John Dewey, The Child and the Curriculum (Chicago: The University of Chicago Press, 1911), p. 26.

The subject-centered curriculum does not concern itself with current and persistent social problems. The organization consists of an exposition of what has been done in the past and commits the students to the mastery of its knowledge which means ignoring the current social issues and conflicts. This social isolation is most inherent in the subject curriculum. It arose out of the fact that the content was taught as a self-contained system.

Perhaps the most serious weakness of the traditional concept of subject organization is its assumption that a vigorous training in academic disciplines detached from social reality develops the abilities and skills most needed in meeting the demands of life problems.<sup>24</sup>

It should be borne in mind that the curriculum failed to develop habits of effective thinking. Mastery of the conclusions of thought rather than mastery of the process by which the conclusions were derived were confirmed. This led to learning by repetition and memorization. Little importance was placed upon the thinking processes by which conclusions were reached.

#### Correlated Curriculum

Partly in response to criticisms and partly to general feelings of dissatisfaction owing to the results of new psychological and educational concepts efforts were made to improve the subject curriculum which resulted in the development of the correlated and the broad-based curricula. The correlated curriculum was subject-centered in which two or more subjects

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<sup>24</sup>Taba, op. cit., p. 391.

were articulated and relationships between or among them were made a part of instruction without destroying the subject boundaries. This idea originated in the last century from the psychological and educational conceptions of Herbart. His views laid great emphasis upon concentration by which he meant complete absorption in an idea or object of thought, and correlations, and also, meant the reinforcement of the idea by related and supporting conceptions. As a result, history and geography might be taught so as to reinforce each other. Three kinds of correlation depending upon the kinds of subject matter involved:

1. Factual - which was illustrated in the articulation of history and literature, when the historical facts concerning the writing a piece of literature, were discussed with the literature.
2. Descriptive - illustrated in the area of generalization common to two or more subjects.
3. Normative correlation attained in much the same way as descriptive, the chief difference being that the principles would be social-moral rather than descriptive. In the correlated curriculum, children and youth would show greater participation and interest in the conventional subjects, as they were correlated and learned more readily than in the conventional program of subject-centered.

#### Broad-fields Curriculum

The broad-fields curriculum arose in American secondary schools and colleges in the second decade of the present century. It began as one or two broad courses which drew subject matter from two or more departments of instruction. This curriculum varied from the conventional subjects by dissolving certain subject-matter boundaries and creating a few comprehensive categories to take the place of the multiplicity of specialized subjects and by adding new content into the broad categories. The employment of themes permitted greater flexibility within the broad-field courses. At the same time continuity and integration were safeguarded.



### The Activity Curriculum

This curriculum emerged from fundamental conceptions extending back to Rousseau and others. It was set up at the University of Chicago in 1896 by John and Alice Dewey. It was based upon four human impulses: (1) Social impulse and desire to share experiences, (2) Constructive impulse and shaping of raw materials into useful objects, (3) The investigating impulse and experiment, and (4) The expressive or artistic impulse.

The curriculum was designed to utilize, in the education of the young, those basic impulses toward saying, making, finding out and creating, and took the form of certain occupational categories, not of school subjects.

In Dewey's language:

The core of school activity was to be found in occupations, rather than in what are conventionally termed studies. Study in the sense of inquiry and its outcome in gathering and retention of information was to be an outgrowth of the pursuit of certain continuing or consecutive occupational activities.<sup>25</sup>

The curriculum attempted to organize instruction around children's interest and consisted largely of activities related to major centers of child interest. It was characterized by the interests and purposes of children which determined the educational program--what was taught, when it was taught and the order in which it was learned. The basic principles of the program referred to the felt interests and needs of children. According to the theory of the activity curriculum children are always engaged in doing something. Interests did not have to be created. Some interests were always present. The teacher's task was to discover them and to build educative activities upon them. From these activities new interests arose which in turn would lead to further activities and so on through the entire career of

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<sup>25</sup>Mayhew Camp Katherine, and Edwards Camp Anna, The Dewey School (New York: D. Appleton-Century Co., 1936), p. 5.



the child. This fact gave rise to the notion that the activity curriculum was characterized by "activity leading to further activity."

The second characteristic was that common learnings resulted from the pursuance of common interests. Since child's interest was the first limiting factor in determining what to teach general education or commonness of education would be possible only to the extent that children had like interests. Also the curriculum was characterized by not being planned in advance. As a child's interests provides the starting point for instructional planning it followed that the activity curriculum could not be pre-planned.

#### The Core Curriculum

The core curriculum involved the unification of the subjects based on a conception that visualizes the school as an instrument for deliberate social reconstruction and reintegration. It emphasizes social values, the universal elements of a culture that gives the society its stability and unity. The core of the universals consists of the basic values or rules that govern or ought to govern, peoples' activities. The values that make up the stable and vital aspects of the universals constitute the heart of the core curriculum. In short, the core of the curriculum consists, in large part, of the social-moral rules comprising the core of the culture.

The second characteristic feature of the curriculum was that the structure of the core curriculum was fixed by broad social problems or by themes of social living. Just as the structure of the subject-centered curriculum was shaped by the requirements of explanation and research, and that of the activity by the interests of children, so the structure of the core curriculum would be determined by the way in which social issues were grouped. Hence it could be referred to as a society-centered curriculum.

### Curriculum of Education in Agriculture

In the review of literature it was indicated that courses taught in agriculture education prior to 1917 were academic in nature and were viewed as "non-vocational". In 1917, the Smith-Hughes Act was passed. As a result of the Smith-Hughes Act and subsequent legislation, agricultural education in the United States might be described as vocational education in agriculture, varying from state to state. With the result that agricultural education had changed rapidly and had become specialized.

The curriculum in agriculture was influenced by resolving forces in curriculum decision making such as subject-centered, students needs, and needs of the society. The courses of study were identified by means of using the advisory council and conducting a survey of the society. Thus the instructor could identify the needs and job opportunities in the area. Having identified the societal needs and job opportunities, he would use the concept of the intermeshing of subject matter, philosophical and psychological factors affecting student learning to obtain specific instructional objectives within the curriculum.

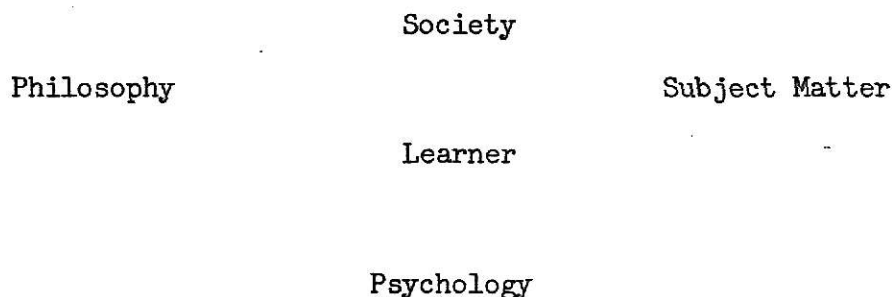


FIGURE 1

THE INTERMESHING OF A NUMBER OF FACTORS  
AFFECTING STUDENT LEARNING

In Nigeria agricultural education is very academic and taught in only a few secondary schools, such as the Secondary School, Gindri and the Secondary School, Egbe. It is offered as agricultural science as a subject. The curriculum was more or less formal and British.

1. Primary: Academic education with some "Rural Science" studies.
2. Secondary: Academic education with some "Rural Science" subjects.
3. Ministry and Technical Schools or Colleges: Technical training in Agriculture, Animal Health and Husbandry, Forestry, Irrigation, Home Economics, Laboratory Technology.<sup>26</sup>

As the traditional schools were not providing courses for technical agriculture the ministries of agriculture had been until recently almost the sole source of public sponsored agricultural education and training programs. Hence extension had evolved as a ministry responsibility. So, to provide extension education the government established the School of Agriculture at Moor Plantation, Ibadan in 1921, and the School of Agriculture Samaru in 1927. They offered courses in subuniversity education in technical agriculture to train extension workers for the Ministries of Agriculture. Courses offered were:

1. General Agriculture
2. Extension Methodology
3. Field Experimentation
4. Basic Agricultural Economics
5. Farm Management
6. Office Procedure
7. Soil Science
8. Animal Husbandry
9. Surveying

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<sup>26</sup>James M. Kincaid, Jr., "Strategies for the Improvement of Agricultural Extension Work and Non-Degree Agricultural Training in Nigeria." Consortium for the Study of Nigeria Rural Development, (Michigan: 204 Agricultural Hall, Michigan State University, East Lansing, CSNRD-13, Sept., 1968), p. 87.

10. Agricultural Botany and Zoology
11. Practicals<sup>27</sup>

These courses covered basic technical knowledge in agriculture with emphasis on practical application and extension methodology. The content of curricula, when viewed in total, had changed considerably since national independence. This indicator of change was closely related to increases in the kinds of programs and the broad objectives established by the Ministry for the number of extension workers needed by the end of the 1962-68 Plan Period which was one extension worker per every 2,000 farm families.<sup>28</sup>

	<u>STAFF</u>	<u>TRAINEES</u>
1963-64	98	93
1964-65	128	293
1965-66	49	367
1966-67	132	357
1967-68	155	331

FIGURE 2

PROJECTED NUMBER OF STAFF AND EXTENSION  
TRAINEES FOR NORTHERN NIGERIA IN THE  
1962-68 PLAN PERIOD

When developing the curriculum the proper subject matter content was selected to provide skills and competencies to the candidates after due consultation with the Ministries. Thus the needs of the society which the successful candidates would serve were determined. Then, taking into con-

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<sup>27</sup>Ibid.

