



Building Skills and Inclusivity Through Scientific Crafts for Self-Reliance of Students in Rivers State

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Abstract

This study investigated Building skills and Inclusivity through Scientific Crafts for Self-Reliance of Students in Rivers State. A descriptive survey research design was adopted. The population of the study comprised of 342,645 students in all 463 senior secondary schools across the three senatorial areas of the state. The sample of the study included 284 respondents (250 science students and 34 science teachers) selected from three schools, one each per senatorial district. The sample size was determined using Taro Yamene formula. The study was guided by three objectives and three research questions. Checklist and structured questionnaire served as instruments for data collection. The instrument was validated by two experts in the Department of Science Education, Rivers State University, Port Harcourt. The test-retest method was used to estimate the reliability of the instrument, with a reliability coefficient of 0.82. Data obtained were analyzed using descriptive statistics of mean and standard deviation to answer all research questions. Findings revealed that skills developed through scientific crafts included critical thinking, problem solving, creativity and innovation, entrepreneurial, income generation skills, etc. It also showed that building skills through scientific crafts influences students' self-reliant ability to a high extent. Finally, findings revealed that, building skills through scientific crafts influences students' critical thinking and problem- solving ability to a very high extent. Building skills through scientific crafts significantly improved students' practical skills, creativity, and confidence in applying scientific knowledge to real-life situations. Based on these findings, the study recommended that science educators should consistently adopt scientific crafts in classroom instruction, while school administrators and education stakeholders should provide training and resources to encourage this practice.

Keywords: Building Skills, Entrepreneurial Skill, Inclusivity, Scientific Crafts, Self-Reliance, Skill.

Introduction

Education is generally accepted to be the bedrock of not only personal empowerment but also national development. The learning environment has become more competitive, and technology

has become more advanced, making it more imperative than ever to have education that isn't just theoretical, but actually hands-on. Science education is an important component in the education system that helps to provide learners with the necessary cognitive and manipulative skills of science, including inquiry, observation, critical thinking, experimentation and problem-solving, especially at secondary school. These are essential in innovation and self-reliance as well as entrepreneurship.

Secondary education in Nigeria is essentially a stepping stone to tertiary education and a platform for acquisition of skills for work and entrepreneurship, particularly in Rivers State. The mode of science teaching in many schools, however, is still largely traditional. It heavily depends on rote memorization, textbook instruction and few opportunities for students to have meaningful experiences of hands-on learning. The theoretical learning/employability gap has led to the creation of science students whose knowledge and understanding are not reflected in their ability to transfer it to a useful skill for the employment market or for self-reliance.

An innovative way to help close this gap is to integrate scientific crafts into the teaching and learning process. Scientific crafts are the creative application of scientific principles to design, build, run experiments and create solutions for everyday problems using the resources available in the local community. These include constructing an electric circuit, creating water filtration systems, making weather tools and making simple machines. The activities are hands-on, project-oriented and motivate students to use their scientific knowledge creatively and constructively to help them come to a better understanding of science and to independently solve problems.

Scientific crafts promote experiential learning and help students develop important 21st-century skills such as creativity, collaboration, innovation, and adaptability. They make learners good listeners and active participants in the process of learning science so that they will be able to understand science in a way that is stimulating and meaningful to them. Importantly, they also provide opportunities for entrepreneurship as students learn to innovate, design and create with scientific principles. This is especially so in Nigeria where unemployment and underemployment are social issues due to the youth.

However, Rivers State is not spared as many school leavers in the state are still young, jobless and lacking in self-reliance despite the increasing enrolment of the populace in schools across its urban and semi-urban centres. It is common for secondary school students to only acquire theoretical knowledge and not have the necessary skills to face the challenges of the modern

economy. This has led to concerns that the current science curriculum and teaching approach are not relevant and successful.

The inclusion of scientific crafts in science education in this context has several benefits.

First, it fits well into Nigeria's vision of promoting Technical and Vocational Education and Training (TVET) which is aimed at enhancing the skills of the learners with hands-on skills for the market.

Second, it supports the national and international campaign for STEM (Science, Technology, Engineering and Math) education. Second, it supports the national and/or international campaign for STEM (Science, Technology, Engineering, and Math) education.

