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INTERNATIONAL JOURNAL OF CONTEMPORARY ISSUES IN
INTEGRATED SCIENCE EDUCATION (IJCIISE)

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EDITORIAL

Dear Readers,

We are excited to announce the launch of International Journal of Contemporary Issues in Integrated Science Education (IJCIISE). This Association Integrated Science Educators' Association of Nigeria (ISEAN) play a vital role in promoting scientific advancement, supporting science education, informing science policy, recognizing science excellence and fostering community engagement. The desire to float this journal was borne out of the passion to organize a yearly conference of Integrated Science by the Integrated Science Educators' Association of Nigeria, of which selected scholarly articles will be published after a thorough review. The journal dedicated to advancing knowledge and fostering dialogue within. Our mission is to publish high-quality research, innovative ideas, and critical analyses that contribute to the understanding and development of Integrated Science. At IJCIISE, we believe in the power of interdisciplinary collaboration and inclusivity. We welcome contributions from scholars, practitioners, and thought leaders worldwide, providing a space for diverse perspectives and groundbreaking work. As we embark on this journey, we invite you to submit your research, engage with our content, and join us in creating a vibrant academic community. Together, we can push the boundaries of knowledge and inspire future generations. Thank you for your support as we launch this exciting new endeavour.

This edition moves around issues that border on "**Enhancing Quality Assurance in Integrated Science in Nigeria.**" It is believed that diverse contributions from scholars and researchers expressed in this edition will provoke the understanding of issues that could foster education for societal transformations on a global scale
We look forward to your contributions!

For further information on future conference activities, visit <http://ijciise.org/index.php/ijciise>

Warm regards,
Professor O. S. Agboola
President, Integrated Science Educators' Association of Nigeria (ISEAN)

TABLE OF CONTENTS

ASSESSMENT OF THE LEVEL OF STAKEHOLDERS INVOLVEMENT IN THE IMPLEMENTATION OF NATIONAL POLICY IN BASIC SCIENCE IN SOUTHWESTERN, NIGERIA Busayo Veronica OLANIPEKUN, Ph.D., Simeon Olayinka OLAJIDE, Ph.D. & Abiodun Emmanuel OKEYA, Ph.D.	1-12
STRENGTHENING QUALITY ASSURANCE IN BIOLOGY EDUCATION IN NIGERIA TO PRODUCE GLOBALLY COMPETITIVE GRADUATES FOR THE 21 ST CENTURY AND BEYOND Emmanuel Ikechukwu NNAMONU	13-24
AI-TRANSFORMATIVE TOOLS IN TACKLING CHALLENGES IN TEACHING OF PHYSICS IN TERTIARY INSTITUTIONS Ezekiel Adedayo ADEOLA & Femi Timothy OSHO	25-39
STRENGTHENING QUALITY ASSURANCE IN CHEMISTRY EDUCATION IN NIGERIA: STRATEGIES FOR IMPROVEMENT Suleiman Ayodele ADEBAYO, Ph.D. & Victoria Olufunke BABATUNDE, Ph.D.	40-56
ENHANCING QUALITY ASSURANCE IN BASIC TECHNOLOGY THROUGH PROJECT BASED LEARNING AT THE BASIC LEVELS IN NIGERIAN SCHOOLS Umar Isa MUHAMMAD, Sabo Abubakar BASHIR, Ibn Salihu YAHAYA & Sani Chado MUHAMMAD	57-71
IMPACT OF INQUIRY DEMONSTRATION METHOD IN ENHANCING THE QUALITY OF STUDENTS' PERFORMANCE IN ALGEBRA AMONG SENIOR SECONDARY SCHOOL STUDENTS IN KADUNA STATE, NIGERIA Ibn Alhassan SULAIMAN, Ph.D.	72-83
INTEGRATED SCIENCE CURRICULUM CONTENTS IN THE CONTEMPORARY NIGERIA: RATIONALIZATION OF ITS INTEGRATION Jacob Gbemiga AROWOLO, Ph.D, Amina ISYAKU, Joshua OLALERE, Ph.D., Peter AGBENYEKU, Augusta Ndidi OJOKO, & Ganiyu Oladimeji OLARONGBE	84-95

