



IJIS

Journal of the Institute of Education
Obafemi Awolowo University, Ile-Ife, Nigeria

ISSN: 3043-6400

Vol. 2, No. 1, 2025

CALL FOR PAPERS
IFE JOURNAL OF INTEGRATED SCIENCE (IJIS)

NOTE TO CONTRIBUTOR

Ife Journal of Integrated Science, (IJIS) is a Bi-annual publication of Institute of Education, Obafemi Awolowo University, Ile-Ife (Integrated Science Unit). The Journal aims at improving the quality of academic and research manuscripts submitted by scholars and researchers, through peer review process, and disseminate the publications through open access to practitioners, educators, educationists, academia, researchers, curriculum planners and policy makers. The manuscripts can have different approaches which are quantitative as well as qualitative.

IJIS is an annual and peer - reviewed Journal.

Manuscript submitted to IJIS should:

1. have a strong introduction that clearly states the organizing points of the study, acquaints the readers to what is ahead, and makes a direct link between theory, questions and research design
2. have focused literature review that clearly establishes why the topic /problem warrants discussion
3. be prepared according to the style prescribed by the 6th or 7th edition of publication manual of American Psychological Association.

Guidelines for Paper Submission

- * Articles should not be longer than 15 A4 - sized pages using Times New Roman, font size of 12. Longer articles will attract additional publication fee.
- * Reference style should conform to the American Psychological Association format (6th or 7th Edition). This should be arranged in alphabetical order according to the surname of the author.
- * Footnotes are not allowed.
- * Manuscripts' cover should include the title of the paper, author(s) name(s), institution affiliation, contact and E-mail address (es).
- * Abstract should not be more than 250 words.
- * Articles can be submitted electronically via e-mail to ijisn.2023@gmail.com
- * Assessment fee of ₦6,000 shall be paid before any paper shall be reviewed.
- * Publication fee of ₦35,000, is a condition for publication that a manuscript submitted to Ife Journal of Integrated Science (IJIS) has not been published and will not be simultaneously submitted or published elsewhere.

All fees must be paid into Ife Journal of Integrated Science Account.

Bank Name: Polaris Bank

Account Name: Ife Journal of Integrated Science (IJIS)

Account Number: 1140280175

- * Submissions are published at the editor's exclusive discretion. Submission that does not conform to these guidelines may not be considered for publication.

EDITORIAL BOARD

Prof. P. O. Jegede
Editor - in - Chief

Prof. T. O. Bello
Managing Editor

Editors

Prof. O. S. Agboola
Dr. S. O. Olajide

EDITORIAL CONSULTANTS

- Prof. A. Akinlua - Dept of Chemistry, Obafemi Awolowo University, Ile-Ife.
Prof. O. A. Ogunfowokan - Dept of Chemistry, Obafemi Awolowo University, Ile – Ife.
Prof. T. O. O. Oladipupo - Dept. of Botany, Obafemi Awolowo University, Ile – Ife
Prof. J. G. Adewale - Institute of Education, University of Ibadan, Ibadan
Prof. M. A. Eleruja - Dept. of Physics, Obafemi Awolowo University, Ile -Ife.
Prof. M. A. Adeleke - Dept. of Science and Technology Education,
Obafemi Awolowo University, Ile – Ife.
Prof. O. A. Sofowora - Dept. of Educational Technology and Library Studies,
Obafemi Awolowo University, Ile – Ife
Prof. I. A. Olaosun - Dept. of English, Obafemi Awolowo University, Ile – Ife
Prof. D. Okunoye - Dept. of English, Obafemi Awolowo University, Ile – Ife.
Prof. E. T. O. Babalola - Dept. of English, Obafemi Awolowo University, Ile – Ife.
Prof. M. A. Ajayi - Dept. of Human Kinetics and Health Education,
University of Ibadan, Ibadan.
Prof. J. B. Bilesanmi - Dept. of Curriculum Studies and Instructional Technology,
Olabisi Onabanjo University, Awoderu Ago-Iwoye
Prof. A. T. Akande - Dept. of English, Obafemi Awolowo University, Ile – Ife
Prof. E. F. Bamidele - Dept. of Science and Technology Education,
Obafemi Awolowo University, Ile-Ife.
Prof. R. O. Ogunlusi - Dept. of Chemistry, Obafemi Awolowo University, Ile-Ife
Dr. A. Tella - Dept. of Science and Technology Education,
University of Ibadan, Ibadan
Dr. A. S. Adelokun - Department of Educational Management
Dr. K. A. Aderounmu - Department of Kinesiology and Human Recreation,
Obafemi Awolowo University, Ile-Ife.
Dr. T. A. Adebisi - Dept. of Science & Technology Education, Faculty of
Education, Obafemi Awolowo University, Ile-Ife.
Dr. A. A. Adetunji - Dept. of Science and Technology Education,
Obafemi Awolowo University, Ile-Ife.
Dr. V. O. Animola - Dept. of Integrated Science, Federal College of Education,
Iwo, Osun State.
Dr. O. O. Bakare - Institute of Education, Obafemi Awolowo University, Ile-Ife
Dr. M. O. Omiyefa - Institute of Education, Obafemi Awolowo University, Ile-Ife
Dr. V. B. Olanipekun - Bamidele Olumilua University of Education, Science and
Technology, Ikere, Ekiti State.