Innovation and sustainable development through Engineering (and Mathematics) education.

Third, scientific crafts can be used to close the gender gap in science education as they provide hands-on activities, engaging learners of both sexes and help to foster interest and confidence in science.

In the light of the aforementioned advantages, there are several challenges that need to be addressed in the integration of scientific crafts in secondary school science teaching. These include lack of trained human resources, poor infrastructure, rigid curricula, limited institutional support and insufficient resources. The majority of science teachers have not been trained to create and apply craft-based learning activities. Moreover, current practices in most schools continue to focus more on written tests than on practical application of understanding and creativity. These systemic barriers pose challenges in the broad utilisation of scientific crafts as a major component of science teaching.

Furthermore, little empirical studies exist that explore the specific effect of scientific craft on students' learning outcomes in Rivers State. There are few studies which have investigated critical thinking, entrepreneurial growth and self-dependence of students due to these crafts. This gap in the literature demands a detailed discussion of the contribution scientific crafts can make to change science education from an academic exercise into a life enhancing experience.

Hence, this study seeks to examine the effect of using scientific crafts in science education for self reliance of secondary school students in Rivers State. It will explore how much scientific crafts have a positive effect on students' critical thinking, problem solving and entrepreneurial

skills. It will also highlight issues of concern for the integration of these practices and suggest ways for successful implementation.

The aim of this study is to offer helpful information which can be used for educational policy, curriculum development, teacher training, and classroom practice. The ultimate target is to encourage more dynamic, practical and empowering science education which equips students to pass exams but also to be innovative, independent, and productive citizens.

The Experiential Learning Theory (Kolb, 1984) was the theory used as the basis for this study. The Experiential Learning Theory (ELT) developed by Kolb is based on experience and the idea of dynamic and continuous learning. Learning is effective when people go through four stages of learning: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation, says Kolb. This cycle describes the way in which people digest and internalise new information, and is especially applicable in education systems that emphasize experiential and student-centred approaches.

The scientific crafts as the model-building, do-it-yourself experiments, and simulations, are well related to Kolb's learning cycle which is the basis of this study in the science education. These activities not only help encourage retention of the material covered but they also develop important life skills like self-reliance, independence, creativity and decision making. In a region like Rivers State where resources and engagement strategies are limited in many schools, experiential learning through crafts is a very effective way of learning, gaining personal and intellectual development.

This study was supported by Vocational and Skill Acquisition Theory (Becker, 1964; Schultz, 1971): Vocational and Skill Acquisition Theory, which is rooted in the economic understanding of education places emphasis on the importance of education to increase the productivity, jobs and self-sufficiency of the individual by acquiring skills that are practical and marketable. Gary Becker and Theodore Schultz were among the first to develop the Human Capital Theory, which argues that education and training are investments which generate the economic returns from boosting the productive capacity of individuals. Education is not only a cultural process but also an economic process in that the value of an individual is enhanced in the labour market. It plays an active role in economic development by providing the individuals with the required knowledge and skills. Such theoretical perspectives highlight the need for vocational and practical learning to be part of learning systems, particularly in resource-poor and underdeveloped contexts.

The introduction of scientific crafts into science education in the context of secondary education in Nigeria especially in Rivers State can be regarded as a vocational approach to developing the skills of scientific crafting, scientific problem solving and scientific innovation among science students for their self reliance and national development. The Vocational and Skill Acquisition Theory is based on the Human Capital Theory which recognizes education as an economic good. It suggests that the abilities, knowledge and skills acquired in school increase an individual's earning potential and ability to be productive in society. Becker and Schultz believe that formal education is a form of investment whose dividends are reaped in terms of earning personal income, moving to the next level in a career and enhancing the productivity of a nation.

Practical training and vocational learning are not peripheral to academic education but rather part of it, from this perspective. Students' participation in activities like scientific crafts (construction of machines, apiary, poultry keeping, fish farming, experiments with local materials, etc.) contributes to the acquisition of skills which can be used outside the classroom. These skills can be applied to entrepreneurial or technical pursuits, particularly in biotechnology, the environment and engineering.