EFFECT OF INQUIRY INSTRUCTIONAL STRATEGY ON PRE-SERVICE TEACHERS' KNOWLEDGE ON GENETICS IN FEDERAL COLLEGE OF EDUCATION, IWO, OSUN STATE Olarewaju Rasheed RAHEEM, Sekinat Adekilekun FOLORUNSO & Abolore Nimota ABDULKAREEM	96-108
A STUDY OF PERCEIVED DIFFICULT TOPICS IN BASIC SCIENCE CURRICULUM FOR JUNIOR SECONDARY SCHOOL STUDENTS IN IFE CENTRAL LOCAL GOVERNMENT, OSUN STATE Odunayo Victor ANIMOLA, Ph.D., Omowunmi Sola AGBOOLA, Ph.D. & Bamidele Adegbola ALABI	109-121
ASSESSMENT OF AWARENESS OF ARTIFICIAL INTELLIGENCE IN COLLEGES OF EDUCATION AND ITS EFFECT ON ACADEMIC ACHIEVEMENT OF BIOLOGY STUDENTS Ajibola Abidemi ADENIJI, Ph.D., Abosede Olajumoke OLABANJI, Elizabeth Odunayo ADEBORI, Justina ACHI & Toluwalope Damilola ADEDIRAN	122-131
QUALITY ASSURANCE IN EARLY CARE EDUCATION IN ONDO STATE Bowale Elizabeth BABAJIDE, Comfort Aderemi OGUNDIPE & Olufunke Elizabeth AFONJA	132-152
DEMOGRAPHIC VARIABLES AND DIGITAL LITERACY OF MATHEMATICS STUDENTS IN SENIOR SECONDARY SCHOOLS IN OSUN STATE, NIGERIA Rachel Oluwatoyin ADEBISI	153-162
TEACHERS' FEEDBACK AND SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS Oladayo John ADUROTA & Simeon Olayinka OLAJIDE, Ph.D.	163-171
PERCEIVED STRATEGIES FOR ENHANCING QUALITY ASSURANCE ON SECONDARY SCHOOL PHYSICS TEACHERS IN KOGI EAST EDUCATIONAL ZONE Ayodele Gabriel FASAN YA, Ph.D.	172-182
MIND-MAPPING AND JIG-SAW INSTRUCTIONAL STRATEGIES AS PANACEA TO IMPROVING SENIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE AND SKILL ACQUISITION IN AGRICULTURAL SCIENCE IN OSUN STATE, NIGERIA Waheed Oladele EWUOLA, Ph.D. & Akeem Adedeji ADETUNJI, Ph.D.	183-203

