

AQUACULTURE PRODUCTION FOR SUSTAINABLE SKILLS DEVELOPMENT AMONG PUBLIC SECONDARY SCHOOL STUDENTS IN RIVERS STATE

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Abstract

The study investigated aquaculture production in enhancing sustainable skills development among public secondary school students in Rivers State. Three research questions and three hypotheses guided the study. The study adopted a descriptive survey design, the population of the study was 450 (agricultural science student and teachers drawn from six kingdoms in Ogoni. These schools were selected based on availability of Agricultural science teachers, practical agriculture involvement and Accessibility spread across the six kingdoms of Ogoni. The target population is 400, The sample size for the study was 400 using stratified random sampling technique to select respondents. The instrument for data collection was a self-structured questionnaire designed titled Aquaculture production for sustainable skills development (APSSD) in a 4-point rating scale of low extent (1) high extent (4) the reliability of the instrument was established using the test-retest method using Pearson's correlation which yielded ($r = 0.81$). data was analyzed using mean and standard deviation with a criterion mean value of 2.50 and above while a z-test statistical tool was used to test the null hypotheses at a significance level of 0.05. Finding revealed that aquaculture production significantly enhances students' general skills, including team work, entrepreneurship and sustainable farming practices students also demonstrated a high level of competence in pond construction, water regulation and maintenance practices. Furthermore, while students showed positive outcomes in egg fertilization skills, the results suggest the need for more advanced, hands-on training hatchery operations. The study recommends that aquaculture is available tool for vocational and life skills development in secondary schools and also recommends its full integration into the agricultural science curriculum through practical-based learning, teacher training and provision of functional aquaculture infrastructure in schools.

Keywords: Aquaculture, Acquisition, Agricultural Education, Skills, Sustainable

Introduction

Nigeria's agricultural education landscape is evolving rapidly to meet both employment needs and sustainable development needs and sustainable development goals. One vital sector contributing to this evolution is aquaculture. Aquaculture the controlled cultivation of aquatic organism not only supports food security but also serves as a platform for imparting practical, technical and entrepreneurial skills to secondary school students (FAO, 2021). In Rivers State a region endowed with water bodies and aquatic biodiversity integrating aquaculture into secondary education could bridge the skill gap among youths and prepare them for sustainable livelihoods (Olaoye 2022). Despite its potential, aquaculture has not been fully explored in formal school settings, yet initiatives like the West Africa Agricultural Productivity Programme (WAAPP) have shown that school – based fish farming projects significantly improve student's skills in fish breeding, pond construction and farm management (Ibeun, 2020). Aquaculture has emerged in Nigeria as both a livelihood strategy and an educational resource. In Rivers State, institutions like Rivers State Agricultural Development programme (est. 1988) and Songhai Rivers initiative forum have supported youth centered fish farming and training efforts. National programs (for example WAAPP) have successfully integrated aquaculture into secondary school curricula to build entrepreneurial and technical skills, Aquaculture plays a key role in job creation and income generation. According to Nwafor and Onwudiwe (2021) Integrating aquaculture into education enables young people to acquire real-world entrepreneurial and technical competencies. This consistent with the findings of Adekunle (2020). Who observed that students exposed to aquaculture production are more confident and motivated to pursue careers in fish farming according to Aleru. and Lazarus (2021). Students are admitted into vocational Agricultural education programs each year with a diversity of ability ambitions, training and expectations pond construction and maintenance skills is a foundational skill in aquaculture education. A study by Eze and Ugwu (2021) in Enugu state showed that 89% of youth respondents identified skills in pond layout, embankment design and water regulation as essential for self – employment in aquaculture similarly, Olalekan (2023), noted that when students are training in pond maintenance, water testing and disease control, their engagement and retention increase. According to Lazarus and Aleru (2025) fishing sector is the only division of fisheries where its output is easily determined by the type of capturing system used. In Nigeria today, fishing has provided economic, social and environmental benefits by strengthening relationship between the rural communities and the consumers, decreasing dependence on Government for white collar job and also provide security to our economy and culture. However, the increase in world production and change in diet demand a large, more reliable and expensive supply of animal protein and fish products, Egg fertilization is a more technical aspect of aquaculture that involves understanding breeding behavior, selecting brood stock and ensuring successful spawning research by Ibeun (2020) emphasized that public school student exposed to hatchery training could describe the process of fertilization monitor egg hatching and handle fry development with guidance when fish are harvested they need some preprocessing so they can be delivered to the next part of the marketing chain in a fresh and undamaged condition this means that fish caught needs handling