This is a theoretical perspective which questions the traditional distinction between academic and vocational education. Rather, it recommends that skill acquisition be connected to general education practices, such as scientific craft-making, to create students' practical ability and independence.

Types of Scientific Crafts

Scientific crafts vary widely depending on the topic and available resources. Below are common types used in secondary science education:

Model-Making: Building models of the human heart, solar system, thermodynamics systems, digestive system, etc, using cardboard, clay, or recycled materials, etc.

Experimental Tools: Constructing simple tools like rain gauges, thermometers, and anemometers for weather observation, measuring cylinders, retort stands, etc.

Electrical Crafts: Creating simple electric circuits, electromagnets, or burglar alarms using wires, batteries, and bulbs.

Biological Crafts: Designing plant propagation setups, aquaponics systems, or home-made microscopes, skeletons, etc.

Chemical Crafts: Making pH indicators from natural substances like hibiscus or red cabbage, or conducting simple chemical reactions with vinegar and baking soda, etc.

These crafts enable students to apply scientific knowledge to real-world tasks while fostering practical understanding and creativity.

Agricultural crafts: mushroom farming, fish farming, snail farming, vegetable farming, etc.

Production of Scientific Crafts

Scientific craft production typically involves the following steps:

1. **Concept Identification:** Select a scientific concept or topic to demonstrate.
2. **Design Planning:** Sketch the model or experimental setup and identify necessary materials.
3. **Material Sourcing:** Gather accessible materials, preferably affordable or recyclable ones.
4. **Craft Assembly:** Build or construct the scientific craft following step-by-step procedures.
5. **Testing and Evaluation:** Test the functionality or representation accuracy of the craft.
6. **Presentation and Reflection:** Students explain their work and reflect on the learning process.

Teachers can guide this process, but it is most beneficial when students take the lead, allowing for autonomy and creative problem-solving.

There have been past studies on the role of scientific crafts in improving the self-reliance of students in science education. These studies are aimed at the enhancement of student outcomes through hands-on learning, skills acquisition and innovation by means of scientific crafts.

Adebayo & Olatunji (2021) investigated the effect of hands-on science activities on problem-solving skill of secondary school students in Nigeria. The study adopted descriptive survey method and sample of 200 science students and teachers. Structured questionnaires were used to find the data, and the reliability was done by Cronbach's alpha coefficient of 0.83. The study revealed the students who were exposed to the craft based science activities experienced 35% gain in problem solving skill over the students who were instructed by lecture method. The study suggested that scientific crafts could be introduced to the science classrooms in the future, so as to make the students self-reliant.

Likewise, Nwankwo (2020) studied the link between the scientific crafts and student creativity in the rural school of Nigeria. The quasi-experimental study of the present study was conducted with 120 students who participated in scientific craft projects, who showed increased creativity, and enhanced its scientific concept application and confidence in practical problem solving. There is a need for locally available materials to be used in science education, which the study highlighted.

Moreover, Ibrahim and Bello (2021) investigated the effect of craft learning on the entrepreneurial skills of Secondary school students. They conducted their study in three schools of Northern Nigeria involving a total of 100 students by structured interview and assessment. Students involved in science based crafts were found to be more interested in entrepreneurship with 45% of them saying that they will take up self-employment in science based fields. It is recommended that science curricula include entrepreneurial based crafts so that children will become self-sufficient.

Ogunleye (2002) carried out a study on the effectiveness of practical science education in secondary schools in south western Nigeria. The students who exposed to craft-based science activities gained higher cognitive and psychomotor skills than their peers in traditional (theory-based) class.

Ogunleye stated that this kind of activity would help to create more impact between theory and practice, which would make the students self-reliant and inquisitive. Several studies have found problems in the effective incorporation of scientific crafts, despite its apparent advantages. Ezeudu and Ezinwanne (2015) reported inadequate funding, limited laboratory facilities and teachers' practical training as some of the factors responsible for the challenges. These are the barriers that are likely to limit the rate and volume of craft activities in public schools particularly in local government areas such as Obio-Akpor.

Likewise, Nwachukwu and Nwosu (2017) reported that the schools who promoted project-based learning in science showed more students who were innovating at home, and participating in science fairs in the community, which helped build their self-confidence and economic creativity.