- ASSESSMENT OF CLASSROOM SIZE IN THE TEACHING OF MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN AKURE NORTH LOCAL GOVERNMENT AREA, ONDO STATE
Kehinde Oluwaseun AKEREYENI, Fatai Oluseyinde AJAYI & Badirat Aduke JIMOH 204-218
- EFFECTIVENESS OF FLOW-MAP AND JIGSAW INSTRUCTIONAL STRATEGIES ON JUNIOR SECONDARY SCHOOL STUDENTS' LEARNING OUTCOMES IN BASIC SCIENCE AND TECHNOLOGY IN ILE-IFE, OSUN STATE
Olakunle Olusegun AWOYALE & Simeon Olayinka OLAJIDE, Ph.D. 219-230
- CONCEPTION OF TEACHERS' STRATEGIES ON QUALITY ASSURANCE IN THE DELIVERY OF ACADEMIC CONTENT AMONG BASIC SCIENCE TEACHERS IN IBADAN METROPOLIS, OYO STATE
Veronica Oluwatoyin ANIMASAHUN, Ph.D., Saudat Titilope ADEYANJU & Ganiyat Omolara DAUD 231-242
- CLASSROOM INTERACTION AND STUDENTS ACADEMIC PERFORMANCE IN BASIC SCIENCE IN JUNIOR SECONDARY SCHOOLS IN ONDO STATE
Festus Oluwatobi AJALA & Theodora Olufunke BELLO, Ph.D. 243-253
- SIGNIFICANCE, IMPLEMENTATION AND CHALLENGES OF IN-SERVICE INTEGRATED SCIENCE TEACHERS' PROGRAMME IN TERTIARY INSTITUTIONS IN NORTHEAST, NIGERIA
Samuel Akinola OGUNDARE, Ph.D. & Ahmed IBRAHIM, Ph.D. 254-267
- INVESTIGATION OF AVAILABILITY AND USABILITY OF LABORATORY RESOURCES IN THE TEACHING OF BIOLOGY IN SENIOR SECONDARY SCHOOLS IN LAGOS STATE
Aminat Adenike OLAYIWOLA, Adebusola Oluseyi MOKANJUOLA & Toluwalope Damilola ADEDIRAN 268-282
- EFFECT OF MULTI-MEDIA TEACHING STRATEGY ON STUDENTS' PERFORMANCE IN SECONDARY SCHOOL BIOLOGY IN DEKINA LOCAL GOVERNMENT AREA OF KOGI STATE
Simon Adekali NEGEDU, Stephen Francis IDACHABA, Bunmi Mercy ALAFIYATAYO & Oziehisa DAUDANANA 283-293

- EFFECT OF FLIPPED CLASSROOM INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN CHEMISTRY IN OSUN STATE, NIGERIA.
Olufunmiso Olatunbosun AJALA, Ph.D. 294-303
- TEACHERS' STRATEGIES AND SCIENTIFIC INQUIRY SKILLS OF PRIMARY SCHOOL PUPILS IN OSUN STATE
Hannah Olubunmi AJAYI, Ph.D., Temilola Janet POPOOLA, Ph.D. & Faoziyyah Adenike AMOKEOJA 304-312
- TEACHERS' CLASSROOM PRACTICES AND UPPER PRIMARY SCHOOL PUPILS' LEARNING OUTCOMES IN BASIC SCIENCE AND TECHNOLOGY, OGUN STATE
Tajudeen Gbenga AMUDA, Simeon Olayinka OLAJIDE, Ph.D., Isyaku MOHAMMED & Daniel OLUDIPE, Ph.D. 313-324
- IMPACT OF MOTHERS IN STEM LEARNING FOR EARLY YEARS IN NIGERIA
Omowunmi Sola AGBOOLA, Ph.D. 325-334
- INTEGRATION OF ARTS IN SCIENCE EDUCATION
Samirah Ahmed ABDULSALAM, Ph.D. & Rakiya SALEH, Ph.D. 335-347

EFFECTIVENESS OF FLOW-MAP AND JIGSAW INSTRUCTIONAL STRATEGIES ON JUNIOR SECONDARY SCHOOL STUDENTS' LEARNING OUTCOMES IN BASIC SCIENCE AND TECHNOLOGY IN ILE-IFE, OSUN STATE

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Abstract

The study investigated the effectiveness of flow-map and jigsaw instructional strategies on junior secondary school students' academic achievement in Basic Science and Technology in Osun State. It also examined the effectiveness of the two instructional strategies in enhancing junior secondary school students' interest towards the learning of Basic Science and Technology concepts in Osun State. These were with a view to providing information on effectiveness of the two instructional strategies on junior secondary school students' learning outcomes in Basic Science and Technology in Osun State, Nigeria. The study employed the pretest, posttest control group quasi-experimental research design. The study population comprised all junior secondary school students of Basic Science and Technology in Osun State. The study sample consisted of 75 junior secondary two (JSII) students in their intact classes who were selected using simple random sampling technique from three selected schools in Ile-Ife, Osun State. Two research instruments were used to collect data which are: Basic Science and Technology Achievement Test (BSTAT) and Interest of Students towards Basic Science and Technology Questionnaire (ISBSTQ). Data collected were analyzed using Analysis of Covariance (ANCOVA). The results of the study showed that there was a significant effectiveness of flow-map and jigsaw instructional strategies on junior secondary school learners' academic accomplishment in Basic Science and Technology in Osun State at ($F_{1, 72} = 11.66; p < 0.05$. Partial $\eta^2 = 0.25$). The result also revealed a significant effectiveness of flow-map and jigsaw instructional strategies on interest of students towards Basic Science and Technology in junior secondary schools in Osun state ($F_{1, 4} = 35.79; p < 0.05$. Partial $\eta^2 = 0.43$). The study concluded that flow-map and jigsaw instructional strategies were effective in improving students' academic achievement and their interest towards the learning of Basic Science and Technology if properly proctored in the classroom.