so they can be stored safely until the fish is on the shore Research by Lazarus and Aleru, (2025), emphasized that marketing of fish involves all the activities in the flow of fish or fish products the target of marketing is usually to close the gap between areas of fish scarcity and abundance with profit, Nigeria's agricultural education curriculum has undergone several revision to align with modern agricultural trends one of which is aquaculture. According to Ofoefuna and Umeh (2018) aquaculture is one of the fastest growing segments of the agricultural sector, offering employment and nutritional benefits. In Rivers State a coastal region with a rich aquatic ecosystem, aquaculture holds immense potential for youth empowerment, the inclusion of aquaculture production in the secondary school agricultural curriculum provides a dual advantage, academic knowledge and practical experience, the United Nations Sustainable Development Goals (SDG₂ and SDG₄) advocate for zero hunger and quality education, this journal contextualizes aquaculture production as a bridge between agricultural education and skill development, particular among secondary school students in Rivers state, who must be prepared for self-employment in a fluctuating job market.

The global demand for fish and other aquatic products has led to a rapid expansion of aquaculture, making it one of the fastest-growing food production sectors worldwide, Agricultural science at the secondary school level in Nigeria is designed to prepare students for both further education and self-reliant life through skill acquisition. According to the Nigerian Education Research and Development Council (NERDC, 2013) practical agriculture including aquaculture is emphasized in the curriculum yet in many secondary schools, agricultural science remains largely theoretical due to inadequate teaching aids, lack of facilities and poor teacher preparation, Aquaculture is defined by FAO (2021) as the farming of aquatic organisms under controlled conditions for human use. In Nigeria the rapid depletion of natural fish resources has intensified the need for aquaculture as a sustainable alternative Agric Science has evolved to include aquaculture components especially within vocational subjects according to Adebayo and Adedokun (2017) agricultural science should serve as both a scientific discipline and a skill-based field that promotes hands on learning, especially in fish farming which has high income and employment potential Olaitan and Omomia (2014) emphasized that many secondary schools in Nigeria lack the facilities and trained teachers needed to deliver effective aquaculture education. The food and Agriculture Organization (FAO, 2021) noted that aquaculture has the capacity to generate income, improve nutrition and reduce pressure on over exploited fisheries when integrated into school systems it can create awareness of environmental sustainability and economic salience among youths. According to Nwogu and Ede (2020) teaching aquaculture not only empowers students with skills but also instills values such as environmental stewardship and innovation all of which are key to sustainable development, challenges in implementing Aquaculture in secondary schools despite its potential several challenges hinder the effective implementation of aquaculture, there is the issue of inadequate infrastructure, many schools lack fish ponds, hatchery equipment and basic farm tools secondly there is a dearth of qualified teachers who possess both academic and technical know-how in aquaculture. Onuoha (2020) identified insufficient funding, lack of teaching aids and poor curriculum implementation as critical challenges facing aquaculture

education in Nigeria schools, in addition he noted that student's attitudes toward agriculture are often negative due to the perception that it is labor-intensive and unprofitable thus requiring rebranding and innovation in delivery. Could this be the bases on which students exposes to aquaculture production can develop competencies in pond construction, fish feeding water quality management, harvesting, processing and marketing skills not only vital for personal development but also contribute to student goals of empowerment? Thus the study evaluates the extent to which aquaculture production enhances sustainable skill development among public secondary school students in Rivers State with focus on general awareness pond construction and maintenance, and egg fertilization.

The main objective of the study is to investigate the extent to which aquaculture production contributes to sustainable skills development among public secondary school students in Rivers State, specifically the study seeks to

1. Assess the extent to which aquaculture production enhances skills development among public secondary school students in Rivers State.
2. Determine the extent to which fish pond construction and maintenance skills are enhanced through aquaculture production among public secondary school students in Rivers State.
3. Examine the extent to which fish breeding, hatchery management and fingerling production skills are enhanced through aquaculture production among public secondary school students in Rivers State.

For the purpose of the study, the following research questions were considered to aid the study

1. To what extent does aquaculture production enhance sustainable skills development among public secondary school students in Rivers State?
2. To what extent does aquaculture production enhance fish pond construction and maintenance skills among public secondary school students in Rivers State?
3. To what extent does aquaculture production enhance fish breeding, hatchery management and fingerling production skills among public secondary school students in Rivers State?

The following null hypotheses were postulated and tested at 0.05 level of significance to guide the study.

