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# Pond Water Management Modules and Students 'acquisition of Skills in Fish Culture in Secondary Schools in Uyo Local Government Area for Sustainable Food Security

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***Abstract***
*The study was conducted to determine the pond water management modules and students acquisition of skills in fish culture and sustainable food security in secondary schools in Uyo Local Government Area of Akwa Ibom. Five objectives, five research questions and five null hypotheses were guided the study. Quasi experimental, Pre-test, post-test non-randomized control group design was adopted for the study. The population for the study was 6,058 SS11 students offering agricultural science in secondary schools in the four clans in Uyo Local Government Area. The schools were sampled based on availability of fish pond culture facilities or closeness to location of fish pond and qualified agricultural science teachers to handle the subject. Four secondary schools were sampled using balloting technique and a total of 200 students were used for experimentation and control. Pond water management instructional package (PWMIP) and pond water management skills acquisition test (PWMSAT) divided into six sections A-E was developed and used to generate data for the study. The instrument was validated by three experts from the University of Uyo. Test- retest method was utilized and treated to Cronbach Alpha statistics which yielded a reliability coefficient of .94. Mean deviation and analysis of covariance were used to analylized data obtained. The hypotheses were tested at 0.05 level of probability. The results revealed that there is significant difference on the students' skills acquisition level in pond water fertilization, pond water temperature control, pond water depth determination, identification of features of polluted pond water and drainage of polluted pond water between students taught with the used of instructional module and those taught with conventional strategies. Based on the findings, it is recommended that state government and state secondary school board should provide adequate fish pond facilities to public secondary schools to enhance students' skills acquisition development in fish culture for sustainable food security.*

**Key Words*:*** Pond Water Management, Skill Acquisition, and Sustainable Food Security.

## Introduction

Pond is a body of standing water, which may be natural or man-made. Naturally it may arise from flood plains as part of a river system or from an isolated depression (FAO, 2000). Pond contains shallow water with marsh aquatic plants and animals. Some ponds are created for habitat restoration, aesthetics, and ornamentation as landscape or architectural features (FAO, 2009). One of the most important features of ponds is the presence of standing water which provide habitat for wetland plants and animals. Such plant and animals include water lilies, frog, turtles and herons (Hughes, 2003). Cereghino, Biggs, Oertli and Declerck (2008), gave formal definition for pond as bodies of water where light penetrates to the bottom

of water body, and bodies of water shallow enough for rooted water plants to grow throughout. Pond according to Keddy, (2010), can result from the wide range of natural processes, such as depression in the ground which collects and retains sufficient amount of precipitation. Such depression can be formed by a variety of geological and ecological processes. A fish pond is defined as an artificial structure used for the farming of fish. It is filled with fresh water, is fairly shallow and usually non-flowing. Pond fish culture refers to the farming and husbandry of fish under control or semi-controlled condition. A fish pond is a controlled pond, artificial lake or reservoir that is stocked with fish and is used in aquaculture for fish farming or is used for recreational fishing or for ornamental purposes. (Iwena, 2008), the fish pond in this work explains the artificially constructed structures using concrete with the following dimension of 3 x 5 x 1.5m. Fish ponds are of different types, kinds and sizes and have to be managed for derivation of benefits.

Fish could be reared naturally in the pond water; the fish pond source of water is directed into the pond for purposes of culturing fish. Fish pond can be done using plastic containers, earthen pond, drums, and all forms of containers depending on the size and purpose of rearing the fish. The establishment and management of fish pond is a component of the secondary schools curriculum but, it is rather observed that, the majority of secondary schools in Uyo Local Government area are yet to teach fish pond and management and a few also establish and manage fish ponds. It is doubtful if the students who are supposed to be beneficiaries are exposed to practical experiences not to talk of acquisition of skills for managing pond water in fish pond culture at satisfactory levels.

Pond water management is therefore, meant to ensure the physical, chemical and the biological suitability of pond water for controlling of growing fish. Ogundari and Ojo (2009), described that pond water management is the manipulation of water bodies to achieve desired results in growing fish to a marketable size at the shortest possible time and at the least cost. Okaeme (2011) described pond water management as an act of keeping fish in captivity and feeding them to grow to mature size for sale, consumption or for some other purposes. Some of the selected pond water management practices include pond water fertilization, pond water temperature control, pond water depth maintenance, identification of polluted pond water, and drainage of polluted pond water.