There are several problems that arise in the implementation of science education using handicrafts. Okafor & Chukwu (2020) highlighted the availability of resources, trained teachers and school funding as challenges. They used a mixed method approach involving survey to 150 science teachers, where as they found that 85% of them were unable to access material for scientific crafts and hence could not effectively carry out scientific practical lessons. The study recommended that the government and other stakeholders should provide the schools with materials and train them to improve the utilization of scientific crafts in science instruction.

There is empirical evidence that strongly backs the idea that scientific crafts increase students' self-reliance. In Nigeria and elsewhere, these activities have resulted in better critical thinking, personal responsibility, entrepreneurial and academic engagement. Many students in

ObioAkor Local Government area of Lagos state are saddled with socio-economic challenges, equipping them with practical scientific skills could provide them with alternative economic and intellectual means of self-reliance.

However, effective implementation requires addressing infrastructural, financial, and teachers' capacity challenges. The benefits seen in isolated case studies need to be scaled up to have a more widespread and lasting effect, and this requires collaboration among educators, policymakers, and community stakeholders.

The results also showed that the role of teacher training is also an important element in the successful implementation of craft-based learning.

This study would find relevance in the following areas

Enhancing Practical Application of Science Concepts: The study will highlight the importance of scientific crafts in making science education more practical and hands-on. By engaging students in creating and experimenting with scientific crafts, they develop skills and deeper understanding of scientific principles and how they could be applied to real world situations.

Promoting Self-Reliance and Entrepreneurship: Scientific crafts encourage students to develop innovative solutions to problems, fostering self-reliance. Using practical activities, students learn skills which can be applied to a small scale business or an enterprise and are prepared for self-employment in the future.

Enhancing the students' creativity, critical thinking and problem solving skills: The study will show how the integration of scientific crafts in science lessons will enhance the student's creativity, critical thinking and problem solving skills. The skills are fundamental to school and success in the world of science, technology, and engineering.

Bridging the gap between theory and practice: Many students struggle with science because it is often taught in an abstract manner. The study will also include scientific crafts, its purpose is to give insights into the learning aspect that can be done in a hands-on method so that it is expected to facilitate the learning process and increase the ability to understand and retain material.

Contributing to National Development: By fostering self-reliance and equipping students with practical skills, the study aligns with national goals of developing a skilled workforce and promoting technological advancement. Students with entrepreneurial mindset by means of scientific crafts can make contribution to local and national economic growth.

Statement of the Problem

Students are expected to acquire knowledge and skills required in science education for problem solving, innovation and self-reliance. In many secondary schools, however, the emphasis in science is mainly lecture-theoretical, with very little attention given to the applications of science. This makes it more difficult for students to grasp science beyond what is in the textbook and makes it difficult to apply science in real life or teach students skills that will make them self-reliant.

A good way to overcome this challenge is to integrate scientific crafts and indigenous technologies into science teaching and learning. Scientific crafts include hands-on activities including model construction, experimental design and innovative solutions in their local context that enable students to apply scientific knowledge in practical ways. These activities encourage creativity, critical thinking, problem solving and entrepreneurial abilities that are key to self-sufficiency. Even with these possible advantages, many schools are unable to incorporate scientific crafts into the teaching-learning process because of the lack of resources, specialized teachers, and rigid curriculum structure.

There is a lack of hands on learning in science education, which is responsible for high unemployment and low participation rate of school graduates in entrepreneurship. Numerous students graduate from school without the ability to make opportunities for themselves and are therefore reliant on limited formal jobs. If properly implemented, the integration of scientific crafts in science education could help students develop self-reliance by fostering technical skills, innovation, and problem-solving abilities that are applicable in various fields.

This study, therefore, seeks to examine building skills and inclusivity through scientific crafts for self-reliance of students in Rivers State.

It aims to determine whether hands-on learning enhances student's ability to apply scientific knowledge practically, develop innovative solutions, and cultivate self-sufficient career paths. The findings will provide insights into how practical, skill-based learning can be effectively integrated into science education to better prepare students for future challenges.