TABLE OF CONTENTS

INFLUENCE OF TEACHERS' QUALIFICATION ON SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN IFE-EAST LOCAL GOVERNMENT AREA OF OSUN STATE, NIGERIA Timilehin Christianah ADEDEJI	1-18
ASSESSMENT OF CHEMISTRY CURRICULUM IMPLEMENTATION IN SENIOR SECONDARY SCHOOLS IN IFE CENTRAL LOCAL GOVERNMENT AREA OF OSUN STATE Elijah Oluwatobi ADEWUYI	19-41
LOCUS OF CONTROL AND SELF-EFFICACY AS PREDICTORS OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN IFE CENTRAL LOCAL GOVERNMENT AREA, OSUN STATE, NIGERIA Olamide Rofiat TIJANI	42-60
EFFICACY OF SELF-DIRECTED AND COLLABORATIVE CONSTRUCTIVISM INSTRUCTIONAL STRATEGIES ON JUNIOR SECONDARY SCHOOL STUDENTS' ENGAGEMENT IN BASIC SCIENCE AND TECHNOLOGY IN ADAMAWA STATE Samuel Akinola OGUNDARE, Ph.D, & Ahmed IBRAHIM, Ph.D	61-75
EFFECTS OF JIGSAW COOPERATIVE INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ACQUISITION AND RETENTION OF MATHEMATICS PROCESS SKILLS Lucy ERAIKHUEMEN, Peter Akpojehih Agbarogi & Festus Osadebamwen Idehen	76-93

EFFECTIVENESS OF FLIPPED AND BLENDED CLASSROOM LEARNING APPROACHES ON STUDENTS' ACHIEVEMENT IN GENETICS CONCEPTS IN BIOLOGY Blessing Izehiuwa EDOKPOLOR, C. N. OMOIFO, Ph.D & L. ERAIKHUEMEN, Ph.D	94-111
EFFECTS OF FLIPPED AND BLENDED CLASSROOM LEARNING APPROACHES ON STUDENTS' RETENTION IN GENETICS CONCEPTS IN BIOLOGY IN EGOR LOCAL GOVERNMENT AREA OF EDO STATE L. ERAIKHUEMEN, Ph.D, C. N. OMOIFO, Ph.D & Blessing Izehiuwa EDOKPOLOR	112-130
SUSTAINABLE STEM EDUCATION IN THE IOT ERA: BALANCING THE PARADOX OF APPLICATIONS, BENEFITS, AND CHALLENGES FOR BETTER PROSPECT Ezekiel Adedayo ADEOLA	131-157
TEACHERS' TEACHING METHOD PREFERENCES AND RESOURCES UTILISATION AS PREDICTORS OF SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN OSUN STATE, NIGERIA Damilola Monsurat ELUYERA & Omowunmi Sola AGBOOLA, Ph.D	158-188
ENVIRONMENTAL LITERACY AMONG OSUN STATE CLASSROOM TEACHERS Omowunmi Sola AGBOOLA, Ph.D, Simeon Olayinka OLAJIDE, Ph.D, Olusegun Ojo BAKARE, Ph.D & Muraina Olugbenga OMIYEFA, Ph.D	189-207
EFFECTS OF BI-MODAL SCHOOL YARD PEDAGOGY AND GENDER ON SCIENCE PROCESS SKILLS OF PRESCHOOLERS IN OYO STATE, NIGERIA Florence Taiwo. OGUNYEMI, Ph.D. & Fatimah ZAKARIYYAH	208-226

STUDY HABIT AS PREDICTOR OF JUNIOR
SECONDARY SCHOOL STUDENTS' INTEREST IN
BASIC SCIENCE IN IFE CENTRAL LOCAL
GOVERNMENT AREA, OSUN STATE

Oluwaseun Newton AJEWOLE

227-234

ROLE OF SCHOOL FARMS IN DEVELOPING
ENTREPRENEURIAL SKILLS AMONG
SECONDARY SCHOOL STUDENTS IN IFE
CENTRAL LOCAL GOVERNMENT AREA, OSUN
STATE, NIGERIA