Keywords: Flow-map, Jigsaw, Basic Science and Technology, Conventional method, Academic achievement

Introduction

Science is the systematic study of the structure and behaviour of the physical and natural world through observation, experimentation, and the testing of theories against the evidence obtained. It is a branch of knowledge or study that deals with a body of systematically arranged facts or truths and demonstrates the operation of general laws. Science and Technology have been instrumental in shaping the development and progress of nations.

According to Olajide, Ajewole, & Amusat (2018), the scientific method is a methodical approach to the process of collecting information by conducting meticulous recorded investigations and experiments. The advancement of science and technology is a significant driver of social and economic transformation. According to Zopperson (2002) & Mankilik (2007), the scientific method is an essential instrument for productive growth. According to Bessong (2002), a significant number of countries all over the world, including a significant number of African nations, seem to have accepted science and technology as a foundation stone for the expansion of their national economy. This is evidence that lends credence to our assertion. It is an essential instrument for bringing about the reduction and eradication of poverty as well as illiteracy. It is a very effective tool for creating a population that is tolerant on a social and cultural level and that shows care for matters of ethics and morality at all levels of governance, including the local, the national, and the international levels. It has been dubbed the foundation upon which the nation's economy and knowledge are constructed, which fitting is given that it is crucial for both individual and communal health. Not only is it essential to the process of economic expansion, but it also constitutes a significant contributor to the process itself.

According to Olajide (2019), science education plays a critical part not only in the lives of people but also in the advancement of a nation's scientific and technical capabilities. It is common known that scientific literacy, which can only be acquired via instruction in science, is the key to ensuring the continued existence of any country in terms of its scientific and technical advancements. The strength of a country is closely correlated with its scientific and technical prowess and its capacity to use that prowess to fostering social and economic development. Because of this, the union of scientific and technological endeavors is the pivot around which national development revolves. Science and technology advancements are generally good for the economy of any country, but they are especially beneficial for emerging countries like Nigeria. If a nation is serious about realising its full economic and social development potential, Olajide and Aladejana (2019) argue that the country must invest more in scientific research

and technological innovation. Interaction with the world around them helps students understand it, form their own ideas about it, find answers to problems, and ultimately develop their own sense of agency. To make sense of new material, constructivists believe that students should compare it to what they already know and draw conclusions about the relationship between the two (Olajide, 2019).

To achieve this goal, it is necessary to use efficient strategies for teaching content in the classroom. We can only say that learning has taken place after we know for sure that the student has gotten something of value that will help the experience stick with them in some way. It will be premature to declare any learning accomplished until that time comes. Regular teaching technique (also known as the conventional teaching method) has been the only form of instruction used in the past when teaching the sciences to Nigerian students, but this approach has failed to produce the necessary level of scientific literacy due to the inherently theoretical nature of the subject matter.