A module is explained by Olaitan and Ali (1997) as a unit of related skills arranged sequentially to be used in teaching a group of learners within a given time. A module represents a training package arranged in units of related skills used for transferring skills to the trainees in a specified area. Modules lend themselves to training in bits and reduce training periods (Onuka 2006). The objectives contents and methodology are represented at a glance in a concise form for the trainer and trainees to ensure that they are participating effectively in the training programme. Yabani (2006) further conceived a module as a body of knowledge and skills capable of being utilized on its own for training purposes. It is expected that the correct use of modules for pond water management are bound to make training effective.

Pond water fertilization is the application of fertilizers either organic or inorganic to the pond. Food and Agricultural Organization (FAO, 2007), stated that the reasons for fertilizing the pond are to increase fish yield and also stimulate the growth of microscopic plants such as algae or planktons. Pond water temperature control is designed to control the degree of hotness or coldness in the body of the living organism in the pond, temperature very important in pond water management because it determines the rate of metabolism of aquatic organisms. It also plays a vital role in the production of fish food in the pond ecosystem and ultimately in the production of fish. Pond water depth is the relative acceptable level of water in the pond. The water depth is usually 30 cm at the shallow end and 1m or 0.5-1.0m at shallow end slopping to 1.5-2.0m at the drain end. Polluted pond water can be identified by fish farmers when some of the fishes show changes in their behaviour, fishes usually gasp at the surface, also hang motionless in the water, lay on the pond floor or jump out, the colour of the pond water will turn to milky instead of green. Lastly, the pond water will change and become slippery. (Food and Agricultural Organization FAO, 2005). Drainage of polluted pond water is the process of removing harmful substances from the pond water that might cause problem to the health of the fishes in the pond. These pollutants are substances like domestic effluent, oil, industrial wastes, organic and inorganic fertilizers that are toxic to fish and eventually could cause economic loss fish farmers National Agricultural Extension and Research Liaison Services (NAERLS, 2003).

Fish culture is defined as the production of fish and other aquatic resources in which the cycle breeding, feeding, culturing and protecting are virtually controlled by man in contrast with the capture fishery where the wild stock of fish are harvested (FAO, 2000). Adalija, (2004), defined fish culture: fish culture as involving the raising of fish commercially in tanks or enclosure usually for food and also for the growing of improved variety of fish having good taste, cultured in small and controlled water body under controlled conditions and management, fish culture is therefore an enclosure (earthen or concrete) built to retain water for the purpose of growing fish to table-size for household consumption and for sale to generate additional income. Culturing fish in ponds from which they can rarely escape allows feeding, breeding, growing and harvesting of fish in a well-planned manner. Fish pond constructed in a proper way and managed under controlled conditions gives the highest possible fish production with respect to the size of pond or reservoir (FAO, 2007).

The high production costs forces one to fetch high market price in order to make the fish culture economically to attain sustainable food security, sustainable food security is therefore can defined as an access by all people at all times to enough food for an active healthy life at present plus the ability to provide enough for future generation. Sustainable food security has been defined in various ways by different scholars. According to World Health Organization (WHO) (1995) and FAO, (2013) food security is access to the food needed by all people to enable them live a healthy life at all times. A country is said to be food secured when there is access to food of acceptable quantity and quality consistent with decent existence at all times for the majority of the population (Reutlinger, 1985; Idachaba,

2004). This means that food must be available to the people so as to meet the basic nutritional standard needed by the body. But it should be noted that availability of food does not mean accessibility to food. Availability depends on production, consumer prices, information flows and the market dynamics. Abudullahi (2008) defined sustainable food security as when people have physical and economic access to sufficient food to meet their dietary needs for a productive healthy life at present as well as in the future.

Absence of food security is food insecurity; food insecurity on the other hand represents lack of access to enough food and can either be chronic or temporary. FAO (2010) refers to food insecurity as the consequences of inadequate consumption of nutritious food bearing in mind that the physiological use of food is within the domain of nutrition and health. When individuals cannot provide enough food for their families, it leads to hunger and poor health. Poor health reduces one's ability to work and live a productive healthy life. Poor human development destabilizes a country's potential for economic development for generations to come (Otaha, 2013).