**Oluyemisi Dolapo ADISA & Ibironke Ibiwumi
IDOWU**

235-248

TEACHERS' SELF- EFFICACY AND JUNIOR
SECONDARY SCHOOL STUDENTS' LEARNING
OUTCOMES IN BASIC SCIENCE IN
SOUTHWESTERN NIGERIA

**Abosede Adenike OYAGBILE, Ph.D. & Theodora
Olufunke BELLO, Ph.D.**

249-262

EFFECTS OF BI-MODAL SCHOOLYARD PEDAGOGY AND GENDER ON SCIENCE PROCESS SKILLS OF PRESCHOOLERS IN OYO STATE, NIGERIA

Florence Taiwo OGUNYEMI, Ph.D.

Department of Childhood Education,
Tai Solarin University of Education,
Ijagun, Ogun State.

Corresponding Author: taiwoogunyemi2014@gmail.com

Telephone Number: +234 9056002059

Fatimah ZAKARIYYAH

Graduate Student,
Department of Childhood Education,
Tai Solarin University of Education,
Ijagun, Ogun State

E-mail: fatimmashams@gmail.com
Telephone Number: +234 7036712717

Abstract

It is widely acknowledged that education of the young children should start from preschool in order to target the age at which learning and brain development are at their best. However, children's nature necessitates the use of pedagogies that ensures learners active participation and interaction with the natural environment especially when learning the science process skills. This study investigated the effect of bi-modal schoolyard pedagogy and gender on science process skills of preschool children in Oyo State, Nigeria. Three hypotheses were formulated to guide the study. This study adopted the pretest - posttest control group quasi-experimental research design. The study has a sample size of 113 preschoolers in public schools in Ibadan, Oyo State, while the teachers and research assistants participated in the data collection and instrument administration process. Science Skills Rating Scale (SSRS) and Social Skills Assessment Rating Scale (SSARS) were used for Data collection. The

instruments which were rated on 4 points Likert scale were validated through experts in the field of early childhood education and related field of study while the reliability index of ($\alpha=0.78$) and ($\alpha = 0.82$) were calculated for SSRS and SSARS respectively using Cronbach alpha reliability technique. The study found a significant main effect of schoolyard pedagogy on science process skills ($F_{(2,101)} = 4.188, p < .05$). There was no significant main effect of gender on science process skills ($F_{(1,101)} = 0.336, p > .05$) while the interaction effect of treatment and gender was also not significant ($F_{(2,101)} = 0.468, p > .05$). It was concluded that Schoolyard Pedagogy helped the preschoolers to learn the science process skills and other skills better. It was recommended among others that, teachers, educational administrators and all stake holders should therefore work hand in hand to ensure provision of good learning environment and explore the potentials of the schoolyard as an extension to the classroom.

Keywords: Preschool, Schoolyard Pedagogy, Gender, Science Process Skills

Introduction

Education is a veritable and potent development tool for any nation or society. It is not surprising that the sustainable development goal three centres on quality education. However, for the true development of any society, the educational system has to make functionality its target. This means that the skills to be acquired should equip the learners to contribute their quotas towards solving of societal problems. Bell (2016) described sustainable development education as including the education of individuals who are capable of creating, and developing an environment that is more sustainable, as well as economy and social order and those who can make strategic plans for the future. Nigeria as a nation is still developing especially, in terms of technological advancement. Hence, science related disciplines should be made one of the priorities in setting an agenda for a functional educational system.

Acquisition of these skills should start from the preschool since children at that stage learn at the fastest rate and it forms the foundation for more sophisticated learning. In recognition of this, one of the early childhood education objectives in Nigeria includes "to inculcate in children the spirit of enquiry and creativity as they explore nature, environment, art, music and make use of toys" (FRN, 2014). Preschool instils many live-long skills in children. It enables them to become more independent, have confidence and experience all round development. Obiweluzor (2015) observed the preschool education as being noted to be the first step towards entrance into the world of knowledge as well as a gate to a purposeful academic life as a result of which it is well-thought-out for relevance to the educational development of a child.

Preschool education in Nigeria has gone a long way. It started from the stage of low public acceptance to obvious public acceptance judging by the patronage enjoyed by private elementary schools which usually have integrated preschool sections (Onuka & Arowojolu, 2009). Also, all the public schools now have their own integrated preschool session which has been helping the public primary schools to maintain their enrolment since it gives them the opportunity to catch the children very young. Public preschools also provide alternative for parents who may be unable to afford the fees in private schools.