<sup>28</sup>Ibid., p. 93.

sideration the interests and the individual needs of the student, a balanced curriculum under the British system of education was developed.

As previously suggested agriculture education in Nigeria still tends to be academic. Assuming this to be true, the definition of educational needs by Knowles was applied in shaping the Bakura School of Irrigation curriculum. Atwood made a distinction between educational needs which could be satisfied by means of a learning experience from other needs. He said that educational needs would have reference to specific understandings, attitudes and skills that would be lacking but required for the attainment of a more desirable situation.

He proposed four characteristics of real educational needs:

1. It must be required or necessary for a desired state of affairs.
2. It must be lacking, absent or deficient.
3. It must carry a legitimate claim about which something ought to be done.
4. It must be capable of being satisfied by means of a learning experience which can provide appropriate knowledge, attitude or skills.<sup>29</sup>

With the four characteristics of real educational needs the writer would develop a curriculum which hopefully, could satisfy the needs of the trainees so they could perform their advisory functions as extension specialists successfully within the organization of the Ministry of Natural Resources in the Division of Agriculture Field Services as shown in Figure 3.

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<sup>29</sup>Mason H. Atwood, "The Concept of Need: An Analysis for Adult Education," Adult Leadership Vol. XII, 1971), p. 212.

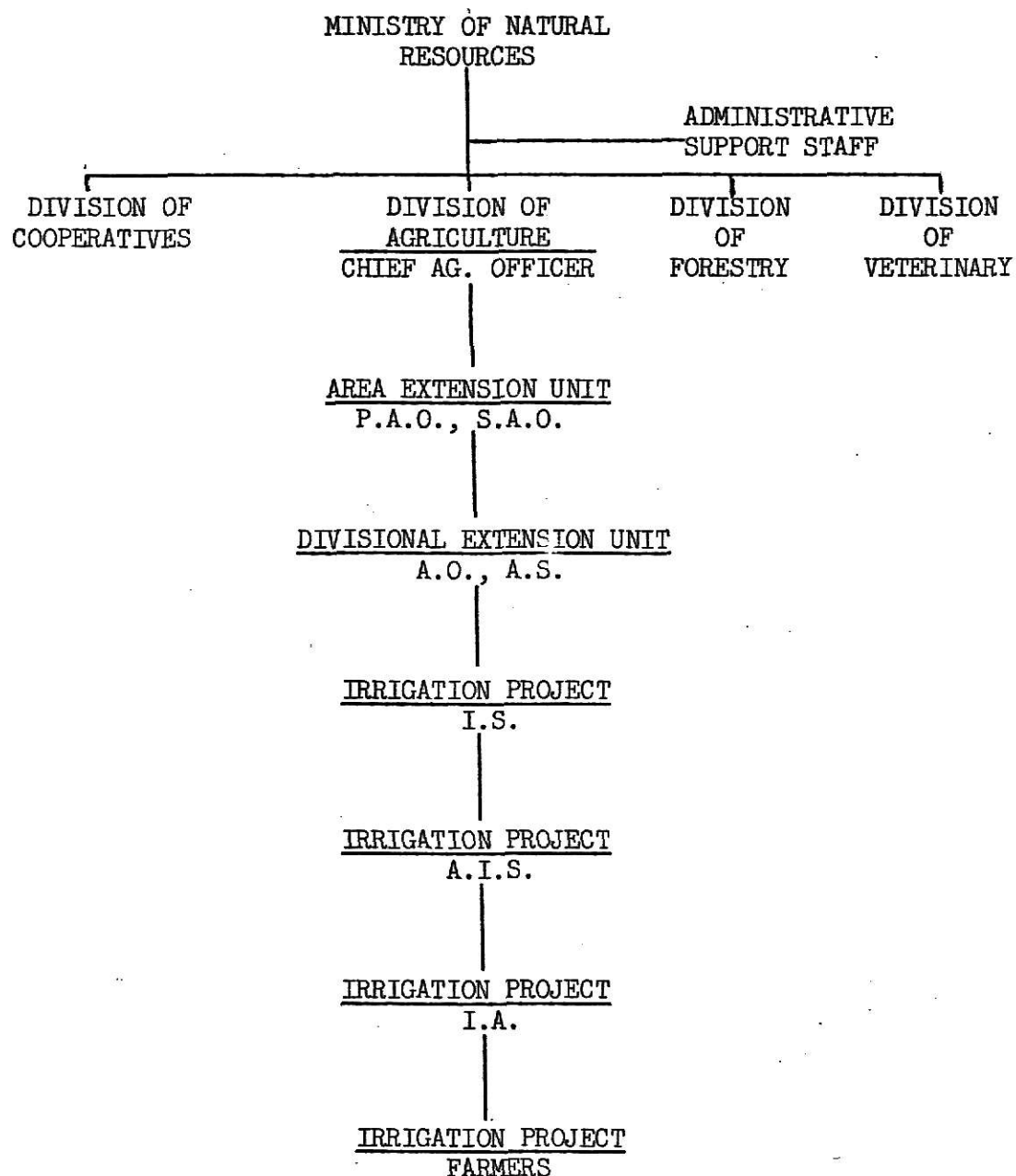


FIGURE 3

ORGANIZATION CHART WITHIN WHICH THE SUCCESSFUL CANDIDATES OF  
BAKURA IRRIGATION SCHOOL WILL BE WORKING IN THE  
AGRICULTURAL EXTENSION SERVICES OF  
NORTHERN NIGERIA.

Summary

In educational history religious motive, the political influence and theories contributed to the foundations of curriculum development. In an effort to provide pleasant situations conducive to learning subject-centered, student-centered and society-centered curricula evolved. These became the curricular patterns from which sources were derived to develop courses of instruction in agriculture education.

In an attempt to develop a guide the writer sought a compromise among the three patterns of curricula. This is based on valid and reliable information about the learning process, the conditions under which learning occurs, the values, attitudes, skills and knowledge required of the learner. The stage of personal development and the needs of the student are considered as well as culture, society and their values.

## Chapter 3

### METHODOLOGY

The purpose of the study was to develop a curriculum guide for teaching Irrigation Agronomy in the School of Irrigation Bakura.

In the literature reviewed, three main types of curricular patterns: subject-centered, student-centered and society-centered were identified. It was also indicated that one important characteristic of adequate curriculum development was that, the decisions made in the course of planning rested on multiple criteria. From these, the writer felt that no single factor could solely be a basis for curriculum development.

As Taba said:

Since obviously a curriculum has to do with teaching something to somebody, it can be neither entirely content centered nor child centered, in the sense of neglecting either the nature of the learner or the nature of the content.<sup>1</sup>

In the course of organizing the guide, the school philosophy which is to provide basic technical knowledge in Irrigation Agronomy, to cultivate the desire for knowledge, and to develop a disciplined, discerning and honest mind, were principles used by the investigator in arriving at decisions.

To achieve these objectives the curriculum would provide fourteen major competencies. These would be: (1) Agronomy, (2) Soil Science, (3) Farm Mechanics, (4) Education, (5) Rural Sociology, (6) Irrigation, (7) Surveying, (8) Soil Conservation, (9) Horticulture, (10) Crop Protection,

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<sup>1</sup>Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace & World, Inc., 1962), p. 414.



(11) Government Regulations, (12) Field Experimentation, (13) Agriculture Economics, and (14) Water Quality. These subject matter areas would provide basic skills and competencies. In the study, the investigator would not use questionnaires to survey opinions concerning subject matter areas. He obtained his information of the subject contents from consultations and discussions with the administrators, technical and subject matter specialists in the field of irrigation agronomy. The "Syllabus of Schools of Agriculture" by Bell and the report on Training Irrigation Agronomy by Tyson and Datri presented at West African Conference on Agricultural Education at the Intermediate Level, Ahmadu Bello University, Zaria, Nigeria, and "Irrigation," by Hamilton were used as sources for the development of the guide. The writer used information from literature reviewed, which together with his professional knowledge and the training acquired in irrigation agronomy at Kansas State University would give him a useful and valuable insight into the problem. Then, this information augmented by the writer's familiarity with the Nigerian's situation and needs plus four years of personal experience as a teacher and as an extension officer would result in a comprehensive curriculum guide.

#### Summary

As stated in the limitations of the study, questionnaires were not used. So, sources from which the curriculum would be developed were obtained from: (1) consultations with administrations, (2) technical and subject matter specialists, (3) syllabus of Schools of Agriculture, report on Training Irrigation Agronomy Assistants, (4) the writer's professional knowledge and personal experience in Nigeria, and (5) training in irrigation agronomy and education acquired at Kansas State University.

## Chapter 4

### CURRICULUM GUIDE

The School of Irrigation Agronomy at Bakura will offer courses in Irrigation Agronomy for a period of 12 months. Instructions will begin at Bakura in late 1973 or early 1974. The school calendar will be divided into four terms each of 11 weeks duration, with one week break at the end of each term. April to June will be used by students to gain on-the-job practical experience in their State Ministries. Each student would be required to work on an irrigation project operated by the Division of Agriculture, Section of Irrigation, where he would work under an experienced Irrigation Assistant.