The instructor's ability to build a classroom atmosphere that encourages meaningful exchanges between students and between students and the instructor is crucial to the success of the learning process. The instructor and the teaching methods used, claim Olajide and Aladejana (2019), are the most important factors in fostering increased student performance and enthusiasm for science. This means that teachers may use their professional expertise to oversee the course's many moving parts, and then direct that expertise in order to raise their pupils' motivation for, ability in, and success in the scientific sciences. Ugwu (2008) and Olajide (2019) found, however, that the vast majority of science teachers aren't familiar with how to use certain instructional strategies that have been proved to be successful by scientists studying how to best teach their subjects. Most science teachers still rely on lectures to convey fundamental concepts rather than adopting the innovative methodologies and student-centered demonstration methods that have been shown to improve students' academic outcomes. Our elementary and secondary schools have relied on the teacher-expository method to impart understanding of these foundational subjects to their pupils for decades. Poor performance in physics, chemistry, mathematics, and biology has been linked to a method that has made teaching the subjects a chore for teachers and killed students' enthusiasm for learning (Aladejana, 2008; Adeyemi, 2011).

The Flow-map is a kind of mental map that may be used to not only plot out the steps involved in a process, but also to draw attention to the interconnections between those steps. As a visual depiction of the relationships between various entities, flow-maps are often used by students to help them organize a series of events. Incorporating "actions" performed inside each component of the event being detailed into sub-stages of a flow-map may reveal even more about those connections. Flow-maps are an effective way to depict the complex interplay of components inside a system or cycle. If students need help finding a certain room

or door, for example, they may ask for detailed instructions on how to do so. Most often, they are not set up in a perfectly straight line. In the case of the water cycle or a plant's life cycle, the process is often represented by a cyclical "flow map." In most situations, a flow-map is a gate way to help students visualize the components of a procedure or set of instructions.

According to Aronson (2006), "jigsaw" is an approach of teaching in which individuals within a "home" group individually concentrate on a subset of a wider subject. Students return to their "home" group to teach the content to their fellow classmates after learning it and interacting with members of other groups that have been given the same component. It might be an efficient strategy for attracting and retaining students' attention and encouraging their participation in class discussions. For students to take ownership of their education and take an active role in solving group issues, they must have a thorough understanding of the topic and be able to teach it to others. Every member of the class is expected to do their part to help the group succeed, while using the jigsaw approach. Students in a jigsaw classroom often work in groups of three to five, as indicated by Slavin (2011). Once a topic has been assigned to a group, it is subdivided into manageable chunks so that each student may focus on a specific part of the assignment. After practicing on their own, students come back to the group to take turns teaching the others what they've learned. They interrogate one another to make sure they are on the same page throughout this time as well. One way to bring the group together is to have each member give a presentation. Teachers at all levels, from elementary to university, could benefit from trying out the integration approach. Therefore, in order to assimilate the content, each learner must act as both a student and a teacher.

An individual student's, a teacher's, or a school's academic achievement may be measured by how well they were able to influence their students to improve their performance, (Ezeudu, 2006). It is the act of effectively accomplishing a task, and the term "achievement" is used to describe anything that a person has completed well, particularly by the use of their own efforts and talents. When a student accomplishes something important because of his or her own hard work and dedication, regardless of how much time or how many assignments were handed in, that student has succeeded.

Statement of the Problem

The academic performance of students, regardless of gender, as well as their interest in Basic Science and technology, has been proven to be low in a number of studies. This has been associated to teachers' inappropriate teaching-learning strategies and students' interest in the subjects. To teach this subject, a number of innovative strategies such as flow-map and jigsaw, have been developed because they are students-centered and self-regulated approaches. It has been shown that the instructional methodologies of flow-map and jigsaw are

helpful in enhancing the learning outcomes of students in the physical sciences (Physics, Chemistry, and Biology). Nevertheless, their usefulness in the education of Fundamental Science and Technology as a subject in the curricula of junior secondary schools warrants evaluation; hence this study.

Purpose of the Study

The study's aims was to investigate the effectiveness of flow-map and jigsaw instructional strategies in improving junior secondary school students' learning outcomes in Basic Science and Technology in Ile-Ife, Osun State.

The specific objectives of the study are to:

- a. investigate the effectiveness of flow-map and jigsaw instructional strategies in improving junior secondary school students' academic achievement in Basic Science and Technology in Osun State; and
- b. examine the effectiveness of the two instructional strategies in enhancing junior secondary school students' interest towards the learning of Basic Science and Technology concepts in the study area.