Despite efforts by the government at various levels and international bodies to ensure the quality of these preschools (Osho, 2022), so that the children can benefit maximally, more innovative instructional strategies are still needed in the preschools given the peculiarity in the learning needs of the children and the variability of their individual learning needs. Children are naturally curious and therefore needs instructional strategies that will help them to satisfy their curiosity while they learn in the process. The instructional strategies employed by teachers at that level do not take cognizance of the needs of the children; they are rather monotonous, not interesting, mostly based on rote learning and do not consider the children's attention span.

Instruction at this level in many preschools is restricted only to the four walls of a classroom. They are subjected to conventional instructional strategies which are majorly teacher centered. They are not allowed to explore their environment and engage in developmentally-appropriate and age-appropriate plays. Ekine (2016) observed that many preschool children are constantly denied the opportunity to learn away from their desks, learn outside the classroom or experience activities-based learning. In the same vein, for Salami (2015) observed that typical instructions in the schools involved “memorisation and recitation of basic elements of literacy and numeracy such as letter recognition, writing and numbers.” Children cannot benefit maximally from these kinds of approaches”.

Meanwhile, the inculcation of the spirit of enquiry through exploration of nature and environment as prescribed in FRN (2014) will only be possible with the adequate attention given to the science process skills of the children through the deployment of good instructional strategies by the educators at that level and adequate exploration of the environment for learning opportunities. According to an observation by Rahman et al. (2018), the science process skills in children include observation skills using senses, classifying, inferences as well as measuring. They further suggested that children should be exposed to science process skills from preschool. These skills will help the children in learning sciences, not only later in life but also, right from childhood. Given, the nature of the science process skills, they may be better learnt through instructional strategies that encourage exploration and involve hands-on activities.

Waite (2011), is of the opinion that unexpected opportunities are mostly abound outside the classroom for boosting of learning and support of child development. In this case, Schoolyard Pedagogy (SYP) and other outdoor pedagogies provide opportunities for learner-centered and inquiry-based learning across multiple disciplines (Feille & Nettles, 2019). The SYP allows the teachers to exploit the availability of the schoolyard as an opportunity to extend the normal in-class

learning to a space where interaction with nature and reality is assured. This easily links the content with the real world and thereby help the children to learn more.

However, SYP may be grouped into two namely, Structured Schoolyard Pedagogy (SSYP) and Unstructured Schoolyard Pedagogy (USYP). In SYP, the teacher engages the children in a structured outdoor lesson in which case the children are to follow rules towards attainment of certain objectives. The role of the teacher is provision of partnership in facing difficult tasks and reflection on their experiences. USYP on the other hand allows the children to freely decide on the choice and mode of their activities. The role of the teacher is then reduced only to planning of the environment and observation. The children are thereby accorded the freedom of choice of learning activities making boredom unlikely.

Several factors may have effects on the success of SYP on the science process skills of preschoolers. The factors may include age, gender, school location, mental ability, etc. Gender has been over a long time been a factor in the performance and choice of females in STEM disciplines. Orile-edo et al. (2021) posited that men are more likely to take on roles in STEM disciplines than their females who appears to be more interested in non-STEM disciplines. Researches on gender differences in science process skills have presented some inconsistent outcomes. The current study investigates the interaction effect SYP and gender on science process skills of preschoolers in Oyo State.

Statement of the Problem

Preschoolers need to learn science process skills as foundation for their future leaning in science. The practice of restricting the learning of the preschoolers only to their desks in the classroom is neither age appropriate nor developmentally appropriate. It has proven to be mostly less effective especially for children at the preschool age to learn science process skills. However, many preschoolers in Nigeria still endure such instructions. Some studies have suggested few outdoor

instructional strategies. Fewer of the studies were however carried out in Nigeria. Also, most of the studies that focused on SYP did not consider two modes of the pedagogy namely, SSYP and USYP. So also, many did not consider other factors that may have effect on science process skills of the preschoolers in respect to gender. This study therefore investigates the interaction effect of Schoolyard Pedagogy and gender on the science process skills of preschoolers in Oyo State, Nigeria.

Objectives

The study investigated the effect of bi-modal schoolyard pedagogy and gender on science process of preschoolers in Oyo State, Nigeria. The specific purposes were to:

- (i) examine the effect of treatment on science process skills
- (ii) determine the effect of gender on science process skills
- (iii) examine the interaction effect of treatment and gender on science process skills

Hypotheses

The researcher would test the following hypotheses based on the objectives stated above.

- H₀1:** There is no significant main effect of treatment on science process skills of preschoolers.
- H₀2:** There is no significant main effect of gender on science process skills of preschoolers.
- H₀3:** There is no significant interaction effect of treatment and gender on the science process skills of preschoolers.