Entry requirement to the School was completion of secondary education and the West African School Certificate (W.A.S.C.) or General Certificate of Education Ordinary Level (G.C.E.O.L.) in science subjects. This would be equivalent to a high school Diploma in the United States. The candidates would spend the first two terms at the School of Agriculture, Samaru, where they would study General Agriculture Science. Successful candidates could enter the School of Irrigation Agronomy to complete their work which would lead to a Certificate in Irrigation Agronomy.

The writer developed the curriculum based on the school philosophy, certain assumptions concerning the learning process, the needs of the individual student, the social and technical needs of Nigeria and the educational objectives.

#### Statement of the School Philosophy

The Irrigation School, as it is commonly called, is an educational

institution which provides basic technical knowledge in irrigation agronomy. Successful candidates would qualify for appointment as Field-Extension Workers in the Irrigation Section of the Division of Agriculture and Field Services, Ministry of Natural Resources. Hopefully the school would help cultivate a desire for knowledge in the students and explore society's need so they would be able to get along and work effectively within it while working to improve it. A part of the philosophy would be to develop a disciplined, discerning and honest mind and to foster a spirit, sensitive and responsive to truth, beauty, goodness and love. ✓

To achieve these goals the institution would be involved in the development of the total growth of the individual. This would be an essential part of the educational program since each individual brought to the school attitudes, values, skills, competences and knowledge which could be reorientated, improved and changed. Then successful candidates would be prepared for gainful employment in the duties and position of an Irrigation Assistant and become a most valuable member of society. Thus the guide would be designed to meet the psychological, sociological and economic needs of the individual while building a base for progress in his career.

#### Assumptions

As indicated in the literature reviewed curriculum builders must make certain decisions based upon their understanding of assumptions about the learning process, the needs of the individual and the needs of the society. These assumptions vary according to geographical location, biological inheritance and the cultural heritage transmitted to the target

population.<sup>1</sup>

For the purpose of this guide the following assumptions would be considered.<sup>2</sup>

#### About the Learning Process

1. There is no one form of correct schooling for all persons.
2. The school is not the only place where learning occurs.
3. All individuals are capable of growth.
4. Curricula must be relevant to the world in which people live.
5. Education should involve all of the senses.
6. Learning is a lifetime process.
7. Teacher behavior is an integral part of the educational process.

#### About the Needs of the Individual

1. All persons need to be recognized as having dignity and worth.
2. All persons need opportunities for self-realization.
3. Diversity in education is essential.
4. Work is essential for individual fulfillment.
5. Individuals may change their occupations several times during their life spans.
6. Individuals have a need for self-improvement.

#### About the Needs of Society

1. Society needs individuals who have acceptable attitudes and values.
2. Society needs an educational program which provides an adequate and efficient labor supply.
3. Society needs individuals who are self directed in a socially constructive manner.
4. Society needs an educational program which will transmit its acceptable social values.
5. Society needs individuals who are willing and able to participate in worthy civic projects.

#### Educational Objectives

Planning for the learning process within education demands the definition and specification of objectives at each level of the total curriculum.

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<sup>1</sup>A. T. Tyan, "A Guide for Vocational Education Curriculum Development." A Cooperative Project by Oregon State University and United States Office of Education. Class Notes, for Course 410-824 Curriculum in Agriculture, (Kansas State University, Summer 1972), p. 3.

<sup>2</sup>Ryan, op. cit., p. 4.

When planning experiences for students educational objectives must be defined in terms of observable behavior. A behavioral objective generally defines a capability, disposition or tendency and each statement might well begin with such words as "ability to . . . ." Objectives should pertain to human performances. Therefore they should be operationally defined. Clear statements of learning outcomes are necessary to guide the behavior of both the teacher and the learner. They are valuable in providing students with immediate goals and contributing to their motivation. They are necessary as a form and basis for assessment of student progress. The management of learning demands behavioral definitions of objectives. Behaviorally defined objectives can be perceived as minimal requirements for the attainment of both short and long-range aims for a curriculum.

#### Guidelines for Writing Behavioral Objectives

A statement of behavioral objectives should:

- a. describe a desired outcome.
- b. communicate the instructional purpose.
- c. describe the terminal behavior of the learner clearly enough to avoid misinterpretation.
- d. describe the desired behavior in its most elementary form.
- e. specify the kind of behavior which will be accepted as evidence that the learner has achieved the objective.
- f. describe the conditions under which the behavior will be expected.
- g. describe the acceptable level of performance of the learner.
- h. indicate a time limit for acceptable performance when applicable.
- i. include all desired attitudinal and value outcomes.
- j. state the criteria for performance adequacy.
- k. refer to the student rather than text, instructor, or classroom experiences.
- l. be concerned with ends rather than means.
- m. associate specific practices or instructional procedures with objectives.

#### Behavioral Objectives

The writer has developed some examples of behavioral objectives in

the Bakura curriculum based on the guidelines noted above:

### 1. Crop Production

Goal: The student must be able to select the proper commercial fertilizer for growing groundnut (peanuts).

Behavior: Learn to identify the right fertilizer for the groundnut crop.

Conditions: The student must have:

1. Fertilizer bags with tags.
2. Predetermined characteristics of soils to be fertilized.
3. Select groundnuts for seed.

Criterion 1. The student must be able to identify the fertilizer from the tags.

Criterion 2. The student must be able to determine proper application rates and methods.

### 2. Soil Science

Goal: The ability to select soils suitable for the production of vegetables.

Behavior: Learn to identify the soil with good drainage qualities.

Conditions: The student must have:

1. Loam or sandy loam soil.
2. Onion seed.
3. Lettuce seed.

Criterion 1. The student must be able to determine the soil types.

Criterion 2. The student must be able to select the type of vegetable best suited to particular soils.

### 3. Water Quality

Goal: The ability to determine salinity hazard.

Behavior: Learn to test for and identify salinity hazard from an

analysis of a given sample of irrigation water.

Conditions: The student must know:

1. Electrical conductivity of water = 9 mmhos/ce.  
(EX  $\times 10^3$  = 9 mmhos/ce.)
2. Percent Exchange of Na = 3.
3. pH = 7.

Criterion 1. The student must be able to interpret the analysis of water.

Criterion 2. The student must know the concepts and principles involved.

#### 4. Field Experimentation

Goal: Ability to conduct experiment on behalf of the Institute of Agricultural Research (I.A.R.)

Behavior: Learn to shake out the experiments correctly.

Conditions: The student must have:

1. A logbook with the plan of the experiment.
2. A plot.
3. Appropriate tools.
4. Tested and recommended seed varieties.
5. Measuring devices.
6. Labels.

Criterion 1. The student must use the plan to stake out the experiment according to specifications.

Criterion 2. The student must plant the different seed varieties according to labels and rates indicated.

#### 5. Irrigation Practice A

Goal: Ability to calculate the cost of providing irrigation water to a site.

Behavior: Learn to determine the cost of providing water for a surface irrigation.

Conditions: The student must have the following facts:

1. Pumping rate of 450 gpm.
2. Well is 160 ft. deep with a static water level of 86 ft.
3. Drawdown in the well is 34 ft.
4. Centerline of the discharge pipe is 3 ft. above the ground level.
5. Friction loss in the pipe column is 4 ft.
6. Engine pump is ₦2300 with an efficiency of 80%.
7. An internal combustion engine and right angle gear drive will cost 60 per rated horsepower/hr.
8. Cost of well is ₦18 per foot complete with casing and gravel pack.
9. Shelter and base for pump a 14 horse power unit shelter is 800.
10. For annual fixed costs:
  - Interest - 6% on  $\frac{1}{2}$  original investment
  - Taxes - 3% of original cost
  - Insurance - 5% per ₦2,000 of original cost
11. For annual operating costs:
  - Fuel - 50 Kobo per gallon
  - Repairs on pump and power unit - 40 Kobo per 100 hours
  - Lubrication - ₦2 per 100 hours
  - Attendance - ₦1 per 8-10 hours

Criterion: The student must calculate the cost of the complete pumping plant and the cost per acre foot of water.

### 5. Irrigation Practice B

Goal: To be able to plan a surface irrigation system.

Objective: Learn to plan and lay out a surface irrigation system for furrow irrigated guinea corn (sorghum).

Conditions: The student is given the following:

1. Soils - the soil is a loam in the 0.3 in/hr. intake range with an available moisture holding capacity of 2.1 ins/ft.
2. Topography - elevations for a 100 x 100 ft. grid are given.
3. Well - a well was drilled at Row AA, Station 0 + 00 and test pumping indicates a maximum allowable continuous pumping rate of 600 gallons per minute.
4. Using design data - hand out for planning purposes with guinea corn grown in 40 in. rows.
5. Tolerances for the irrigation systems
  - a) Irrigation grade shall be from 0.001-0.007
  - b) Slide slope shall not exceed one-half the irrigation grade.

Criteria:

1. The student will draw contours at one foot intervals.
2. The student will locate irrigation and drainage ditches



- on the grid map and show direction of irrigation.
3. The student will draw a cross section of irrigation and drainage ditches.
4. The student will determine
  - a) Length of run;
  - b) Flow into each furrow;
  - c) Depth of water;
  - d) Irrigation time for guinea corn.
5. The student will determine the maximum acreage of guinea corn that can be normally irrigated from the well.

### 5. Irrigation Practice C

Goal: Ability to calculate water flow through ditches.

Objective: Learn to calculate the flow through the ditch using rectangular weir (without contraction).