In some secondary schools in Uyo Local Government Area, though, fisheries is there in their curriculum to be thought as a topic in agricultural science, it is only the theoretical part of it the students are learning, the schools could not establish fish ponds. This is as a result of not having a well-equipped genetic laboratories where research can be carried out on the production of genetically improved species of fishes, poor management skills, inadequate supply of quality seeds, lack of capital, high cost of feeds, faulty data collation, lack of environment impart consideration and marketing of products and poor security. Fish culture is benefiting activities as it extend into several direct and indirect benefits; fish culture provides a new commercial avenue, opens job opportunities to the masses, generates foreign exchange, useful in the area of research work and other educational purposes and also provides easy digestible protein-rich food, which helps in improving nutritional status of the masses.

**Statement of the Problem**

Fish is an important source of protein and the consumption rate is very high. Every home virtually uses fish as an important condiment in food preparation. Despite this importance, the production rate is very low at least to complement other sources of protein. For increase production, fish culture has to be taught in schools since it is embraced in schools curriculum and taught in schools so that students after graduation should choose fish culture as one of the occupational areas he or she may be interested in. Osimen, (2008) has opined that students' skills acquisition is an occupational task depending basically on integration of theoretical knowledge and field practicals. The basic curricular activities outlined for practical agriculture includes skills acquisition in secondary schools. This will make students proficient in fish culture and other agricultural related activities to secured food sustainability. Despite the provisions made for practical activities in secondary schools in Uyo Local Government Area with the combination of theoretical knowledge in the teaching and learning of fish culture, coupled with its favourable environment supporting fish culture in ponds

(concretes, earthen, plastics or any device), students still have the problem of acquiring skills in fish pond culture and there is no hope for increased fish productivity.

The researchers has observed the challenges faced by the Secondary School Students in the teaching and learning of fish culture, which are the management of water resource, the insufficiency of fish culture facilities for practicals among others. The teachers and the students seems to have lost interest in fish culture practicals to complement the classroom instructions for the internalization of relevant experiences in pond management to boost food security, such as pond water management, such experience would provide complete and effective process that would enhance fish culture skills among the students. Water is the major facility for pond culture and therefore, the knowledge of managing the resource becomes imperative. It therefore, becomes necessary to establish the level of acquisition of relevant pond water management skills for the production of fish by the students. One is forced to ask, are pond water management skills well taught in secondary schools? Could one increase the rate of fish production using fish culture activities to ensure food security, hence the study.

**Purpose of the Study**

The purpose of this study is to determine the level of students' acquisition of skills in pond water management for fish culture in Secondary Schools in Uyo Local Government Area for sustainable food security. Specifically, the study seeks to:

1. Determine students' skills acquisition level in pond water fertilization in fish culture.
2. Determine students' skills acquisition level in pond water temperature control in fish culture.
3. Determine students' skills acquisition level in pond water depth determination in fish culture.
4. Determine students' skills acquisition level in the identification of features of polluted pond water in fish culture.
5. Determine students' skills acquisition level in the draining of polluted pond water in fish culture.

**Research Questions**

The study seeks answers to the following research questions:

1. What is the students' skills acquisition level in pond water fertilization in fish culture?
2. What is the students' skills acquisition level in pond water temperature control in fish culture?
3. What is the students' skills acquisition level in pond water depth determination in fish culture?
4. What is the student's skills acquisition level in identification of features of polluted pond water in fish culture?
5. What is the students' skills acquisition level in draining of polluted pond water in fish culture?

**Null Hypotheses**

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

**$H_{O1}$** There is no significant difference in the students' skills acquisition level in pond water fertilization between students taught with the instructional package and those taught with the conventional method.

**$H_{O2}$** There is no significant difference in the students' skills acquisition level in pond water temperature control between students taught with the instructional package and those taught with the conventional method.

**$H_{O3}$** There is no significant difference in the students' skills acquisition level in the pond water depth determination between students taught with instructional package and those taught with the conventional method.

**$H_{O4}$** There is no significant difference in the students' skills acquisition level in the identification of features of polluted pond water between students taught with instructional package and those taught with the conventional method.

**$H_{O5}$** There is no significant difference in the students' skills acquisition level in the drainage of polluted pond water between students taught with the instructional package and those taught with the conventional method.