Methodology

Research Design

This study adopted the pretest - post-test control group quasi-experimental research design. The design is schematically presented thus:

- O₁ X₁ O₂ - Experimental group one
- O₃ X₂ O₄ - Experimental group two
- O₅ X₃ O₆ - Control group

Sample and Sampling Techniques

Purposive sampling was adopted to select 113 preschoolers precisely pupils between age 5 – 6 years while simple random sampling techniques was adopted to select pre-primary class teachers in Five public Preschools were purposively selected from the three Local Government areas divided among Three Local government areas were randomly selected from the eleven Local Government Areas within Ibadan, Oyo State. The three local government areas were randomly assigned to treatments and control groups.

Instrumentation

1. Science Skills Rating Scale (SSRS)
2. Social Skills Assessment Rating Scale (SSARS)

Instructional Guides

1. Structured Schoolyard Pedagogy Guide (SSPG)
2. Unstructured Schoolyard Pedagogy Guide (USPG)
3. Conventional Method Guide on Schoolyard Pedagogy (CMGSP)

Procedure for the Study

The study took twelve weeks following the stages below.

Preliminary Stage

The preliminary stage involves a visit to schools to be selected, selection and training of research assistants and administration of pre-test measures. These activities are explained below.

Visit to the Selected Schools

The researcher visited three schools to selected using certain set criteria. The participating research assistants and teachers were reached personally and given information about the study. They were intimated with the roles they were expected to play. This lasted for one week.

Selection and Training of Research Assistants

The Preschool teachers and research assistants were trained in their respective schools. During the training, the participating teachers and research assistants were exposed to the various activities that would require their attention. The research assistants were trained on how to administer the response instruments and how to implement the schoolyard pedagogy following the three instructional guides (SSPG, USPG and CMSPG). The research assistants were assessed after being trained to ascertain their level of competences in implementing the activities.

Administration of Pretest

Pre-test conducted on all the Preschool school children in the experimental and control groups by the researcher and research assistants using the response instruments (Science Skills Rating Scale - SSRS and Social Skills Assessment Scale - SSAS). This lasted for one week.

Treatment Stage

Treatments was carried out on both experimental and control groups, that is, (Structured Schoolyard Pedagogy Group, Unstructured Schoolyard Pedagogy Group and Conventional Method Schoolyard Pedagogy Group) for a period of eight weeks. The lesson in each group were carried out following the steps below.

Structured Schoolyard Pedagogy Group

The five steps below were followed to implement the lesson activities in this group.

Step 1: Teacher prepared the schoolyard area with relevant natural materials and in line with the topic for the week. Teacher introduced the topic of the day.

Step 2: Children listened to a story or sing song or recite rhymes about the topic in focus and teacher will divide them into groups.

- Step 3:** Children in their respective groups explored the materials in the schoolyard by engaging in different activities relevant to the topic being treated.
- Step 4:** Teacher moved around to observe children in their respective groups. Teacher asked open-ended questions to make children express their thoughts about the activities, think about their experiences and how it relates to their daily life. The teacher offered assistance to the children when needed and she motivated passive children to be involved in the activities.
- Step 5:** Children gathered thereafter to reflect on and review the activities. They reported or talked about their experiences. The teacher stimulated children by asking them questions that will encourage them to think about what they had been through and to relate it to their real-life experiences.

Unstructured Schoolyard Pedagogy Group

The five steps below were followed to implement the lesson activities in this group.

- Step 1:** Teacher will prepare the schoolyard area with relevant natural materials and in line with the topic for the week. Teacher introduces the topic of the day.
- Step 2:** Children listened to a story or sang songs or recited rhymes about the topic in focus and teacher divided them into groups.
- Step 3:** Children, on their own, explored the materials in the schoolyard by engaging in different activities relevant to the topic being treated.
- Step 4:** Teacher moved around to observe children as they engage in the activities. Here, teacher did ask questions or scaffold children in any way.
- Step 5:** Children gathered thereafter to reflect on and review the activities. They reported or talked about their experiences.

Conventional Method on Schoolyard Pedagogy Group

The seven steps below were followed to implement the lesson activities in this group.

Step 1: Teacher introduced lesson.

Step 2: Teacher explained the concept in focus with relevant teaching aids.

Step 3: Teacher led the pupils in repeating the concept explained after her.

Step 4: Teacher asked questions on the topic taught

Step 5: Teacher summarised and concluded the lesson by going briefly over it again.

Step 6: Teacher gave class work or exercises to pupils to write or practice in their notebooks.

Step 7: Teacher gave homework to pupils.

Post-treatment Stage

Administration of the Post-test

Post-test administration was conducted during the last week in the experimental and control groups by the researcher and research assistants using the using the response instruments (Science Skills Rating Scale - SSRS and Social Skills Assessment Scale - SSAS). This will last for one week.