Conditions: The student must have:

1. Length of weir crest = L.
2. Depth of water flowing over it = H.
3. Coefficient  $C'' = 3.33$
4. Discharge equation:  $Q = C''LH^{3/2} = 3.3LH^{3/2}$ .

Criteria: The student should calculate the flow in C.F.S.

### Occupational Information

Noted in the school philosophy the Bakura School would be occupationally directed. Owing to this concept the writer would develop the guide based upon employment needs and the developmental trends in the Section of Irrigation, Division of Agriculture, Ministries of Agriculture and Natural Resources of the northern Nigeria States. For the training to be most effective the school must continually re-evaluate its educational objectives. This re-evaluation would be on the basis of reliable information obtained from governmental and related agencies with irrigation operations in the areas to be served. With this information the necessary changes and updating would be made. This would keep the learning programs current and dynamic. When the need to reconstruct the curriculum arises, reliable

information of job descriptions of Irrigation Assistants (I.A.), projections of manpower needs of the states, and conditions within the civil services must be obtained to develop current data for innovative curriculum development and change.

### Curriculum Implementation

Once behavioral objectives had been selected and relevant information about the learner, the occupation and the society gathered, the many difficult and complex decisions could be made. In making decisions the following questions would have to be answered:

- a. What content is appropriate?
- b. What teaching sequence should be used?
- c. How should scheduling be handled?
- d. What administrative support is needed for staffing and organizing instructions?

The writer would thoroughly examine each area of decision and creatively develop strategies to determine the degree of success. In doing so five major curriculum decision areas would be explored: scope, sequence, staffing, scheduling and organizing instruction.

### Scope

Scope dealt with the latitude of the breadth of the curriculum. Perspective in fitting a profusion of knowledge into limited periods in the development of learners was required. It attempted to provide those educational experiences to achieve the behavioral objectives. Of the curriculum: Taba had this to say about scope:

Scope is a way of describing what is conveyed, or what is learned. As was pointed out earlier, one needs to determine what is learned in two different dimensions: What content is mastered and what mental processes are required.<sup>3</sup>

The writer included in the guide the subject matter and analyses of the contents which would be necessary to equip the students for the jobs for which they were being prepared. It would be necessary to teach for:

(1) entry level proficiency, (2) upgrading after the graduate is employed, and (3) preparations for post graduate study.

### Sequence

Sequence was the order of time in which educational experiences were taught. It concerned the problem of coordinating the development of the individual with the order of activities and content. It intended to answer the questions: (1) when should the study of a group of skills, facts, principles and problems begin, and (2) what experiences and materials would best facilitate learning? The problem of finding appropriate sequence was always encountered in teaching and learning that subject matter in which certain ideas and developments necessarily build upon others. Speaking about sequence Taba said:

The continuity of learning has two aspects: that of a vertical process from one level to another, and that of a relationship between the learnings in various areas of the curriculum which take place at the same time. The first of these is associated with the term sequence.<sup>4</sup>

Thus sequence might be regarded as a systematic organization of activities building on what students had already learned. Therefore, learning might be arranged in the following manner:

a. Simple to complex: From single skills or concepts to a

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<sup>3</sup>Hilda Taba, Curriculum Development: Theory and Practice (New York: Harcourt, Brace & World, Inc., 1962), p. 428.

<sup>4</sup>Taba, op. cit., p. 428.

- combination of skills and concepts.
- b. Development: Proceeding from the previous concept or skill.
- c. Chronological: Teaching facts and ideas in the order of their frequency of use.
- d. Frequency: Teaching skills or concepts in the order of their frequency of use.
- e. Skill: Organizing tasks to provide orderly development.
- f. Interest: Dispensing strategically throughout the course units that are interesting to the student.<sup>5</sup>

By using these sequences of learning experiences, decisions at two levels in developing the guide were possible: (1) determining the sequence of courses within the overall curriculum, and (2) determining sequence of learning experiences within a specific course.

### Staffing

In making staffing decisions effort must be made to select those instructors who could meet the objectives developed for the course, who had views which supplemented and strengthened assignment and who had a favorable attitude toward change and self improvement through education and training. Considerations must be given to those teachers who could influence student learning, who had an interest in the student and his needs, who were willing to work with students in co-curricular activities, who could assist students with special needs, who had wholesome avocational interests and who showed a willingness and ability to work with others. Above all the teachers must meet the educational and work experience requirements for certification.

### Scheduling

This topic deals with the organization of students, teachers and facilities in the most efficient manner so as to meet the objectives of the instructional program. To schedule instructional programs based on objec-

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<sup>5</sup>Ryan, op. cit., p. 20.

tives the following variables must be considered: (1) students enter the program with varying abilities and experiences, (2) students advance at different rates, and (3) students require varying types of instruction.

In scheduling, students, teachers and facilities were the three major controlling factors. Double-periods, rotating and concentration schedule methods were used in this situation to provide the flexibility needed to better accommodate specific types of instructional programs. In doing so the following must be considered:

- a. General objectives of the school
- b. General objectives of curriculum
- c. Specific objectives of the course
- d. Facility and work station utilization
- e. Student population
- f. Instructional staff
- g. Transportation
- h. Unique local situations<sup>6</sup>

#### Organizing Instruction

It was indicated in the literature and the class notes reviewed that the organization of instruction was based on administration and classroom facilities. Administrative responsibilities laid in the efficient management and coordination of such items as finance, instructional media, space, equipment, clerical help, and materials and supplies necessary to meet the objectives of the instructional program. Sound administrative decisions depended upon the validity of data provided by the following considerations:

- a. Number of students offered
- b. Grade level of students
- c. Student characteristics
- d. Staffing requirements
- e. Program changes involved
- f. Availability of needed equipment, facilities, supplies, and materials.

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<sup>6</sup>Ibid.

- g. Date of implementation
- h. Initial and continuing funding
- i. Provisions for education<sup>7</sup>

In the classroom instructional lessons and units must be organized to follow a developmental learning sequence which would be interesting and stimulating to students. The materials and media used must be personalized for the student as much as possible.

Hours of instruction per day were 6 hours, 30 hours from Monday to Friday and 3 hours on Saturday making 33 hours a week. Each term would be 11 weeks, therefore the total hours of instruction per term would be 363. Then for 4 terms, the candidates would spend at Bakura, the grand total hours would be 1452. But actual total instructional hours would be 1188; the remainder would be used for library, field trips, review and tests. The practical periods would be from 8-10 a.m. in a "block", formal lectures in the afternoon, each for a duration of one hour. Assignments would be given to students to work on their own, during either library individual study or their private study period. Then, the investigator would develop course outlines of various subjects. These subjects would constitute the curriculum guide for the school. Each subject would be arranged for school term and is shown on pages 52 through 59. A summary of subjects and hours of instruction is given on page 60.

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<sup>7</sup>Ryan, op. cit., p. 23.

First Term (12 Weeks)

<u>Agronomy</u> Lecture Hours - 22 Lab. Hours - 33	<u>Soil Science</u> Lecture Hours - 22 Lab. Hours - 33	<u>Farm Mechanics</u> Lecture Hours - 11 Lab. Hours - 33	<u>Extension</u> Lecture Hours - 22
Define: Acid, Base Cation, Anion Strong acid Dissociation pH; adsorption Absorption Chemical formulae: of Sulphuric acid Nitric acid Hydrochloric acid Orthophosphoric acid Acetic acid Ammonia Ammonia hydroxide Urea Calcium chloride Calcium sulphate Common fertilizers: 1. Sulphate of ammonia 2. Superphosphate 3. Trisuperphosphate 4. Potassium chloride (Muriate of potash)	Soil texture Soil structure Mechanical analysis Classification of water Movement of water Infiltration Percolation Permeability Retention of water Field capacity Wilting point Soil consistency Plasticity Friability Optimum soil structure Bulk density Specific density Particle density Porosity Structural Management Minimum tillage Soil Organisms Organic matter	Plough Bulls Parts of a plough Hand powered tools Bullock powered tools Carpentry: 1. Construction of orifice 2. Construction of weir 3. Construction of Parshall flume Practice using bullock plough	Extension education concept Theories Motivation Perception Reinforcement Adult learner characteristics Teaching Qualities of good teacher How to teach adults Instructional objectives Audio-visual instructions

## First Term (continued)

Rural Sociology  
Lecture Hours - 11

Marriage systems  
Family systems  
Values of the rural people  
Attitudes of the rural people  
Formal leaders  
Living habit's  
Individual study of the community  
Village system  
Village organization  
Religious influence on social customs  
Customs' influence on extension  
Report of community study

Irrigation  
Lecture Hours - 11

Define irrigation  
History of irrigation  
Importance  
Irrigation in arid regions  
Irrigation in humid regions  
Extent of irrigation  
Future growth  
Source of water

Surveying

Lecture Hours - 11  
Lab. Hours - 33

Chain surveying  
Object of surveying  
Identification, use, care of equipment  
Laying out of rectangular plots  
Causes of errors  
Overcoming obstructions  
Scales and plan drawing  
Drawing and interpretation of maps  
Determination of areas  
Prismatic surveying  
Bearing measurement of angles  
Magnetic variation  
Causes of errors  
Open and close traverse  
Plotting and adjustment of closing errors