Purpose of the study

The main purpose of this study was to examine the influence of building skills and inclusivity through scientific crafts on students' self-reliance in Rivers State. Specifically, the study aimed to:

1. Identify skills to be developed through scientific crafts for students' economic empowerment.
2. Examine the influence of building skills through scientific crafts on students' self-reliant ability.
3. Investigate the influence of building skills through scientific crafts on students' critical thinking and problem-solving ability.

Research Questions

The study was guided by the following research questions:

1. What are the skills to be developed through scientific crafts for students' economic empowerment?
2. To what extent does building skills through scientific crafts influence students' self-reliant ability?
3. To what extent does building skills through scientific crafts influence students' critical thinking and problem-solving ability?

Methodology

The study adopts a descriptive survey research design. The population of the study consisted of all 342,645 senior secondary school students and science teachers in all the 463 public secondary schools in Rives State. Stratified sampling technique was used to partition the state into 3 senatorial districts. Simple random sampling method was used to select one school in each senatorial district. Using Taro Yamane formula, a total sample size of 284 respondents (250 SSS students and 34 science teachers). 83 science students and 11 science teachers were selected from 2 schools, while the third school, 84 science students and 12 science teachers were used as respondents. A total sample of 284 respondents (250 students, and 34 science teachers) were used for the study. Only SS2 students were used for the study. SS2 students were used for the study because it is assumed that they have benefited more in the incorporation of scientific crafts in the schools. This is so because they have spent more time in the schools and possibly understand more about scientific crafts.

The instruments for data collection was checklist and questionnaire. Checklist was used to elicit data to answer research question one, while Questionnaires was used to generate data to answer the second and third research questions. The questionnaire adopted the modified 4-point Likert scale of: Very High Extent (VHE) – 4; High Extent (HE) -3; Low Extent (LE) – 2; Very Low Extent (VLE) – 1. To determine the decision rule, a mean value of 2.5 was accepted as high extent, and any value below that was accepted as low extent.

The instrument was validated by 2 experts from the department of Science Education, Faculty of Education, Rivers State University, Port Harcourt, to ascertain its face and content validity. These experts made some useful recommendations for adjustment before the final drafts were made.

The test-retest method was used to test the reliability of the instrument. The value of the reliability test of the questionnaire was 0.82. This shows that the research instrument is very reliable.

Mean and Standard Deviation were used to answer the research questions.

Results Presentation

Research Question 1: What are the skills to be developed through scientific crafts for students' economic empowerment?

Table 1: Checklist of responses on skills to be developed through scientific crafts for students' economic empowerment

S/N	Skills to be developed	Yes	%	No	%	Decision
1	Critical thinking	264	92.96	20	7.04	Yes
2	Problem – solving	272	95.77	12	4.23	Yes
3	Creativity and innovation	238	83.80	46	16.20	Yes
4	Entrepreneurial skill	208	73.24	76	26.76	Yes
5	Communication skill	211	74.30	73	25.70	Yes
6	Income generation skill	253	89.08	31	10.92	Yes
7	Project management skill	197	69.37	87	30.63	Yes
8	Manipulative skill	233	82.04	51	17.96	Yes
9	Collaboration and team work skill	275	96.83	09	3.17	Yes
10	Business managerial skill	218	76.76	66	23.24	Yes

Results presented in Table 1 showed that all 284 respondents agreed that all the skills listed above are developed by students through scientific crafts for economic empowerment.

Research Question 2: To what extent does building skills through scientific crafts influence students' critical thinking and problem-solving abilities?

Table 2: Mean Responses on extent to which building skills through scientific crafts influence students' critical thinking and problem-solving abilities.