**Methodology**

The study was quasi experimental pre-test, post test non randomized control group design and the study was conducted in Uyo Local Government Area of Akwa Ibom State. The population of the study consists of 6,058 Senior Secondary II (SSII) students offering Agricultural Science in the Secondary Schools in the four clans of Uyo Local Government Area namely Etoi, Offot, Ikono and Oku, (State Secondary Education Board, SSEB, 2013). The sample size of two hundred students were selected and used for the experimentation and control. From each clan the schools were selected based on the following criteria, there must be availability of fish culture facilities or closeness to location of the pond, there must be qualified agricultural science teachers to handle the subject. A total of four secondary schools were randomly selected by balloting to take part in the study. Two researcher developed instrument were used for the study namely; Pond Water Management Instructional Package (PWMIP) and Pond Water Management Skills Acquisition Test (PWMSAT). Pond Water Management Instructional Package contains the concepts and practices in pond water management. The students were exposed to the instructional situation (experiment) while Pond Water Management Skills Acquisition Test (PWMSAT) was used for testing the student's levels of skills acquisition. The instrument was subjected to content and construct validation by three experts in the faculty of education. The instrument was served to 20 respondents who did not take part in the study; but in the same study area. Their responses were coded for analysis. Test- retest method was used to arrange the responses and treated to Cronbach Alpha Statistics. The analysis gave a reliability coefficient of .94; the instrument was therefore regarded as being suitable to collect the required data

**Experimental Procedures (Data Collection)**

**Nature of the Treatment**

The intact class was exposed to theoretical knowledge and field practical activities on pond water management in fish culture. The experimental group was treated with the package while the control group was taught the pond water management processes using expository strategy.

**Data Analysis**

The research questions were answered using mean, while the null hypotheses were tested at 0.05 alpha levels using analysis of covariance

**Testing of Null Hypotheses**

**Null Hypothesis 1:** There is no significant difference in the students' skills acquisition level in pond water fertilization between the students taught with the instructional modules and those taught with the conventional method.

**Table 1:** Analysis of covariance for students taught with pond water fertilization instructional modules and those taught with the conventional method.

| **Source** | **SS** | **df** | **Ms** | **$F_{cal}$** | **$F_{cri}$** |
|---|---|---|---|---|---|
| Covariate **(Pretest)** | 55.38 | 1 | 55.38 | 4.27 | 3.89 |
| **Main Effect** | | | | | |
| Between groups | 235.50 | 1 | 235.50 | 18.17 | 3.89 |
| Within groups | 2566.08 | 198 | 12.96 | | |
| Total | 2801.58 | 199 | | | |

*N = 200, *significant p<.05*

The result of the analysis as shown on table 1 indicates a significant difference in the performance of students taught with the use of instructional modules and those taught with conventional classroom strategy. The F- critical was 3.89 while the calculated F-value of 18.17 was seen to be significant at .05 level of probability and degree of freedom of 1and 198. The hypothesis is therefore rejected. This means that there is significance difference in students' skills acquisition level in pond water fertilization between students taught using instructional modules and those taught with conventional method.

**Null Hypothesis 2:** There is no significant difference in the students' skills acquisition level in pond water temperature control between the students taught with the instructional modules and those taught with the conventional method.

**Table 2:** Analysis of covariance for students taught with pond water temperature control instructional modules and those taught with the conventional methods.

| Source | SS | df | Ms | $F_{cal}$ | $F_{cri}$ |
|---|---|---|---|---|---|
| Covariate (Pretest) | 63.85 | 1 | 63.85 | 5.57 | 3.89 |
| **Main Effect** | | | | | |
| Between groups | 293.38 | 1 | 293.38 | 25.60 | 3.89 |
| Within groups | 2269.08 | 198 | 11.46 | | |
| Total | 2562.46 | 199 | | | |

*N = 200, *significant p<.05*

The result of the analysis as shown on Table 2 indicates a significant difference in skills acquisition level on pond water temperature control between the students taught with instructional package and those taught with conventional strategy. The F- critical was 3.89 while the calculated F-value of 25.60 was significant at .05 level of significant and at degree of freedom of 1, 198. The hypothesis is therefore rejected. This means that there is significance difference in students skills acquisition level in pond water temperature control between students taught using instructional modules and those taught with conventional classroom strategy.

**Null Hypothesis 3:** There is no significant difference in the students' skills acquisition level in pond water depth determination between students taught with the instructional package and those taught with the conventional method.