Hypotheses

H₀1: There is no significant effect in the effectiveness of flow-map, jigsaw and conventional strategies in improving students' academic achievement in Basic Science and Technology.

H₀2: There is no significant effect in the effectiveness of flow-map and jigsaw instructional strategies in improving students' interest towards the learning of Basic Science and Technology.

Methodology

The study adopted the non-equivalent pretest, posttest and control group quasi-experimental research design to verify the effectiveness of flow map and jigsaw in improving students' learning outcomes in Basic Science and Technology. The pre-test and post-test suggested that measurements are taken before and after the introduction of the treatments.

The design for the study is represented as follows;

O₁ X₁ O₂ O₃ - Experimental group 1

O₄ X₂ O₅ O₆ - Experimental group 2

O₇ X₃ O₈ O₉ - Control group

Where O₁, O₄ and O₇ represent the pre-test in the three groups

O₂, O₅ and O₈ represent the posttest in the three groups

and O₃, O₆ and O₉ represent the retention test in the three groups

while, X₁ is the treatment group that uses flow map instructional strategy,

X₂ is the treatment group that uses jigsaw instructional strategy

and X₃ is the treatment group that uses teacher conventional method for the control group.

The population of the study comprised all junior secondary school two Basic Science and Technology students in Ile-Ife, Osun State, Nigeria. Seventy-five JSII students were picked using a basic random selection procedure, all from the same classrooms they had been in before. A multi-stage sampling technique was used to pick the sample. From all of the states in the country, we picked one Local Government Area (LGA), and then inside that LGA, we picked three middle schools at random. A simple random sample method was used to choose one complete JSII class from each of the schools. The three chosen groups were split into two experimental and one control groups at random. Basic Science and Technology ideas were presented to the experimental group A utilising a flow-map as a guide. Group B in the experiment received teaching utilizing the jigsaw technique, whereas Group A received traditional training.

Two instruments were used to collect the information needed for the study. The two forms are the "Basic Science and Technology Achievement Test" (BSTAT) and the "Interest of Students towards Basic Science and Technology Questionnaire" (ISBSTQ). The BSTAT consisted of two sections, as shown below: Section A asked respondents basic demographic questions, whereas Section B comprised 30 multiple-choice questions, each with four alternative responses. Each set of questions was designed to serve a different purpose: as a pretest to establish whether or not the subjects' abilities were comparable; as a posttest to assess the impact of the treatment on the students' academic performance in the area; and as a retention test to evaluate the degree to which the respondents retained the information presented in Basic Science and Technology. Students were given two sets of test results using the test-retest method, and the reliability coefficient for BSTAT was calculated using the Pearson Product moment correlation (PPMC) to get a value of 0.73. The internal consistency reliability of the ISBSTQ was calculated to be 0.81 using Cronbach's alpha. This proves the accuracy and reliability of the methods used in the inquiry.

Results

Hypothesis One: There is no significant effect in the effectiveness of flow-map, jigsaw and conventional strategies in improving students' academic achievement in Basic Science and Technology.

In a bid to test this hypothesis, data collected on students' academic achievement in Basic Science having been taught with flow-map, jigsaw and conventional strategies were subjected to analysis to descriptive analysis and analysis of covariance (ANCOVA) using the students' post-test scores as dependent variable and pre-test scores as the covariate. The results are as presented in Tables 1, 2 and 3 respectively.

Table 1: Analysis of Covariance of effects of flow-map, jigsaw and conventional strategies in improving students' academic achievement in Basic Science and Technology

Tests of Between-Subjects Effects

Dependent Variable: Post-test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	201.973 ^a	3	67.324	7.7	.000	.248
Intercept	473.492	1	473.492	98	.000	.436
Pre-test	10.586	1	10.586	54.840	.272	.017
Strategies	201.362	1	100.681	1.226	.000	.247
Error	613.014	72	8.634	11.661		
Total	15543.000	75				
Corrected Total	814.987	74				

R Squared = .248 (Adjusted R Squared = .216)

(F = 11.661; p < 0.05)

Result in Table 1 indicates a significant effect of flow-map and jigsaw instructional strategies on junior secondary school learners' academic accomplishment in Basic Science and Technology in Osun State at ($F_{1, 72} = 11.661, p < 0.05$). Hence, the null hypothesis that expresses that there is no significant effect in the effectiveness of flow-map, jigsaw and conventional strategies in improving students' academic achievement in Basic Science and Technology is therefore rejected. The partial eta squared value of 0.247 accounted for the effect size of 24.7% of the instructional strategies on the learners' academic achievement in Basic Science and Technology in the study area.