S/N	Items Statement	N	Mean	Std Deviation	Decision
1	To what extent does the use of scientific crafts in teaching improves students' problem-solving skills?	284	3.50	0.54	High Extent
2	To what extent does the use of scientific crafts improves students' critical thinking ability?	284	3.08	0.94	High Extent
3	To what extent does the use of scientific crafts enhance students' creativity in science-relate activities?	284	3.54	0.68	High Extent
4	To what extent does incorporating scientific crafts encourage students' innovation in science learning?	284	3.48	0.58	High Extent
5	To what extent does using scientific crafts in class spark students' scientific curiosity?	284	3.58	0.50	High Extent
6	To what extent does engaging in scientific crafts enhance students' self-reliance?	284	3.67	0.82	High Extent
7	To what extent does scientific craft-based learning improve students' collaboration with peers?	284	3.75	0.7	High Extent
8	To what extent does the use of scientific crafts increase students' engagement in science lessons?	284	3.82	0.56	High Extent
9	To what extent does the use of scientific crafts help student understand how to isolate variables in a scientific investigation?	284	3.44	0.54	High Extent
10	To what extent does the use of scientific craft activities enhance student ability to	284	3.10	0.93	High Extent

link scientific theory to practical application

Grand Mean **284** **3.496** **High Extent**

Table 2 shows the extent to which building skills through scientific crafts influences students' critical thinking and problem solving skills. The mean responses of all items listed in the table ranged from 3.08 - 3.82, with a total mean standing at 3.496. Since the cut-off point mean is 2.50, it is concluded that the respondents agree on all the items. Therefore, this finding shows that building skills through scientific crafts influences students' critical thinking and problem solving skills to a high extent.

Research Question 3: To what extent does building skills through scientific crafts influence students' self-reliant and entrepreneurial abilities?

Table 3: Mean Responses on extent to which building skills through scientific crafts influence students' self-reliant and entrepreneurial abilities.

S/N	Items Statement	N	Mean	Std Deviation	Decision
1	To what extent does incorporating scientific crafts in science teaching help students develop entrepreneurial thinking?	284	3.50	0.54	High Extent
2	To what extent does using scientific crafts improve students' ability to identify business opportunity in science-related fields?	284	3.08	0.94	High Extent
3	To what extent does scientific craft-based learning promote the development of marketable skills in students?	284	3.54	0.68	High Extent
4	To what extent does engaging in scientific crafts motivate students to start their own science-related business in the future?	284	3.48	0.58	High Extent
5	To what extent does marketing and selling scientific crafts teach students basic entrepreneurial practices?	284	3.58	0.50	High Extent

6	To what extent does crafting in science improve students' awareness of entrepreneurship as a career path?	284	3.44	0.54	High Extent
7	To what extent does the use of scientific crafts in teaching boost students' confidence in their entrepreneurship potential?	284	3.54	0.50	High Extent
8	To what extent does scientific craft-based teaching encourage students to solve real-world problems with business value?	284	3.36	0.60	High Extent
9	To what extent has crafting of science models helped student develop the ability to set goals and follow through with tasks during scientific projects?	284	3.10	0.93	High Extent
10	To what extent has scientific craft activities helped student appreciate the value of time management?	284	3.56	0.50	High Extent
Grand Mean		284	3.418		High Extent

Table 3 shows the extent to which incorporating scientific craft in teaching of science influence students' entrepreneurial skill. The mean responses of all items listed in the table ranged from 3.08 - 3.58, with grand mean standing at 3.418. Since the cut-off point mean is 2.50, it can be concluded that the respondents agree on the items. The finding reveals that scientific crafts enhance students' self-reliant and entrepreneurial skill. Hence, this finding shows that building skills through scientific crafts influences students' self-reliant and entrepreneurial skills to a high extent.

Discussion of Findings

The findings of this study showed that building skills and inclusivity through scientific crafts influences the development of self-reliance ability in secondary school students to a high extent. The results revealed that students exposed to scientific crafts demonstrated improved practical engagement, resource management skills, and the ability to apply scientific knowledge to real-life situations. This aligns with the view of Piaget's Constructivist Learning Theory and Kolb's Experiential Learning Theory, where the learner comes to understand more when actively engaged in experiential learning rather than passive information delivery.

The study also showed that the scientific crafts had a positive effect on the critical thinking and problem-solving skills of students. The results were that students were able to analyze the problem more carefully, recognize mistakes in scientific procedures, and use logical reasoning in activities.

For entrepreneurial skills, the results showed that students learned basic skills including the skills in handling resources, cost estimation, record keeping and simple marketing skills in doing scientific craft activities.