Soil Conservation

Lecture Hours - 22  
Lab. Hours - 22

Climate of Nigeria  
Principles of good soil management  
Soil physical properties that affect soil management  
Moisture conservation  
Drainage  
Cultivation  
Grading and terrace layout  
Bench terraces  
Bank terraces  
Grassed waterways  
Factors affecting rate of erosion  
Rainfall  
Slope  
Type of soil  
Gully erosion  
Sheet erosion  
Wind erosion  
Husbandry practices to reduce erosion  
Wind breaks  
Crop rotation  
Strip cropping



## Second Term (12 Weeks)

<u>Agronomy</u> Lecture Hours - 22 Lab. Hours - 22	<u>Soil Science</u> Lecture Hours - 22 Lab. Hours - 22	<u>Extension</u> Lecture Hours - 22 Lab. Hours - 55
Photosynthesis Mineral nutrition Germination Factors affecting growth Growth regulators (Hormones) Auxin Phototropism Geotropism Harvesting Processing Storage	Structure of water Hydrogen bonding Water as a solvent Soil moisture tension Soil moisture constants Moisture tension - Curves Surface tension Soil moisture stress Movement of water through sound channel Movement through clay Movement in furrow Advance and wetting front Saturation zone Transmission zone Wetting zone Wetting front Horizontal movement Vertical movement Measurement of soil water Tensiometers Electric rest. blocks	Co-operative extension Ext. org. and programs Org. and obj. in ext. education Programming process in extension education Basic rules of organization Steps in program planning The influence of the program planner Long time program planning Effective use of visual aids Posters and leaflets Blackboard Flannel graph Flip chart Puppets Radio Television Film Evaluation of effective- ness of teaching

## Second Term (continued)

Irrigation  
Lecture Hours - 22  
Lab. Hours - 22

Soil profile  
Artesian wells  
Confined and unconfined  
Aquifer  
Drilling methods  
Human labor  
Cable tool method  
Water yield of wells  
Draw-down  
Draw-down discharge  
relations  
Pump  
Force  
Work  
Energy  
Power  
Horse pump  
Water horse power  
Brake horse power  
Primitive irr. pumping  
Modern irr. pumping  
Pump characteristics  
Types of pumps  
Centrifugal pumps  
Propeller pumps  
Types of engines  
Intern combustion engines  
Electric motors

Surveying  
Lecture Hours - 11  
Lab. Hours - 33

Leveling  
Definition  
Object of leveling  
Use of dumpy level and staff  
Level books  
Adjustment of level  
Precautions to ensure accuracy  
Plotting of contours on maps  
Pegging contours  
Pegging specified gradients

Horticulture  
Lecture Hours - 22  
Lab. Hours - 22

Production of the following:  
Carrots and root crops  
Cucumber  
Okra  
Lettuce  
Cabbage  
Pepper (chillies)  
Melons  
Ginger  
Herbs  
Trial plots  
Packing and transportation  
Rotations  
Soil sterilization for  
control of nematodes

Third Term (12 Weeks)

<u>Agronomy</u> Lecture Hours - 22 Lab. Hours - 22	<u>Farm Mechanics</u> Lecture Hours - 11 Lab. Hours - 22	<u>Extension</u> Lecture Hours - 22 Lab. Hours - 55	<u>Irrigation</u> Lecture Hours - 22 Lab. Hours - 22
Husbandry practices for the production: Millet Guinea corn Maize Irish potatoes Sweet potatoes Groundnut Cotton Castor oil bean Sugar cane Kenaf	Tractor operating Driving in yard Hitching of implements Service of tractor Checks for the following: Water Oil Fuel Tyres Air cleaner Adjustment of tractor wheels Irrigation implements Ploughs Discplough Moldboard ploughs Harrow Spike-tooth harrows Disc-harrows Scrapers Levelers Inter row cultivator Border making Ditch making Furrow implements	Adoption process Five stages Adopter categories Time lag Characteristics of new practices The diffusion process Attitudes and values Differences in abilities Farm business Cultural factors Situational factors Recognition Ident. of pot. innovators Selection of innovators Incentives Demonstration Result demonstration Method demonstration Package demonstration Supplies of necessary materials	El. hydrology Earth canals Seepage Flumes Tunnels Drops Chutes Siphons Flexible tubing Orifice Weir Advantages Disadvantages Measuring head on weir Limitations Parshall flume Rules for setting and operating weirs Siphon tubes

## Third Term (continued)

<u>Horticulture</u>	<u>Crop Protection</u>	<u>Govt. Regulation</u>	<u>Field Exp.</u>
Lecture Hours - 11	Lecture Hours - 22	Lecture Hours - 22	Lecture Hours - 11
Lab. Hours - 22	Lab. Hours - 22		
Economic importance of tree crops	Diseases	Appoint. procedure	Object of field experiments
Ecology dist. of tree crops	Virus	Permanent staff	Comparison of field exp. and lab.
Domestic and export crops	Bacterial	Daily paid staff	Field variables
Probable future developments	Fungal	Transfer to permanent appointment	Site
Propagation methods	Mechanical damage	Conditions for:	Climate
Nursery practice	Disease vectors	Dismissal	Season
Potting mixture	Plant contact	Resignation	Differences
Germination	Wind	Payment of salaries and allowances	Homogenous population
Potting up	Insects	Rights and privileges	Differences in samples
Planting out	Man	General Orders (G.O.)	Average value
Grafting	Seed born	Financial Instructions (F.I.)	Study of results
Pruning	Control seed hygiene	Public Service Commission	Discussion of probability
Trailing	Removal and destruction of diseased plants	Public service manuals	Need for replication
Harvesting of:	Spraying	Government circulars	Reduction of site errors
Citrus	Rotations	Discipline	Choice of site
Pawpaw	Insect pests	Org. of M.A.N.R.'S.	Topograph
Mango	Examples	Duties and responsibilities	Previous cropping
Banana	General methods of control		Site preparation
Date plum	Chimal methods		Randomized blocks
Guava	Biological methods		Latin square
Cashew	Economical imp.		Replication
	Costs of control		Random sampling
	Problem arising after controlling eg. new resistant strains		

# Fourth Term (12 Weeks)

<u>Agronomy</u> Lecture Hours - 22 Lab. Hours - 33	<u>Extension</u> Lecture Hours - 33 Lab. Hours - 55	<u>Soil Science</u> Lecture Hours - 22 Lab. Hours - 22	<u>Irrigation</u> Lecture Hours - 22 Lab. Hours - 33
Consumptive use Factors affecting consumptive use Measurement Evaporimeter Atmometer Climate related to consumptive use Plant growth relation to consumptive use Frequency of irriga- tion for: Rice Guinea corn Maize Groundnut Cotton Cowpea Onions Tomatoes Irish potato Sweet potato Wheat Lettuce Other vegetables	Co-operative societies Objectives Kinds Co-operative marketing Organizing Running a co-operative society Young farmer's club Purpose Organizing a club Club projects Leadership Concepts of leadership Leadership and personality What type of leader are you The role and development of lay leaders Evaluation in extension Six key of evaluation Social action process Power structure Its application	Alkali soil Elect. conductivity Non-saline alkali soil Saline soil Dispersion Flocculation Movement of salts in the soil Influence of water table Sodium Na <sup>+</sup> Calcium Ca <sup>++</sup> Exchangeable sodium percentage	Methods of irrigation: Surface Uncontrolled Flooding Basins Furrows Borders Sub surface Irrigation efficiencies: Water-conveyance efficiency Water-application Water use Water storage Water distribution Land preparation When to irrigate Depth of root zone Soil moisture removal Choice of irrigation systems Rate of water intake Land elevation (grade) Soil type and depth Crop grown Availability of water Water quality Designing furrow irrigation

Fourth Term (continued)

Field Experimentation  
Lecture Hours - 11

Choice of site  
Land preparation  
Pegging out  
Discards  
Orientations  
Calculation of:  
Seeds  
Fertilizer rates  
Planting  
Germination counts  
Cultural practices  
Weeding  
Spraying  
Cultivations  
Timeliness of operations  
Observation  
Use of log book  
Scouring for pests  
Scouring for diseases  
Recording keeping  
Use of records  
Misuse of records  
Harvesting  
Processing  
Shelling  
Decorticating

Agric. Economics  
Lecture Hours - 22

Nigerian economy  
Roles of natural resources in economic growth  
Agricultural importance in Nigerian economy  
Labor force in agriculture  
Population and economic potential  
Land tenure system  
Water rates  
Cost of maintenance of channels and terraces  
Cost of maintenance of irrigation equipment  
Loans, interests and depreciation costs  
Basic principles of supply and demand  
Basic principles of farm management  
Factors of farm management  
Farm management

Water Quality  
Lecture Hours - 22

What determines water quality?  
Salinity hazard  
Sodium hazard  
Other hazards  
Estimation of irrigation water quality  
How to collect samples of water  
River water  
Well water  
Interpretation of tests  
Light textured soils  
Medium textured soils  
Heavy textured soils  
Conversion factors for irrigation water  
Tolerance of crops to salinity  
Reduction of hazards:  
Tillage  
Leaching excess salts  
Leaching requirements  
Chemicals  
Adequate lowering of water table  
Reclamation and management of saline and alkaline soils  
Irrigation water quality ranks

## SCHOOL OF IRRIGATION AGRONOMY BAKURA

## PROPOSED SYLLABUS FOR CERTIFICATE

## IN IRRIGATION AGRONOMY

Subjects	1st Term		2nd Term		3rd Term		4th Term	
	L	P	L	P	L	P	L	P
Agronomy	22	33	22	22	22	22	22	33
Soil Science	22	33	22	22			22	22
Farm Mechanics	11	33			11	22		
Extension	22		22	55	22	55	33	55
Rural Sociology	11							
Irrigation	11		22	22	22	22	22	33
Surveying	11	33	11	33				
Soil Conservation	22	22						
Horticulture			22	22	11	22		
Crop Protection					22	22		
Government Regulations					22			
Field Experimentation					11		11	
Agricultural Economics							22	
Water Quality							22	
Sub Totals	132	154	121	176	143	165	154	143
Individual Study (Library)	22		22		22		22	
**Visits (Field Trips)					22		22	
Review and Tests	33		33		33		33	

Key

L = Lessons

P = Practicals

Figures give number of hours of lessons

\*\*Visits (field trips) = take place on Saturdays

Total hours of instruction = 1188

## Evaluation

Evaluation is a continuous effort inquiring into the effects of utilizing educational contents and processes according to clearly-defined goals. It is necessary to know what the students had accomplished and secondly to justify expenditure of time, talents and money.