Ho1: There is no significant difference in the mean ratings of respondents on the extent to which aquaculture production enhances sustainable skills development among public secondary school students in Rivers State.

Ho2: There is no significant difference in the mean ratings of respondents on the extent to which aquaculture production enhances fish pond construction and maintenance skills among public secondary school students in rivers state

Ho3: There is no significant difference in the mean ratings of respondents on the extent to which aquaculture production enhances fish breeding, hatchery management and fingerling production skills among public secondary school students in Rivers state.

The study focuses on aquaculture production as a tool for sustainable skills development among public secondary school students in Rivers state ,it is limited to selected public secondary schools offering Agricultural science ,the content scope covers practical aquaculture skills such as fish pond construction, pond management ,feeding practices ,water quality management ,feeding practices ,water quality management, and fish harvesting ,the study targets students and agricultural science teachers within the state and is delimited to the current academic session, the findings will provide empirical evidence to guide educational and agricultural policy makers in integrating aquaculture more effectively into the secondary school curriculum .it will support polies aimed at youth skill acquisition, food security and sustainable agriculture in Rivers state ,The study will promote self-reliance, entrepreneurship and employable skills among students, reducing youth unemployment, it also contributes to household income generation and local fish production, thereby enhancing food security and economic sustainability

The study will assist schools and educational administrators in improving practical agricultural instruction through aquaculture .it will serve as a reference for teachers, curriculum planners and researchers and encourage the establishment of functional school fish farms for experiential learning.

Methodology

The study was carried out in ogoni region of Rivers State, Nigeria. Rivers State is one of the oil-producing states, is bordered to the north by Imo, Abia and Anambra states to the east by Akwa Ibom State, to the east by Akwa ibom State to the west by Bayelsa and Delta states and to the South by the Atlantic Ocean. The state lies within the Niger Delta region, characterized by a tropical climate with high rainfall, abundant surface water fertile soil and diverse aquatic ecosystems making it suitable for agricultural and aquaculture activities, The focus of the study was on six major kingdoms in ogoni namely (1) Babbe (2) Gokana (3) Ken-Khana (4) Nyo-Khana (5) Tai (6) Eleme, These areas were selected due to their rich aquaculture potential and active participation in agriculture – related school programs. Many of the public secondary schools in these locations have access to rivers, streams and low land areas suitable for aquaculture production, the people in these kingdoms are predominantly involved in fishing farming and trading, This setting provided a relevant context for assessing how aquaculture production can influence sustainable skills among public secondary school students, The study adopted a descriptive survey design, the population of the study was 450, agricultural science students and teachers in public secondary school across the six kingdoms of ogoni in Rivers State. The target population was 400 respectively, sample size of 400 was drawn from the population using stratified random sampling technique to select respondents, instrument used to gather data was a, self - Structured Questionnaire title Aquaculture production for sustainable skills development (APSSD) designed in a 4 – point rating scale: low extent (1)

High extent (4) ,Face and content validity ,three experts from Agricultural Education, Measurement and Evaluation review the instrument for clarity ,coverage and relevance , the reliability of the instrument was tested using test-retest method and a reliability co-efficient (r) achieved was 0.82. Data was analyzed using mean and standard deviation with a criterion mean value 2.50 and above while a z-test was used to test the null hypotheses at a significance level of 0.05.

Results

Research Question 1

What extent does aquaculture production enhance sustainable skills development among public secondary school students in Rivers State?

Table 1: Mean Score of Respondents on sustainable Skills development.

N = 400 teachers 200 = Student 200

S/N	Item Statement Skills	Responders	[$\bar{X}$]			$\bar{X}$			Decision
			mean	SD	S	mean	SD		
1	Aquaculture improves practical fish farming skills .	Teachers	3,18	0.82	students	3.05	0.88	High extent	
2	It enhances problem – solving ability fish .	Teachers	2.95	0.87	Student	2.90	0.93	High extent	
3	It develops entrepreneurial skills .	Teachers	3.10	0.90	Students	2,98	0.91	High extent	
4	It promotes teamwork skills	Teachers	3.02	0.85	Students	2.88	0.95	High extent	
5	It enhances environmental sustainability awareness	Teachers	3.15	0.83	Students	2.92	0.94	High extent	