Ethical Consideration

Permission was secured from the relevant local government education offices to involve the schools to be selected in the study. Also, an informed consent form was produced to obtain the consent of the teachers that participated in the study. In addition, another informed consent form was designed for parents to secure their permission to involve their children in the study. The consent forms were sent to the parents through their children and with the assistance of the school.

Results

H₀₁: There is no significant main effect of treatment on preschool children's development of Science Process Skills.

To test this hypothesis, Analysis of Covariance (ANCOVA) was carried out and the result is presented in Table 1

Table 1: Tests of Between-Subjects Effects, Dependent Variable: Post Science Process Skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13130.994 ^a	11	1193.727	11.890	.000	.564
Intercept	5335.005	1	5335.005	53.141	.000	.345
Pre Science P Skills	7370.556	1	7370.556	73.416	.000	.421
Treatment	840.962	2	420.481	4.188	.018	.077
Gender	33.765	1	33.765	.336	.563	.003
Education	7.316	1	7.316	.073	.788	.001
Treatment * Gender	93.911	2	46.956	.468	.628	.009
Treatment * Educ	11.454	1	.003	.000	.996	.000
Gender * Educ	.003	1	162.248	1.616	.207	.016
Treatment * Gender * Educ	.003	101	100.394			
Error	10139.785	112				
Total	485479.000					
Corrected Total	23270.779					

a. R Squared = .564 (Adjusted R Squared = .517)

Table 1: Tests of Between-Subjects Effects, Dependent Variable: Post Science Process Skills

The data on Table 1 show that there is a significant main effect of treatment (Instruction) on preschool children's development of Science Process Skills. ($F_{(2,101)} = 4.188, p < .05 = 0.018$). Based on this finding, hypothesis 1 was rejected. In order to show which group brought about the significance, Estimated Marginal Means (EMM) was carried out and the result is presented in Table 4.5.

Table 1.1: Estimated Marginal Means of Post-test development of SPS score according to Treatment

Grand Mean

Dependent Variable: Post Science Process Skills

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
64.468 ^{a,b}	1.455	61.582	67.355

- a. Covariates appearing in the model are evaluated at the following values: Pre Science Process Skills = 47.7965.
b. Based on modified population marginal mean.

Treatment

Table 1.2: Dependent Variable: Post Science Process Skills

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Structured SYP	70.122 ^a	2.473	65.218	75.027
Unstructured SYP	62.265 ^{a,b}	2.282	57.738	66.791
Conventional TS	60.467 ^a	2.691	55.129	65.805

- a. Covariates appearing in the model are evaluated at the following values: Pre Science Process Skills = 47.7965.
b. Based on modified population marginal mean

From the data in the EMM, Tables 4.5, the grand mean is 64.468 for the development SPS. The data in Tables 4.6 revealed that the Experimental Group I (Structured SYP) had a mean score of 70.122, experimental Group II (Unstructured SYP) had a mean score of 62.265, while the Control group (Conventional Teaching Strategy) had an adjusted mean of 60.467. This indicates that the Experimental Groups performed better than the Control group confirming that treatment had differential effects on the development of Science Process Skills of the respondents making a contribution of 0.0059% (.077)² to the development of Science

Process Skills. The remaining 99.99% were due to pre-test measures and other unexplained sources not covered by this study. Relatively the experimental group I accounted more for the variance observed in the dependent variable followed by the experimental group II and lastly the control.

H₀2: There is no significant main effect of gender on preschool children's development of Science Process Skills.

The data in Table 1 revealed that there is no significant main effect of gender on preschool children's development of Science Process Skills. ($F_{(1,101)} = 0.336$ $p > .05$). Based on this result, hypothesis 2 was not rejected. Estimated Marginal Means, Table 1.1, was determined to examine the differences in the post-test means of the two categories of gender.

Estimates

Table 1.3: Dependent Variable: Post-test Science Process Skills

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	63.497 ^{a, b}	2.151	59.229	67.765
Female	65.278 ^a	1.976	61.358	69.197

- a. Covariates appearing in the model are evaluated at the following values: Pre-Science Process Skills = 47.7965.
- b. Based on modified population marginal mean.

From the data in the EMM, Table 1.2, the grand mean is 64.468 for the development or acquisition of Science Process Skills. The data in Table 1.3 revealed that the males had a mean score of 63.497 and the females had an adjusted mean of 65.278. With this result, the females had a better post-test acquisition mean score but from ANCOVA this was not significant. This indicates that there is no significant difference in the development or acquisition of Science Process Skills across gender and so hypothesis 2 was not rejected.

H₀3: There is no significant interaction effect of treatment and gender on the acquisition of Science Process Skills.