There are two types of evaluation that may be used in this situation. One is the paper and pencil test and other kinds of examinations used during training. These determine grades for awarding certificates. The student assessment system being used in D.A.S.T. is the same paper and pencil test and others. At the end of each term, examinations count for 33 1/3%; class assignments - 33 1/3% and practicals 33 1/3%. Then at the end of course, the six term's work account for 90%, and a general paper 10%. In awarding certificates, the grading is as follows:

70 and above	Grade I (A)
69 - 60	Grade II (B)
59 - 50	Grade III (C)
50	Pass
Below 50	Certificate of attendance**

The second would be follow-up, to determine on-the-job performance. Long-range follow-up involved keeping track of the graduates and keeping records of their employment activities. Candidates would be informed of the evaluation system when they entered the school. During work experience, between first and second year, the evaluation sheet on page 63 would be used to evaluate their field activities. Well trained personnel would handle the records for correct recording, easy accessibility and identification. A comparison of school to job performance would determine the correlation

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\*\*B. O. Ogbole, "Proposed courses for Irrigation Agronomy: Curriculum in Agriculture" (Term paper, submitted to Dr. J. Albracht, Summer, 1972), p. 13. (Mimeographed.)



between grades and actual performance in real life. By doing this, it would be possible to determine if the instruction had been geared to real life. In other words, had the training been successful in making a contribution to rural development.

Evaluation of this type provided up to date information required for curriculum improvement, to see if it is serving societal needs. Thus the effectiveness of the course could be measured. Where the needs for improvements were detected corrective action could be taken.

### Summary

The school philosophy was stated. Then the investigator, using the information and materials obtained from sources mentioned on page 38, developed 14 course outlines. The course outlines, Agronomy, Soil Science, Farm Mechanics, Extension, Rural Sociology, Irrigation, Surveying, Soil Conservation, Horticulture, Crop Protection, Government Regulations, Field Experimentation, Agricultural Economics and Water Quality comprised the guide for the school.

SCHOOL OF IRRIGATION, BAKURA  
EVALUATION OF STUDENTS WORK EXPERIENCE  
BETWEEN FIRST AND SECOND YEAR

NAME OF STUDENT \_\_\_\_\_  
 NAME OF SUPERVISOR AND TITLE \_\_\_\_\_  
 STATION \_\_\_\_\_  
 STATE \_\_\_\_\_  
 DATES: Supervision Began \_\_\_\_\_  
 Supervision Ended \_\_\_\_\_

ACTIVITY	PERFORMANCE		
	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE
1. Always punctual.	_____	_____	_____
2. Has good relationships with colleagues.	_____	_____	_____
3. Takes initiative in preparing for assignments.	_____	_____	_____
4. Has ability to make clear explanations.	_____	_____	_____
5. Has ability to select most appropriate methods and techniques.	_____	_____	_____
6. Has skill in questioning and getting at the base of situation.	_____	_____	_____
7. Arouses interest of clientele by his teaching activities.	_____	_____	_____
8. Shows leadership ability.	_____	_____	_____
9. Understands the individual farm planning process.	_____	_____	_____
10. Understands the Ministry's extension and research programs.	_____	_____	_____
11. Understands purpose and functions of Advisory Council.	_____	_____	_____
12. Gets along well with Young Farmers Club members and understands group/individual/project approach.	_____	_____	_____
13. Exhibits good farmer-staff-student relationship.	_____	_____	_____
14. Has a good attitude toward his assignment and work.	_____	_____	_____

GENERAL COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_

## Chapter 5

### SUMMARY, DISCUSSION, JOB DESCRIPTION AND RECOMMENDATIONS

#### Summary

The purpose of this study was to develop a curriculum guide for the School of Irrigation Agronomy, Bakura. In the literature reviewed the concept of curriculum was identified and curriculum guide defined. The roles played by religion, politics and other elements influencing curriculum development were noted. The three common types of curricular patterns: (1) subject-centered, (2) student-centered, and (3) society-centered served as guides for decision making in developing the Bakura School curriculum. The school's assignment is to provide basic technical knowledge in irrigation agronomy. Hopefully the school would help to cultivate a desire for knowledge in the students and enable them to explore society's needs so they would be able to get along and work effectively. The writer, on the basis of the school philosophy, made certain assumptions concerning the learning process, the needs of the individual student, the social and technical needs of Nigeria and the educational objectives, developed a guide for a four term (12 month) teaching program.

Subject matter areas were obtained from information gathered from the literature reviewed, consultations with administrators, and technical and subject matter specialists. The writer's professional knowledge and four years personal experience as a teacher and as an extension officer in Nigeria and the training acquired in irrigation agronomy and education at Kansas State University gave him useful and valuable insight into the

problem. The subject matter areas covered fourteen major competencies. These were: (1) Agronomy; (2) Soil Science; (3) Farm Mechanics; (4) Extension; (5) Rural Sociology; (6) Irrigation; (7) Surveying; (8) Soil Conservation; (9) Horticulture; (10) Crop Protection; (11) Government Regulations; (12) Field Experimentation; (13) Agricultural Economics and (14) Water Quality. Each subject was further divided into sub units which outlined the content of the course for each particular subject. The subject matter areas and sub units made up the curriculum guide.

Evaluation of technical agricultural training was briefly discussed. The progress of the trainees would be evaluated by paper and pencil tests and other kinds, such as ratings and check lists. The check list developed by the writer would be used by supervisors for evaluation of 3 to 4 months field work experience programs. These evaluations would form the basis for the awarding of certificates. A follow-up for long-range evaluation purposes would be carried out for the purpose of reorganizing and improving the curriculum.

The curriculum guide developed would hopefully provide the trainees with basic technical knowledge in irrigation agronomy. And, as a result, the successful candidates could perform the duties of Irrigation Assistants adequately, properly and enthusiastically.

### Discussion

In Nigeria, agriculture occupies a dominant place, both in the economy and in people's lives. Under adequate rainfall conditions in the south water required for agriculture is normally not a problem. This is not so in the semi-arid regions farther north where growing a successful crop is insecure and precarious. Thus a means of protection against famine must be established. This protection can best take the form of irrigation. In

irrigated farming water must be used both effectively and efficiently whether the supply is limited or excessive.

To assure correct utilization of water resources the intermediate agricultural education and training of extension personnel would be the key element. In intermediate education candidates would be trained as agricultural extension workers to engage in helping farmers and rural people to improve their standards of living. This called for a variety of training which should make an extension worker an effective agent of change. To be effective and successful in teaching irrigated farming methods the extension man should have had a training in irrigation agronomy in the fields of basic soils, crop science and surveying. The combination of these three disciplines with extension methodology and rural sociology were needed to properly equip the candidates for the big task of teaching with the end objective of changing the society.

To achieve the objectives in the basic soil science discipline the writer included in the curriculum the process of soil formation and development of soil horizons; physical and chemical properties of soils; soil organisms and their activities; soil organic matter and plant nutrients; and the need for soil aeration and drainage. The lack of adequate drainage would result in soils becoming saturated with toxic saline and sodic salts which could render the land non-productive. The curriculum included report writing, thereby introducing the candidates to the land capability classification. This was based on economic factors and the availability of farming techniques using the United States Bureau of Reclamation classification for irrigable lands. Also included were the elementary techniques of obtaining soil data to determine feasibility of a potentially irrigable site and/or to evaluate soil limitations.

The crop science syllabus included ancient irrigation practices; fundamental principles of growing specific crops under irrigation; and the design and maintenance of irrigation and drainage structures. The curriculum also included the agronomy of irrigated crops. Methods of record keeping and reporting were included. Other topics described were fertilizer application, methods of determining the basic intake rate of the soil under furrow and border irrigation and the way to control the amount of water to be applied on each field. In addition, recommendations regarding better seeds and proper planting dates to increase production were emphasized.

In order that irrigation field workers could effectively carry out the gathering of necessary investigative and design data instruction would be given in the measurement of distances and use and care of surveying equipment. The guide also covers hydrology, rainfall criteria, estimating rate of runoff, cartography and measurement of flowing water. The course in surveying described in the curriculum would give the candidates sufficient knowledge to enable them to prepare maps and gather data for canal building. They would also be able to stake and construct field ditches, laterals, drainage ditches, prepare a profile survey and lay out plots for land leveling and smoothing operations.