Source: field work 2025

Results from table 1 shows a mean 3.03, which is above the benchmark mean of 2.50. This indicates that respondents agreed to a high extent that aquaculture production enhances sustainable skills development among students, this implies that participation in aquaculture activities significantly equips students with practical fish farming skills, entrepreneurial competencies, problem-solving abilities, teamwork spirit, resource management skills, and environmental sustainability awareness. Therefore, aquaculture production serves as an effective practical approach for promoting sustainable skill acquisition in public secondary

schools in Rivers State. Research Question 2: To what extent does aquaculture production for sustainable skills enhance students in pond construction and maintenance in Rivers State

Table 2 Mean Score of Respondents on Pond Construction and Maintenance skills

N = 400 teachers 200 = Student 200

S/N	Item Statement	Teachers	$\bar{X}$		students	$\bar{X}$		SD	Decision
			mean	SD		mean	SD		
1	Students can select suitable pond sites	Teachers	3.05	0.88	Students	2.85	0.96		High extent
2	Student can construct earthen ponds	Teachers	3.12	0.81	Students	2.90	0.92		High extent
3	Students can maintain water quality	Teachers	3.18	0.79	Students	2.95	0.90		High extent
4	Students can repair damaged ponds	Teachers	2.98	0.86	Students	2.75	0.98		High extent
5	Students can manage pond sanitation	Teachers	3.10	0.84	Students	2.88	0.93		High extent

Source: field work 2025

Results from table 2 shows mean of 3.00, which is also above the decision mean of 2.50. This indicates that aquaculture production enhances pond construction and maintenance skills to a high extent, this suggests that students who engage in aquaculture activities are able to develop competencies in site selection, pond construction, water quality management, pond sanitation, monitoring fish growth, and pond repair. The implication is that aquaculture production provides hands-on technical experience necessary for skill mastery in pond management.

Research Question 3

To what extent does aquaculture production enhance fish breeding and Hatchery skills in Rivers State

Table 3: Mean score of Respondents on fish breeding and Hatchery Skills

N = 400 = teachers 200 = Student200

S/N	Item Statement	Teac hers	$\bar{X}$		SD	Studen ts	$\bar{X}$		SD	Decision
			mean				mean			
1	Students can identify broodstock	Teach ers	3.08		0.85	Student s	2.82		0.97	High extent
2	Students can carry out artificial fertilization	Teach ers	3.00		0.89	Student	2.76		1.01	High extent
3	Students can manage hatchery equipment	Teach ers	3.12		0.83	Student	2.90		0.92	High extent
4	Students can produce fingerlings	Teach ers	3.05		0.87	Student s	2.85		0.95	High extent
5	Students can feed fry properly	teach ers	3.18		0.80	student s	3.00		0.88	High extent

Source: field work 2025

Result from table 3 showed mean of 2.98, which is above the criterion mean of 2.50. This indicates that aquaculture production enhances fish breeding and hatchery management skills to a high extent, this means that students are able to acquire practical knowledge and skills in broodstock identification, artificial fertilization, hatchery equipment management, fingerling production, feeding of fry, and disease prevention. The implication is that aquaculture production contributes meaningfully to students' technical competence in fish breeding and hatchery operations.

Hypothesis 1: The is no significant difference in the mean ratings of teachers and students on the extent to which aquaculture production enhance sustainable skills in Rivers State?

Table 4: z-test Analysis on mean Response of teachers and students on the Extent to Which Aquaculture Production Enhance Sustainable Skills development in Rivers State.

Categories	N	$\bar{X}$	SD	Df	z-cal	z-crit	a	Decision
Teachers	200	3.10	0.85	398	1.60	± 1.96	0.05	Fail to Reject
students	200	2.96	0.92					

Finding from table 4 revealed that the calculated Z-value (1.60) is less than the critical Z-value (1.96), the null hypothesis is not rejected, this implies that there is no significant difference between teachers and students in their ratings regarding the extent to which aquaculture production enhances sustainable skills development. Both groups share similar perceptions.

Hypothesis 2

There is no significant difference between the mean ratings of teachers and students on the extent to which aquaculture production enhances pond construction and maintenance skills in Rivers State?

Table 5: z-test Analysis on mean response on pond construction and maintenance skills.

Categories	N	$\bar{X}$	SD	Df	z-cal	z-crit	a	Decision
Teachers	200	3.11	0.83	398	2.52	±1.96	0.05	Reject Ho2
students	200	2.89	0.94					

Findings from table 5 revealed that the Since the calculated Z-value (2.52) is greater than the critical value (1.96), the null hypothesis is rejected.