From the ANCOVA summary, Table 1, it could be seen that there was no significant interaction effect of Treatment and Gender on the acquisition or development of Science Process Skills. ($F_{(2,101)} = 0.468, p > .05$). Based on this result, hypothesis 3 was not rejected. This means that the interaction effect of treatment and gender did not produce any remarkable changes in the development of Science Process Skills.

Discussions of Findings

The finding of the study revealed a significant main effect of Structured School Yard Pedagogy and unstructured Schoolyard Pedagogy on development of Science Process Skills' development of the preschool children who took part in the study. This means that the School Yard Pedagogy - Both structured and unstructured-increased the rate science skills development of the pre -school children who took part in the study. However, the children in the structured school yard pedagogy group had a better performance than those in the unstructured school yard pedagogy group. The findings have agreement with that of Ting and Siew (2014) who found that outdoor school ground lessons improved Learner's acquisition of science process skills better than the conventional instructional strategy. Although, Ting and Siew (2014) did not separate their experimental groups into structured and unstructured as we have in the present study. The probable explanation for this is that children are naturally curious and the school yard afford them the chance to satisfy their curiosity and consequently to learn. Not only this, the children were able to interact with the natural environment; observe the components of the environment and carry out simple tasks based on their observation. This finding further provides evidential support for

the constructivist theory of learning. The More Knowledgeable Other (MKO) as put forward by Vygotsky in this case were the teachers which gave necessary support for the Structured Schoolyard Pedagogy group. The effort of the MKO probably explains why the children in the Structured School Yard Pedagogy group performed relatively better than those in the unstructured School Yard Pedagogy group.

The findings of Hypothesis 2 revealed no significant effect of gender on the science process skills of the preschool children. This indicates that neither male preschoolers nor the females had a significantly better improvement in the science process skills. The female preschoolers had a better performance on their science process skills than the males but the difference in performance was not significant enough for generalisation. This finding is in tandem with the findings of Akintemi and Oduolowu (2021) who reported no significant effect of gender on pre-primary school children science process skills. It also supports the findings of Yuliskurniawati et al. (2019) whose study outcomes showed no gender difference in the science process skills of children. The present study is not however in agreement with Ihejiamazu, Neji, and Isaac (2020) who reported gender difference in the science process skills of children. This finding could be as a result of non-biased treatment in which both genders had access to equal treatment and learning opportunities. This pointedly shows that equality in access and opportunities discourage gender disparity in acquisition of science process skills.

The result of hypothesis 3 revealed that there is no significant interaction effect of Schoolyard Pedagogy (Both structured and unstructured) and Gender on the acquisition or development of Science Process Skills. This indicates that neither the male nor the females performed significantly better on science process skills despite exposure to school yard pedagogy. Similarly, Nwosu and Ndanwu (2020) reported no significant interaction effect of teaching method and gender on the mean

interest scores of students in electronic libraries. The said study was however conducted on Computer Aided Instruction (CAI) as against School Yard Pedagogy in the present study. Also, Nwosu and Ndanwu (2020) targeted a population different from the population in the present study. The dependent variable in the earlier study was interest of students in electronics library. By implication, the result might be caused by an observed treatment that is free of bias along the line of gender during the study. It may however be a pointer to the artificiality of male dominance in STEM disciplines, however, gender alone may not be a determinant of a child's success in sciences once there is equal opportunities.

Recommendations

It was recommended based on the following that;

The findings will awaken the consciousness of the teachers about the need to maximize the use of the entire space in the school for enhancement of Instruction, especially science Instructions.

School proprietors and administrators should also provide support in the provision of conducive learning environment for science process skills. Sophistication to the extent of complete replacement of natural environment may be potent enough to hinder learning of science process skills.

Further studies are needed to find out the interaction effects of moderator variable on school yard pedagogy. Suggested moderator variables include school location, school type, cultural beliefs and so on

References

- Akintemi, E. O., Oduolowu, E. A. (2021).Sciencing activities and scientific skills of children at pre-primary level in Nigeria. International Online Journal of Primary Education 10 (1), 106-118.
- Bell, S. (2016). Sustainable distance learning for a sustainable