Operating a complex irrigation system carries along with it certain technological and social problems. Ignorance of these could lead to failure and disaster. To help students avoid such situations the writer included courses in extension methodology and rural sociology in the guide and gave special attention to the social and cultural setting in which the new technology would operate. Consideration of the social and economic aspects of the farmer and his community form important parts of the curriculum and must be kept in mind in planning the training, especially field practicals.

Cognizance of these situations should lead to the success of irrigation projects.

The section on the adoption process was designed to teach the candidates how to guide the irrigation project farmer to accept new ideas and concepts. This would hopefully induce the farmer to farm the same land year round and to maintain the fertility of his land through improved practices. Through the process he would learn the importance of timeliness in his farming operations and learn to irrigate when the water was available, whether it was day or night. He would learn to grow crops that were completely new to him and would be largely for sale, not consumption in the home. These changes would be completely strange to the farmer. They may come as great shocks to him, being from a traditional society, and so would require fundamental cultural adjustments. Hence, the importance of rural sociology and extension education was stressed so the trainees would be properly trained to help and guide the farmer through his difficulties.

#### Job Description

In developing the curriculum the investigator kept the present needs of the nation, the rural man and his environments in the foreground and came up with a guide which was oriented towards improving his standards of living, and in the long run, the development of the nation. Thus, in a nut-shell, he had tried to provide a curriculum which would give a comprehensive basic technical knowledge in irrigation agronomy which could be useful to an irrigation agronomist. The guide offers comprehensive courses so the successful candidates can perform the following tasks:

1. Gather soil information and record soil data in reports and on maps using sound soil, water and irrigation practices and accepted methods.
2. Conduct on-the-farm demonstrations of irrigation, water management and agronomic factors involved in crop production under irrigation.

3. Hold group meetings with farmers and assist individual farmers by demonstrating the principles involved in irrigation water management such as schedules of irrigation.
4. Make simple surveys to gather information for planning purposes.
5. Lay out and supervise construction of simple practices related to irrigation in accordance with standards shown in a Technical Guide.
6. Keep notes in accordance with standard methods when equipment for most desirable method is not available.
7. Plot information from field notes by standard methods and to compute acreages and volumes as needed for planning, designing and installing practices.
8. Make simple measurements of flowing using prescribed methods.
9. Supervise construction and installation of both mechanical and vegetative practices to make construction checks to determine those practices that meet the minimum specifications as shown in the Technical Guide and to record findings on appropriate stake sheets and/or in notes.
10. Use instruments such as the dumpy level for simple surveys, the abney level for slope measurement, and the planetable and alidade to prepare base maps; to use alternative methods when equipment for most desirable method is not available.
11. Handle delicate instruments with care and to assist with their maintenance and adjustment.
12. Supervise staff of a lower grade assigned to the project in accordance with accepted principles of personnel management; participate in in-service training activities and carry out a vigorous program of self improvement.

### Recommendations

To achieve the school's objectives and aims the candidates should be recruited from the rural areas so they will be happy and content to live and work among rural people and share their level of life. They will be trained to gain and maintain the respect of the people among whom they would live. In this way a harmonious relationship between the workers and the farmers would be possible. The rural people would accept the extension workers and they have fewer barriers of communication. The candidates should be trained to attain a wide range of skills associated with irrigated farming so they could develop approaches to methods of teaching manual skills with an understanding of the art of communication, both to individuals and groups. To



involve themselves successfully in promoting change and development in agriculture they require the teaching ability of the school master, the skills of the modern farmer, the persuasive capacity of the politician, the understanding of the social worker and infinite patience. Further, it is suggested that they be made aware of the virtue of the grassroots approach to the work they will be performing as well as its vital importance to the development of their country. This training could help graduates identify the rural community, its needs, problems and aspirations. It could make contributions towards development by keeping trained men in rural areas instead of going for white-collar jobs in the cities and towns.

In view of the above statements the institution must be based on indigenous systems. These would fit the specific conditions and needs of the country and incorporate its economic and social problems into the training program. It would avoid "the package deal" approach of setting up an institution based on systems designed to serve different circumstances in a different environment. The immediate problems of the rural community must be taken into consideration. The training structure should be kept as simple as possible and be supplemented by more advanced and specialized courses when and as they are required. The structure should be flexible and related to function, having reference to medium and long-term planning requirements which would make it possible for the graduates to function more effectively in the field. The educational needs should be closely aligned to applied agricultural research and technology. Close links between the applied experimental programs of intermediate institutions and those of the universities must be properly established and maintained. The institution could establish links between research centers and farmers and between farmers and consumers of a limited nature. Hence, strong emphasis should be

placed on practical experience in the applied agricultural sciences and village extension activities. This will acquaint trainees with the need for familiarity and contacts between farmers and scientists.

The educational activities described here should be co-ordinated closely with those of higher agricultural education in the country. This would enable the total system of education and training in the country to gain enormously by having a well-integrated and planned structure that would make maximum use of all available resources. The level of training should be directly linked to the stage of development. Candidates should be kept abreast of new developments as they occur. Subsequent in-service training programs should be established as well. Opportunities should be made available to encourage successful candidates to proceed to the university level later if they merited it.

Above all, for the successful implementation of the guide, the writer recommended that the instructors should have a thorough knowledge of the techniques associated with agricultural production and broad experiences with problems of agricultural development. They require a thorough knowledge and understanding of the rural environments as well.

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## APPENDIX



## Lesson Plans.

### 1. AGRONOMY

#### References

- (1) B. No. 442 Jan. 1962  
Winter Wheat (Kansas)
- (2) Wheat in the Wheat State (Kansas)

Enterprise: Wheat production

Problem: What cultural practices will I follow in growing wheat for my work experience program?

Situation: Most of us have produced wheat on our irrigated plots. But with the importing of wheat flour for bread-making in our country, its production should be taken seriously, and the methods of production should be streamlined and carried out properly to ensure harvest of very good quality.

Objective: To learn cultural practices of wheat production under irrigated farming.

Materials:

- A. Wheat variety recommended
- B. Fertilizer: ammonium sulphate, superphosphate and potash
- C. Plot
- D. Machinery and implements
- E. Water
- F. Granary

Motivation: What is the highest yield in your plot, Amadu? To meet  $\frac{1}{4}$  of the demand of bakers, what yield per acre should we aim at? What are the cultural practices we should carry on plots to expect high yields? How much water will wheat use? At what stage of growth does wheat use water fastest? Is there a period when a critical need for moisture exists? How much water will my

soil hold that will be available for plant?

### PROCEDURE

#### STEPS

#### KEY POINTS

1. Seedbed preparation:
  - A. Start tillage in October to develop nitrates and conserve moisture
  - B. Cultivate the soil early enough in the season to prevent weed growth
  - C. Prepare the plot to a grade of 0.001-0.002
  - D. Make head and drainage ditches
  - E. Prepare 40" rows
2. Selection of seeds:
  - A. Select a high quality seed of adapted variety
  - B. Know the purity and germination percentage - 90%
  - C. Free from weed seeds
  - D. Select clean seed
3. Time and method of applying fertilizer:
  - A. Broadcast superphosphate according to soil test
  - B. Potash may be broad-casted on seedbed and worked into the soil at seeding time
  - C. Sulphate of Ammonia broadcasted and worked into the seedbed before seeding; or at the time of seeding: 50 lb/acre
4. Date to seed wheat:
  - A. Seed at the end of October to have it germinated before the end of first week of November

5. Depth to plant: A. Plant  $1\frac{1}{2}$ -2" deep with good soil moisture
6. Rate to plant: A. Plant 60 pounds per acre
7. Time of irrigating: A. Irrigate in October to wet the soil to a depth of 6 feet before planting  
B. Irrigate when plants are in the boot stage  
C. Irrigate during the milk stage of grain to reduce shriveling
8. Weed control: A. Weed clean
9. Disease and pest control: A. Plant treated seed  
B. Destroy all volunteer wheat  
C. Plow under the wheat stubble early  
D. Plant wheat at the time recommended  
E. Plant resistant varieties  
F. Watch out for grasshoppers and spray two or three sprayer widths into the vegetation to slow the grasshopper migration to the wheat field margin
10. Harvesting and storing: A. Harvest when it is sufficiently mature to store well  
B. Harvest when moisture content is less than 13.5%  
C. Then store in clean granary

#### SUMMARY AND DISCUSSION

My plan for growing irrigated wheat:

1. Have good seedbed preparation.

2. Select seed of high quality.
3. Apply fertilizers at economically proper proportions according to soil test.
4. Plant at correct time, correct depth and the right rate.
5. Weed clean to control weeds.
6. Plant treated seed, resistant variety and destroy all volunteer wheat to control pests and diseases.
7. Harvest, when fully matured and below 13.5% moisture content.
8. The pupils are allowed to have discussions of wheat production in their plots for irrigated farming.

## 2. SOIL SCIENCE

(1) Profitable Soil Management:  
1970 Knuti, Korpi and Hide.

(2) Soils & Crops 10th Ed.  
Successful Farming.

Enterprise: Soils

Problem: What is soil?

Objective: To gain an understanding of the nature of soil.

Materials: A. Soil sample

B. Slides

Motivation: Here is a soil sample

What plants need the soil to grow?

What does it contain?