Table 2: Descriptive analysis of effects of flow-map, jigsaw and conventional strategies on students' academic achievement in basic science and technology

S/N	Instructional Strategies	N	\bar{X}	SD
1.	Flow-map Strategy	25	15.28	4.31
2.	Jigsaw Strategy	26	15.00	2.97
3.	Conventional Strategy	24	11.76	4.86
Total		75	14.01	4.46

Table 2 shows the descriptive analysis of the impact of flow-map and jigsaw instructional strategies on junior secondary school students' academic achievement in Basic Science and Technology in Osun State. It can be deduced from the table that the learners faced with flow-map instructional strategy had highest mean score ($\bar{x} = 15.28$), learners faced with jigsaw instructional strategy

had high mean score ($\bar{x} = 15.00$) while their colleagues exposed to conventional teacher method had a mean score ($\bar{x} = 11.76$).

Table 3: Post-hoc test of pair-wise comparisons of basic science and technology post-test scores of students on treatments

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Jigsaw	Flow Map	-.769	.941	1.000	-3.077	1.539
	Conventional	3.101*	.840	.001	1.040	5.162
Flow Map	Jigsaw	.769	.941	1.000	-1.539	3.077
	Conventional	3.871*	.889	.000	1.690	6.052
Conventional	Jigsaw	-3.101*	.840	.001	-5.162	-1.040
	Flow Map	-3.871*	.889	.000	-6.052	-1.690

Based on Estimated Marginal Means.

* The mean difference is significant at the .05 level

b. Adjustment for Multiple Comparisons: Bonferroni

Table 3 shows the results of the Bonferroni-corrected post-hoc comparisons conducted to determine where the differences exist among the three groups in this study. It can be observed from the table 3 that students exposed to Jigsaw Instructional Strategy are statistically significant different from those exposed to Conventional Method ($p < 0.05$). Also, there is statistically significant different between the students exposed to Flow-map Instructional Strategy and Conventional Method ($p < 0.05$). Conversely, there is no statistically significant different between students exposed to Jigsaw Instructional Strategy and Flow-map Instructional Strategy ($p > 0.05$).

Hypothesis Two: There is no significant effect in the effectiveness of flow-map and jigsaw instructional strategies in improving students' interest towards the learning of Basic Science and Technology.

In a bid to test this hypothesis, data collected on students' interest towards Basic Science and Technology having been taught with flow-map and jigsaw strategies were subjected to descriptive analysis and analysis of covariance (ANCOVA) using the students' post interest scores as dependent variable and pre interest scores as the covariate. The results are as presented in Tables 4 and 5.

Table 4: Descriptive analysis of the effectiveness of flow-map and jigsaw instructional strategies in improving students' interest towards the learning of Basic Science and Technology

S/N	Instructional Strategies	N	Mean (\bar{X})	Standard Deviation(SD)
1.	Flow-map Strategy	25	28.96	2.791
2.	Jigsaw Strategy	26	26.72	4.514
Total		51	27.84	3.883

Information presented in Table 4 shows the descriptive analysis of the effectiveness of flow-map and jigsaw instructional strategies in improving students' interest towards the learning of Basic Science and Technology in Osun State. It can be deduced from the table that the learners beset with flow-map instructional strategy had the most elevated mean score ($\bar{x} = 28.96$) while their colleagues presented to jigsaw instructional strategy obtained mean score ($\bar{x} = 26.72$).