- world. *Open Learning: The Journal of Open, Distance and e-Learning*, (31), 1 2015)
- Ekine A. O. (2016). Meeting the needs of the whole child through effective early childhood education and evaluation. *Journal of Early Childhood Association of Nigeria* 5.1.2:1-19.
- Ekon, E. E & Eni, E. I. (2015). Gender and acquisition of science process skills among junior secondary school students in Calabar Municipality: Implications for Implementation of Universal Basic Education objectives. *Global journal of educational research* 14: 93-99.
- Federal Republic of Nigeria. (2014). National policy on education. 6th Edition
- Feille, K. & Nettles, J. (2019). Permission as support: Teacher perceptions of schoolyard pedagogy. *Electronic Journal of Science Education*. <http://ejse.southwestern.edu> 687–1704 (2021). <https://doi.org/10.1007/s11165-019-9860-1>
- Ihejiamazu, C., Neji, H., & Isaac, A. (2020). Correlates of science process skills knowledge among senior secondary II biology students in Cross River State, Nigeria. *European Journal of Scientific Research*, 155(3), 346-355.
- Makinwa-Adebusoye, P.K. (1981). Female work situation and Early Child-Care and Education in Metropolitan Lagos. Paper, National Workshop on Working Mothers and Early Childhood Education in Nigeria at NISER, Ibadan, Sept. 13-16, 1981.
- Nwosu, O. & Ndanwu, A. I (2020). Effect of computer aided instruction on students' interest in selected topics in electronic libraries course in federal tertiary institutions in Anambra State, Nigeria. *Library and Information Perspectives and Research* 2(1): 71-81. <https://doi.org/10.47524/lipr.v2i1.6>
- Obiweluozor, N. (2015). Early childhood education in Nigeria, policy, implementation: Critique and way forward. *African Journal of Teacher Education*, 4.1:90-95.
- Onile-ere, O. A., Efekemo, O. P. & Eni, A. O (2021). Science,

- technology, engineering and mathematics enrolment patterns and factors influencing the choice to study science among female secondary school students in Nigeria. *African Journal of Feille*, K. A. (2021). Framework for the Development of Schoolyard Pedagogy. *Res Sci Educ* 51, Reproductive Health. 25.5: 91-97. DOI: 10.29063/ajrh2021/v25i5s.8
- Onuka, A. O. & Arowojolu, F. A. (2009) An Evaluation of Parents' Patronage of Private Primary Schools in Abeokuta, Nigeria. *International Journal of African & African American Studies*, 7.2: 58-70.
- Orebanjo, D. (1981). Early (pdf) early childhood education in Nigeria, policy implementation: critique and a way forward available from: https://www.researchgate.net/publication/283573329_early_childhood_education_in_nigeria_policy_implementation_critique_and_a_way_forward [accessed apr 22 2024].
- Orebanjo, D. (1981). Early child care problems of working mothers with implication for social policy. Paper, National Workshop on Working Mothers and Early Childhood Education in Nigeria at NISER, Ibadan, Sept. 13-16, 1981.
- Osho, L. O. (2022). A review of the implementation of early childhood education in Nigeria. <https://www.linkedin.com/pulse/review-implementation-early-childhood-education-nigeria-osho>
- Owojori, M. G., Gbenga-Akanmu, (2021). T.O. Government commitments and teaching strategies foreffective quality early childhood education in South Western Nigeria. *ICEP* 15, 13 <https://doi.org/10.1186/s40723-021-00090-w>
- Rahman, N. A., Yusop, N. A. M. and Yassin, S. M. (2018). Science process skills in pre-schoolers through project. *International Journal for Studies on Children, Women, Elderly and Disabled*, Vol. 5, ISSN 0128-309X
- Salami, I. A. (2015). University to community pilot preschool programme: The effect on learning environment, teachers' attitude and children's holistic development. *African*

- Educational Research Journal 3.1: 55 – 62.
- Sofiani, D., Maulida, A. S., Fadhillah, N. & Sihite, D. Y. (2017). Gender Differences in Students' Attitude towards Science. Journal of Physics: Conference Series, 896. <http://doi.org/10.1088/1742-6596/895/1/012168>
- Thompson, M. (2017). Unpacking instructional strategies of early childhood teachers: Insights from teachers' perspectives. Educational Research and Reviews. Vol. 12.24:1199-1207. [https:// www.doi.10.5897/ERR2017.3370](https://www.doi.10.5897/ERR2017.3370)
- Ting, K. L., & Siew, N. M (2014). Effects of Outdoor School Ground Lessons on Students' Science Process Skills and Scientific Curiosity. Journal of Education and Learning 3(4) <http://doi.org/10.5539/jel.v3n4p96>
- Waite, S. (2011). Teaching and learning outside the classroom: personal values, alternative pedagogies and standards. Education 3-13: International Journal of primary, Elementary and Early Years Education, 39.1: 65-82.
- Yuliskurniawati, D., Noviyanti, N. K., Mukti, W. S., Susriyati Mahanal, S & Zubaida, S (2019). Science Process Skills Based on Genders of High School Students. The International Seminar on Bioscience and Biological Education Series: Journal of Physics. <http://doi.org/10.1088/1742-6596/1241/1/0120551>