### PROCEDURE

#### STEPS

#### KEY POINTS

1. Definition of soil:

A. Soil is a mixture of mineral and organic matter that is capable of supporting plant life.

1. Formed as a result of weathering of rocks and minerals and the accumulation of organic matter.

2. Differentiation of clay content between horizons

B. Four principal components.

1. Mineral matter.

a. Sand, silt, clay.

b. Most abundant minerals in earth's crust are silicate and oxide

minerals.

- c. Approximately 90% of mineral matter in soil includes K, Na, Ca, Mg.

2. Organic matter.

- a. Varies from 1-6%
- b. Improves aeration of soils and water holding capacity.

3. Water.

4. Air.

2. Soil profile:

A. Vertical section of soil exposing the layering.

1. Solum.

- a. A-horizon (top-soil) higher in organic matter, darker.
- b. B-horizon (bottom soil) may contain more clay and be different in color.

2. C-horizon (parent material).

3. Soil differences:

A. Parent material.

- 1. Soils are formed as a result of weathering of rocks and minerals and the accumulation of organic matter.
- 2. Particle size-H<sub>2</sub>O capacity, aeration, other physical properties.

B. Topography:

- 1. Soils developed on slopes do not develop as deep solums.

2. Greater differentiation of A and B horizons in level areas.

C. Vegetation.

1. Forest soils-organic matter high in top soil-low in subsoil.
2. Grass soils-high in top soil and decreases gradually with depth.

D. Climate.

1. Warm and humid-rapid weathering, drastic leaching.
2. Cold-slow weathering, high in organic matter content.

E. Time

1. Leaching occurs with time.

4. Function of soil:

A. Supply of plant nutrients.

1. Plants absorb all 15 essential elements in organic form. Soil provides 12 of them: Ca, N, Cu, Fe, Mg, P, Mn, B, K, S, Zn, Mo.

Na and Al are not needed by plants but are absorbed because of their prevalence in soil and are needed by animals.

B. Support for plant.

C. Storehouse of water-fine texture has more capacity for water.

D. Oxygen for root respiration fine texture has less capacity for air.

SUMMARY AND DISCUSSIONSupplementary Activities

1. Field trip
2. The class choose a site and makes a soil profile; and studies it.



### 3. IRRIGATION

#### References

- (1) K.S.U. Bulletin, Agronomy
- (2) Irrigation Farming for Profit

Enterprise: Irrigated farming.

Problem: Irrigation is a big step in a farming operation. Many individuals are unaware of some of the problems they may face, other than money, when using irrigation on their farms.

Situation: Most people are aware of the cost of irrigation, as well as the profits that may be gained. Irrigated land has increased at a steady rate in our area, however are the farmers who have been using it, using properly, and are those farmers who don't have it, are they missing out a great opportunity.

Objectives: To understand some aspects of irrigation which can better utilize your present system or help in setting up a new irrigation program.

Motivation: I have noticed on many irrigation projects, that poor planning and simple neglects have caused many of the projects to lose valuable resources and many pounds.

#### PROCEDURE

##### STEPS

##### KEY POINTS

- |   |   |
|---|---|
| 1. A realization of some of the physical factors involved in irrigation | A. Planting rates increase or decrease according to species.<br>B. The proper use of plant nutrients.<br>C. An awareness of the best varieties available.<br>D. Know the amount of available moisture |
|---|---|

- throughout the season.
- E. Be up to date on the best insecticides and herbicides in your area.
2. A brief insight on the question of to irrigate or not to irrigate:
- A. It is not like raising livestock, you cannot get in easily and then get right back out.
- B. It is a big step that must be thought out carefully.
- C. Can you make proper use of all the resources available, whether you irrigate or not.
3. To stress the importance of water and how it can be used to work for or against you:
- A. Useful water for irrigation can be found in rivers, reservoirs, and wells.
- B. The water supply should be able to supply between 7 and 10 gal. of water per acre. 100 acres equals 700-10,000 gals. per min.
- C. Before drilling a well test the water supply of the neighborhood.
- D. During irrigation test your water supply at least three times.
- E. Water tests are very important without them your soil can become completely ruined.
- F. For water testing send a 4 oz. sample to Institute of Agriculture Research, Samaru-Zaria.
4. To inform the class
- A. Management is your most important resource

of some helpful management hints for dry farming or irrigation:

but is the most difficult for you to analyze objectively.

- B. You must critically analyze your program to determine your true management potential.
- C. Keep accurate and daily records that are analyzed regularly.
- D. Carry a memo pad and pencil.
- E. A good manager changes to new properly tested practices early.
- F. Run your farm like a business not like an experiment farm.
- G. Good managers perform all duties on time and don't have to depend on luck.

5. Advantages and disadvantages of the gravity method:

- A. Advantages:
  - a. Costs less to operate.
  - b. Its distribution is not effected by wind.
  - c. Is satisfactory for soils with a low intake rate.
  - d. Is possible to increase size without reducing work efficiency.
  - e. Handles large heads of water at low cost.
  - f. Provides uniform soil surface for all field operations.
  - g. Increases farm value.

B. Disadvantages:

- a. Requires investment in land grading.
- b. Land grading often alters uniformity.
- c. Requires skilled irrigator to obtain uniform application and distribution of water.
- d. Cannot be used on soils with high intake rates.
- e. Cannot make uniform small applications of water.

SUMMARY AND DISCUSSION

Discussion and questions on information presented. Handouts given out.

#### 4. CROP PROTECTION

##### References:

- (1) School collection.
- (2) Extension Research Liaison  
Section, Bulletin Guide

Enterprise: Entomology

Problem: To identify various insects on field crops for effective control.

Objective: Given insects found on field crops while on a field trip, the students shall be able to identify the pest insects.

Materials: A. Slides  
B. Collection of pest insect specimens.

#### PROCEDURE

<u>STEPS</u>	<u>KEY POINTS</u>
1. The insect pests of wheat:	a. Grasshopper b. Hessian fly c. Weevil d. Army cutworm e. Leaf hopper f. Pea aphid g. Leaf weevil h. Spotted aphid i. Variegated cutworm j. Stem maggot k. Beetle
2. What soil insects attack corn?	a. Corn-rootworm b. Cutworm

- c. Maize billbug
  - d. Seed corn beetle & maggot
  - e. Wire worm
  - f. White grub
- 3. Other insects that harm corn:
  - a. Chinch bug
  - b. Corn earworm
  - c. Corn flea beetle
  - d. Corn leaf aphid
  - e. Corn rootworm adult
  - f. Stem borers
  - g. Armyworm
  - h. Grasshopper
- 4. The insects of guinea corn:
  - a. Leaf aphid
  - b. Stem borers
  - c. Greenbug
  - d. Beetle
  - e. Earworm
  - f. Armyworm
  - g. Bug
  - h. Webworm
  - i. Wireworm
  - j. Fly
  - k. Sorghum midge
  - l. Mites

#### SUMMARY AND DISCUSSION

The students will be able to correctly identify the insects, collect and prepare for preservation. Then, they will learn how to control them.

PROPOSED CURRICULUM GUIDE FOR SCHOOL OF  
IRRIGATION AGRONOMY, BAKURA, NORTHERN NIGERIA

by

BARTHOLOMEW OCHIGBO OGBOLE

B.Sc. (Agriculture) Ahmadu Bello University, Zaria, 1968

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AN ABSTRACT OF A MASTER'S REPORT

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The purpose of this study was to develop a curriculum guide for the School of Irrigation Agronomy, Bakura in the northern states of Nigeria. In the literature reviewed the concept of curriculum was identified and a curriculum guide defined. The roles played by religion, politics and other elements in influencing curriculum development were noted. The three common types of curricular patterns: (1) subject-centered, (2) student-centered, and (3) society-centered served as guides for decision making in developing the Bakura School curriculum. The school's assignment is to provide basic technical knowledge in irrigation agronomy. Hopefully the school would help to cultivate a desire for knowledge in the students and enable them to explore society's needs so they would be able to get along and work effectively, while working to improve the society. The writer, on the basis of the school philosophy, made certain assumptions concerning the learning process, the needs of the individual student, the social and technical needs of Nigeria and the educational objectives, developed a guide for a four term (12 month) teaching program.

Subject matter areas were obtained from information gathered from the literature reviewed, consultations with administrators, and technical and subject matter specialists. The writer's professional knowledge and four years personal experience as a teacher and as an extension officer in Nigeria and the training acquired in education and irrigation agronomy at Kansas State University gave him a useful and valuable insight into the problem. The subject matter areas covered fourteen major competencies. These were: (1) Agronomy; (2) Soil Science; (3) Farm Mechanics; (4) Extension; (5) Rural Sociology; (6) Irrigation; (7) Surveying; (8) Soil Conservation; (9) Horticulture; (10) Crop Protection; (11) Government Regulations; (12) Field Experimentation; (13) Agricultural Economics and (14) Water



Quality. Each subject was further divided into sub units which outlined the content of the course for each particular subject. The subject matter areas and sub units made up the curriculum guide.

Evaluation of technical agricultural training was briefly discussed. The progress of the trainees would be evaluated by paper and pencil tests and other kinds, such as ratings and check lists. The check list developed by the writer would be used by supervisors for evaluation of 3 to 4 months field work experience programs. These evaluations would form the basis for the awarding of certificates. A follow-up for long-range evaluation purposes would be carried out for the purpose of reorganizing and improving the curriculum.

The curriculum guide developed would hopefully provide the trainees with basic technical knowledge in irrigation agronomy. And, as a result, the successful candidates could perform the duties of Irrigation Assistants adequately, properly, and enthusiastically.