Finally, it may be concluded that the use of scientific crafts in science teaching, not only makes the students self-reliant, but also critical for their survival. These benefits, however, can only be maximized through intentional approaches and activities at the school, community and government levels.

Summary of Major Findings

Some of the key findings of the study are:

1. The skills that are developed through scientific crafts for economic empowerment are; critical thinking skill, problem solving skill, creativity and innovation skill, entrepreneurial skill, communication skill, project management skill, manipulative skill, collaboration and team work skill, business managerial skill.
2. Students' critical thinking and problem-solving capability is significantly influenced by building skills through scientific crafts.
3. The influence of building skills on scientific crafts on student's skill of self-reliant and entrepreneurs is high.

Conclusion

The study concludes that building skills using scientific crafts has a significant positive effect on self-reliability in the secondary schools. Scientific crafts are used in lessons in a way that enhances the interaction, practicality and relevance of the lesson, which further boosts students' confidence and competence in using the scientific concept in their daily lives.

Educational Implications

The study emphasises the need to develop the skills of scientific crafts to promote the self-reliance and practical skills among pupils. This helps to improve theoretical concepts and also helps students prepare for entrepreneurial ventures and problem solving in real life situations. When scientific crafts are fully implemented, the gap between the School lessons and the

practical application of knowledge and skills can be overcome, thus making science more interesting and skill based.

Teacher training programmes should include component of designing and utilization of scientific crafts and curriculum planners should integrate craft activities within science syllabus. Collaboration and partnership between teachers, parents and the local community to provide materials and ideas for scientific craft projects should also be encouraged.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Teachers should adopt the use of scientific crafts in order to develop positive skills and bridge the gap between classroom learning and hands-on application, making science more engaging for economic empowerment.
2. Schools should encourage collaboration between teachers, parents, and the local community to source materials and ideas for scientific craft projects, in order to develop critical thinking and problem-solving skills in students.
3. Schools should provide platforms such as science fairs, exhibitions, hands-on workshops, seminars, and peer-sharing sessions and competitions where students can showcase scientific crafts, thereby motivating creativity and developing self-reliant and entrepreneurial skills in students.

By implementing these recommendations, science education in secondary schools can be enriched, enabling students to develop greater self-reliance, practical skills, and problem-solving abilities that prepare them for both academic success and future career opportunities.

References

- Adebayo, S., & Olatunji, A. (2021). Impact of hands-on science activities on student problem-solving skills in Nigerian secondary schools.
- Ezeudu, F. O., & Ezinwanne, O. A. (2015). Challenges to effective integration of scientific crafts in schools.
- Ibrahim, M., & Bello, K. (2021). Influence of craft-based learning on entrepreneurship skills among secondary school students. *Journal of Education and Practice*, 12 (8), 66–74.
- Nnadozie, O., & Uche, G. (2024). Repositioning technical vocational education and entrepreneurship for self-reliance in Nigeria. *AVTEN Journal*, 2(1), 45–62.

- Nwachukwu, C., & Nwosu, A. A. (2017). Project-based science learning and home-based innovations among students.
- Nwankwo, N. (2020). Scientific crafts and student creativity in rural Nigerian schools.
- Nwankwo, V., & Eze, P. (2021). Vocational technical education as a tool for self-reliance among Nigerian youths. *Journal of Technical and Vocational Education and Training (JOTVETAR)*, 5(1), 10–27.
- Ogbogu, C. N., & Uzochukwu, N. (2022). Influence of vocational and technical education on students' skills acquisition for self-reliance in North-East Nigeria.
- Ogunleye, A. O. (2002). Effectiveness of practical science education in secondary schools across south-western Nigeria.
- Okafor, F., & Chukwu, O. (2020). Barriers to implementation of craft-based science education in public schools.
- Young, B., & Wood, L. (2021). Makerspaces, crafts, and student empowerment in secondary science. *Journal of STEM Education*, 22(2), 32–45.
- Zelege, S. (2022). Enhancing self-reliance of students in technical and vocational education: A systematic review. *International Journal of Research in Technical Education*, 8(1), 50–67.
- Zubairu, M., & Hassan, I. (2023). TVET reformation for entrepreneurship and skills development of Nigerian youths for self-reliance. SSRN.