**Table 3:** Analysis of covariance for students taught with pond water depth determination instructional package and those taught with the conventional method**.**

| Source | SS | df | Ms | $F_{cal}$ | $F_{cri}$ |
|---|---|---|---|---|---|
| Covariate (Pretest) | 97.83 | 1 | 97.83 | 6.73 | 3.89 |
| **Main Effect** | | | | | |
| Between groups | 236.92 | 1 | 236.92 | 16.30 | 3.89 |
| Within groups | 2876.94 | 198 | 14.53 | | |
| Total | 3113.86 | 199 | | | |

*N = 200, *significant p<.05*

The result of the analysis as shown on Table 3 indicates a significant difference in the performance of students taught with the use of instructional modules package and those taught with conventional method. The F- critical was 3.89 while the calculated F-value of 16.30 is significant at .05 level of significant and degree of freedom of 1, 198. The hypothesis is therefore rejected. This means that there is significance difference in students' skills acquisition level in pond water depth determination between students taught using instructional package and those taught will conventional method.

**Null Hypothesis 4**

There is no significance difference in the students' skills acquisition level in the identification of features of polluted pond water between students taught with the instructional modules and those taught with the conventional method.

**Table 4:** Analysis of covariance for students taught with identification of features of polluted pond water instructional package and those taught with the conventional method.

| Source | SS | df | Ms | $F_{cal}$ | $F_{cri}$ |
|---|---|---|---|---|---|
| Covariate (Pretest) | 47.27 | 1 | 47.27 | 4.65 | 3.89 |
| **Main Effect** | | | | | |
| Between groups | 376.60 | 1 | 376.60 | 37.03 | 3.89 |
| Within groups | 2013.66 | 198 | 10.17 | | |
| Total | 2390.26 | 199 | | | |

*N = 200, *significant p<.05*

The result of the analysis as shown on Table 4 indicates a significant difference in the performance of students taught with the use of instructional modules and those taught with conventional method. The calculated F-value of 37.03 was significant at .05 level of significant and degree of freedom of 1, 198, while the F- critical was 3.89. The hypothesis is therefore rejected. This means that there is a significance difference in the students' skills acquisition level in identification of polluted pond water between students taught with the use of instructional modules and those taught with the conventional method.

**Null Hypothesis 5**

There is no significant difference in the students' skill acquisition level in the drainage of polluted pond water between students taught with instructional modules and those taught with the conventional method.

**Table 5:** Analysis of covariance for students taught with the drainage of polluted pond water instructional modules and those taught with the conventional method.

| Source | SS | df | Ms | $F_{cal}$ | $F_{cri}$ |
|---|---|---|---|---|---|
| Covariate (Pretest) | 68.69 | 1 | 68.69 | 6.88 | 3.89 |
| **Main Effect** | | | | | |
| Between groups | 234.00 | 1 | 234.00 | 23.45 | 3.89 |
| Within groups | 1966.14 | 198 | 14.53 | | |
| Total | 2200.14 | 199 | | | |

*N = 200, *significant p<.05*

The result of the analysis as shown on table 5 indicates a significant difference in the performance of students taught with the use of instructional modules and those taught with conventional classroom strategy. The calculated F-value of 23.45 was significant at .05 level of significant and degree of freedom of 1, 198, while the F- critical was 3.89. The hypothesis is therefore rejected. This means that there is significance difference in the students' skills

acquisition level in the drainage of polluted pond water between students with the use of instructional modules and those taught with conventional method

**Conclusion**

Based on the data analyzed and findings of the study, the following conclusions were drawn:

The students required skills in pond water fertilization, temperature control, pond water depth determination, identification of features of polluted pond water and drainage of polluted pond water in secondary schools in Uyo Local Government Area of Akwa Ibom State. Besides there is a significant difference on students skills acquisition level in pond fertilization, pond temperature control, pond depth determination, identification of features of polluted pond water and drainage of polluted pond water between students taught with instructional package and those taught with conventional method.

**Recommendations**

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

1. The state secondary Education Board and other stake holders in education should assists all public schools by providing adequate fish pond and facilities to enhance students' skills acquisition development in fish culture.
2. The state government should organize workshops, in-service training programmes and seminars for Agricultural science teachers in public secondary schools to update their knowledge in fish farming skills.
3. The curriculum planners should introduce the use of instructional modules in all public secondary schools and this will enhance teaching and learning.
4. Enlightenment through workshops and seminars by the state government on fish culture skills acquisition should be organize for students and these will help and encourage the students to develop a deep interest so as to acquire skills and become self-reliance after graduation.

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