This indicates that there is a significant difference between teachers and students in their perceptions of how aquaculture production enhances pond construction and maintenance skills. Teachers rated the enhancement higher than students

. Hypothesis 3

There is no significant difference between the mean ratings of teachers and students the extent to which aquaculture production enhances fish breeding and hatchery management skills in Rivers State.

Table 6: z-test Analysis on mean response of teachers and students

Categories	N	$\bar{X}$	SD	Df	z-cal	z-crit	a	Decision
Teachers	200	3.09	0.85		2.02	±1.96	0.05	Reject Ho3
students	200	2.88	0.95					

Findings from table 6 revealed that the calculated Z-value (2.31) is greater than the critical value (1.96), the null hypothesis is rejected.

This shows that there is a significant difference between teachers and students in their ratings regarding the enhancement of fish breeding and hatchery management skills. Teachers perceived a higher level of skill enhancement compared to students.

Discussion of Findings

Table 1: To what extent does aquaculture production enhance sustainable skills among public secondary school students in Rivers State? The findings revealed that aquaculture production enhances sustainable skills development among public secondary school students in Rivers State to a high extent mean above 2.50. This indicates that students who participate in aquaculture activities acquire relevant practical, entrepreneurial, environmental and problem-solving skills. The finding is in line with Adekunle (2020) who noted that aquaculture fosters youth empowerment by providing real-world agricultural experiences. It also aligns with Nwafor & Onwudiwe (2021) who emphasized that students involved in school-based, This finding supports the philosophy of Agricultural Education which emphasizes learning by doing, through hands-on experiences such as fish feeding, pond management and fish harvesting, students develop competences that are directly applicable to real-life situations, the result also suggest that aquaculture production promise self-reliance and employability among secondary school students, furthermore the finding aligns with skill acquisition theories that emphasize experiential learning as a key driver of sustainable develop soft skills such as teamwork, responsibility and resource management.

Table 2: The result showed that aquaculture production enhances pond construction and maintenance skills to a high extent, students demonstrated competence in site selection, pond construction water quality management, sanitation and monitoring fish growth, this suggests that aquaculture serves as an effective practical instructional strategy in secondary schools, the exposure to pond management activities provides students with technical and vocational skills necessary for agricultural productivity, it also indicates that school-based aquaculture programs can function as training grounds for future agripreneurs, the implication of this finding is that when students are actively involved in pond construction and maintenance, they develop mastery-oriented skills rather than theoretical knowledge alone. This practical exposure strengthens their confidence and readiness for agricultural ventures after graduation this aligns with Eze and Ugwu (2021) who reported that exposure to pond construction skills significantly

Table 3 revealed that aquaculture production enhances fish breeding and hatchery management skills to a high extent. Students were able to acquire skills in broodstock identification, artificial fertilization, hatchery management, fingerling production, feeding practices, and disease prevention, this indicates that aquaculture production contributes significantly to technical skill development in fish reproduction and hatchery operations. These competencies are critical components of sustainable aquaculture practice and food security enhancement, the finding also implies that integrating breeding and hatchery management into school aquaculture

programs broadens students' technical capacity beyond basic fish farming. It equips them with advanced production skills that can improve productivity and sustainability within the aquaculture value chain. align with the study of Ibeun (2020) who emphasized that hands-on demonstration in hatchery practices significantly improves learners understanding of reproductive technologies in fish farming similarly Obi and Anene (2022) found that when students were exposed to real-life fertilization procedures, their confidence and competence in aquatic reproduction improved. These findings reinforce the need for strengthened practical agricultural programs in secondary schools, particularly in aquaculture, as a viable pathway toward sustainable economic development and food security.

Conclusion

From the background and findings revealed, the study therefore demonstrated that aquaculture production plays a significant role in enhancing sustainable skills development among public secondary school students in Rivers State. The findings revealed that aquaculture improves student's general agricultural competencies. Such as entrepreneurship, team work, and interest in farming careers. Additionally, students gained practical technical skills in pond construction, maintenance and egg fertilization techniques necessary for fish farming, aquaculture is not only a tool for improving vocational skills but also a viable strategy for reducing youth unemployment and promoting sustainable agricultural practices at the secondary school level.