Table 5: Analysis of covariance (ANCOVA) of the effectiveness of flow-map and jigsaw strategies on students' interest towards Basic Science and Technology

Tests of Between-Subjects Effects
Dependent Variable: Post-test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	408.275 ^a	2	204.137	29.035	.000	.553
Intercept	936.488	1	936.488	133.199	.000	.739
Pre-interest Strategies	345.555	1	345.555	49.149	.000	.511
Error	251.655	1	251.655	35.793	.000	.432
Total	330.445	47	7.031			
Corrected Total	39492.000	50				
	738.720	49				
R Squared = .553 (Adjusted R Squared = .534)						

(F = 35.793; p < 0.05)

Result in Table 5 indicates significant effects of flow-map and jigsaw strategies in improving students' interest towards the learning of Basic Science and Technology in Osun State at ($F_{1, 4} = 35.793, p < 0.05$). Hence, the null hypothesis stating no significant effect in the effectiveness of flow-map and jigsaw instructional strategies in improving students' interest towards the learning of Basic Science and Technology in Osun State was rejected. The partial eta squared value of 0.432 accounted for the effect size of 43.2% of the strategies on students' interest towards Basic Science and Technology in Osun State.

Discussion of Findings

The results indicated that the instructional strategies of flow-map and jigsaw had a substantial influence on the learners' academic progress in Basic Science and Technology in junior secondary schools located in Osun State. The outcome was consistent with the results of Olajide and Ajewole (2020), who discovered that students had greater levels of success in Basic Science when it was taught using the Jigsaw teaching technique. In addition, the results confirmed the findings of Ogonnaya, Okafor, Abonyi, and Ugama (2016), who said that flow mapping employing idea maps enhances students' progress in Basic Science more so than traditional methods. Also, flow-maps often assist in improving reading comprehension, the writing process, the ability to solve problems, and thinking abilities (Winfield, 2012).

In addition, the findings of this research showed that the flow-map technique was much more successful than the jigsaw strategy in terms of increasing students' interest in the process of learning fundamental scientific concepts and technological principles. The findings are in agreement with Oviawe and Lukmon's (2017) conclusion that the flow-map teaching technique has a considerable influence on the interest of the students than those who were taught using the standard teaching method. Also, the results are consistent with those of Ede (2009), who found that the Jigsaw teaching technique had a considerable influence on the level of interest that students have in Physics.

In conclusion, the investigation revealed that both the flow-map teaching strategy and the jigsaw instructional strategy had an impact on the students' capacity to remember the fundamentals of science and technology, with the flow-map approach proving to be the more successful of the two. The conclusion of Agboola and Abe (2017) was verified by their findings. They demonstrated that an innovative teaching technique is more successful in boosting pupils' capacity to retain information in Basic Science in Ado-Ekiti. Obiagu (2011), Ahmed (2010), Winfield (2012), and Ogwo (2012) are examples of other empirical works in the sciences that lend validity to the results of flow-map and jigsaw models on the retention of concepts learned in scientific disciplines.

Conclusion

The study's findings suggest that teaching strategies like flow-map and jigsaw might help students learn more effectively and stimulate their curiosity in STEM subjects. Students in the fields of Basic Science and Technology benefit more from the activity-based learning instructional strategies of flow-map and jigsaw than they would from the more conventional approach to education.

Recommendations

The following suggestions, based on the results of the research, are offered to advise instructors on the methods to successfully employ activity-oriented types of education in Basic Science and Technology classrooms at the junior secondary

school level:

- i. Workshops and seminars should be attended by instructors of Basic Science and Technology in order to provide them with training on how to effectively employ instructional tactics such as flow-map and jigsaw.
- ii. At the Junior Secondary School (JSS) level, teachers of Basic Science and Technology should embrace the usage of the flow-map technique in order to teach some of the more challenging ideas in Basic Science and Technology.
- iii. Instructional strategies like the jigsaw should be used by teachers since these types of learning strategies encourage greater levels of communication and collaboration among students, as well as higher levels of team spirit and more levels of socialization.

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