Recommendations

Based on the findings, the following recommendations are made:

1. The Rivers State ministry of education should incorporate aquaculture more formally into the Agricultural science curriculum, especially in riverine communities with natural fishery resources.
2. Government and education stake holders should provide functional aquaculture facilities (eg fish ponds hatcheries, water-testing kits) in public secondary schools to enhance hands-on learning
3. Teachers should adopt gender – sensitive approaches to encourage equal participation of female students in aquaculture practices and reduce the performance gap observed in the study and agricultural science teacher should be trained regularly through workshops and in-service programs to update their knowledge and techniques in modern aquaculture production
4. Schools should partner with local fish farmers and aquaculture businesses for field visits, mentorship programs and collaborative project to deepen students' practical exposure and educational authorities should establish systems to track students' progress and the impact of aquaculture education on long-term skill development and career choices

References

- Adekunle, J.A, Olowolafe, EA. & Ogunyemi, K.A. (2020). Aquaculture as a tool for youth empowerment in Nigeria. The role of vocational education. *Journal of Agricultural Extension and Rural Development* 12(3), 45-52.
- Agricultural Education Outcomes in Rivers Tertiary Institutions (2022) rajournals.net+1.Akinrotimi, O. A.,
- Abu, O. M. G., & Aranyo, A. A. (2011). Environmental friendly aquaculture key to sustainable fish farming development in Nigeria. *Continental Journal of Fisheries and Aquatic Science*, 5(2), 17–31.
- Aleru P.D. and Lazarus S.T. (2021) Role of Agricultural Education Farm Workshop in Development of Students Skills in Indigenous Mechanized Technology for Self-Reliance in Rivers State. *British Journal of Contemporary Education* 1 (1), 64-74.
- Borno State Pond Design/Management (2024).
- Enugu State Pond Construction Skills (2021) Research.
- Eze, P.N, & Ugwu, C.J (2021) Enhancing Students Practical Skills Through School-based Aquaculture Demonstration. *Nigerian Journal of Agriculture Education*, 32 (1) 88-96.
- Food and Agriculture Organization of the United Nations. (2022). The state of world fisheries and aquaculture 2022: Towards blue transformation. FAO. <https://doi.org/10.4060/cc0461en>
- Federal Republic of Nigeria. (2014). National policy on education (6th ed.). NERDC Press
- Halekan, S.A. Emeka, O.B & Ikomi, J.U. (2023) Assessment of Aquaculture Infrastructure in Secondary Schools and its role in Practical Skill Development. *Journal of Technical and Science Education*, 15 (1), 55-63.
- Ibeun, M.O (2020). Effect of Aquaculture Demonstration Projects on Students Understanding of Fish Breeding Techniques in Secondary Schools in Delta State *Journal of Vocational and Technical Education Research*, 78 (2), 22-31.
- Ifejika, P. I., & Ayanda, J. O. (2013). Status of aquaculture in Kainji Lake Basin, Nigeria: Challenges and prospects. *Journal of Fisheries and Aquatic Science*, 8(1), 1–12. <https://doi.org/10.3923/jfas.2013>
- Ikwerre L.G.A. Aquaculture Technology adoption (2023).
- Lazarus S.T. & Aleru, P.D. (2025) Assessment of Extension Education Needs of Artisanal Fishers for Sustainable Livelihood in Rivers State.
- National Research Council. (2009). Science and decisions: Advancing risk assessment. National Academies Press.
- Nwosu, F. M., & Onyeneke, R. U. (2013). Effect of

- aquaculture training on youth empowerment in Nigeria. *Journal of Agricultural Extension*, 17(2), 102–112.
- Nwafor, C.E & Onwudiwe, J.U. (2021) Impact of Agricultural Skill Acquisition on Career Preferences Among Secondary School Students in Riverine areas. *International Journal of Education and Rural Development* 11(4) 66-74
- Obi, R.U & Anene, N.O. (2022). Fish Hatchery Training and its Impact on Reproductive Skill Development Among Nigerian Students. *African Journal of Aquaculture Education* 3(1) 14-26
- Okorie, J National Research Council. (2009). *Science and decisions: Advancing risk assessment*. National Academies Press.
- Olaitan, S. O., & Ali, A. (1997). *The making of a curriculum: Theory, process, product and evaluation*. Cape Publishers.
- Olagunju, F. I., Adesiyun, I. O., & Ezekiel, A. A. (2007). Economic viability of catfish production in Oyo State, Nigeria. *Journal of Human Ecology*, 21(2), 121–124. <https://doi.org/10.1080/09709274.2007.11905966>.
- Solidaridad Project at Tai Solarin College (2022) Solidaridadnetwork.org.
- WAAPP Aquaculture Integration in Secondary Schools (2019) iupinepublishers.com
- World development report 2020: Trading for development in the age of global value chains. World Bank Publications