Influence of Manipulative Skills on the Teaching and Learning of Basic Science in Secondary Schools in Ikere Local Government Area of Ekiti State

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Received: November 11, 2025 Accepted: November 13, 2025

ABSTRACT: *The study investigated the influence of manipulative skills on the teaching and learning of Basic Science in Secondary Schools in Ikere Local Government Area of Ekiti State. The study adopted descriptive research design of survey type. The population of this study comprised of Basic Science teachers and Junior Secondary class three (3) students in Ikere Local Government Area of Ekiti State. The sample of study consisted of ten Basic Science teachers and ninety Junior secondary class three students selected from the ten secondary schools in Ikere Local Government Area of Ekiti using simple random sampling techniques. The total sample used for the study were 100 respondents. Self-structured questionnaire was used to collect data for the study. The face and content validity of the instrument was done by experts in Test and Measurement and Integrated Science Education. The reliability of the instrument was established through the test re-test method, the two tests scores were thereafter correlated using Pearson product moment correlation which yielded coefficient value of 0.80 for self-structured questionnaire on manipulative skills on the teaching and learning of Basic Science in Secondary Schools. The researcher personally administered the questionnaire to the respondents. Data collected were analysed using descriptive and inferential statistics. The findings of the study revealed among others that most of the common manipulative skills used by Basic Science teachers influence the teaching and learning of Basic Science in schools. It was concluded among others that the failure rate of students will be curtailed if Basic Science teachers were made to utilize appropriate and relevant manipulative skills during the teaching and learning process of Basic science in secondary schools. Based on the findings of the study, the following recommendation were made among others that Basic Science teachers should endeavour to use and try to improvise instructional materials for effective teaching of Basic Science in the secondary schools. Government should ensure the adequate employment of dedicated and qualified Basic Science teachers to teach the subject in all secondary schools in the study area and in the state.*

Key Words: *Manipulative Skills, Teaching, Learning, Basic Science*

Introduction

Basic Science is the way of presenting science as a whole at the Junior Secondary education in Nigeria in which learners learn and understand their environment, observe and explore the world around them as a whole at the basic level. Basic Science prepares youths to acquire first-hand scientific information, skills and competencies that will enable them become functional in the society. All topics taught in this subject area should be accorded with the requisite instructional strategies and skills that will enable students experience the real life teachings. Therefore, teaching and learning activities in the school must be made interactive, participatory, constructive, practical-based and experiential (rather than placing much emphasis on theory) by appropriate utilization of instructional strategy, which will aid students to develop critical thinking, innovative skills and knowledge construction (Onajite & Aina, 2014).

Basic Science instruction necessitates appropriate and pertinent activities that impact and improve students' engagement and performance. Students' interest and aptitude for science in senior secondary school are enhanced by the inclusion of activities in basic science instruction. Many students may be deterred from studying science in senior secondary courses by the inefficient utilization of activities during basic scientific lessons in secondary schools, and this lack of interest has an impact on students' performance (Nwagbo 2010).

Teaching-learning process is a complex and dynamic interaction between teachers, students, and the curriculum. At the heart of this process is the teacher's teaching method, which can either facilitate or hinder student learning. Despite the best efforts of teachers, many students struggle to understand what's being taught, leading to frustration, disengagement, and poor academic performance. One of the primary

reasons for this challenge is the teacher's teaching method. Traditional teaching methods, which often focus on lecturing, rote memorization, and standardized testing, can be ineffective in engaging students and promoting deep understanding. Many teachers rely on these methods because they are familiar with them, or because they feel pressure to cover a wide range of material in a limited amount of time. However, these methods can lead to a lack of student engagement, motivation, and understanding (Anaekwe, 2019).

Teacher's teaching method can also perpetuate existing inequalities in education. Students from disadvantaged backgrounds, for example, may have had limited access to quality education in the past, and may therefore require more support to succeed. However, if teachers rely on traditional teaching methods, these students may struggle to keep up, leading to a widening of the achievement gap. In Nigeria, the challenge of students struggling to understand what's being taught due to the teacher's teaching method is particularly pronounced. The country's education system is largely exam-driven, with a focus on rote memorization and standardized testing. This can lead to a lack of student engagement, motivation, and understanding, particularly in subjects such as Basic Science, Mathematics and English. Moreover, the teacher shortage and lack of teacher training in Nigeria can exacerbate this challenge. Many teachers in Nigeria lack the necessary training and support to develop effective teaching methods, leading to a reliance on traditional methods that may not be effective in promoting student understanding. Therefore, it is essential to explore alternative teaching methods that can promote student engagement, motivation, and understanding. This can include methods such as project-based learning, problem-based learning, and flipped classrooms, which can help to promote deeper understanding and improve academic performance (Babayeva, 2021).

Manipulative skills in teaching refer to the techniques and strategies used by educators to positively influence student learning, behavior, and attitudes. These skills help teachers create an effective and productive learning environment, guiding students towards achieving educational goals. Manipulative skills in teaching includes effective communication, using educational resources and materials, motivation and positive reinforcement strategies, classroom management and behavior guidance techniques and adapting to individual student needs. The use of manipulative in teaching science subjects helps make abstract ideas concrete (Baruiz and Dioso, 2023).

The use of manipulative skills in Science Education is a critical area of research that requires attention. By exploring the impact of manipulative skills on student learning outcomes, this study aims to provide insights into effective teaching practices that can enhance academic performance and interest in Basic Science. Manipulative skills provide students with the opportunity to engage in hands-on activities, such as experiments, demonstrations, and projects, which can help to clarify complex concepts and principles. Manipulative skills can tackle the students' inability to understand is by promoting active learning. Active learning involves students engaging in activities that promote critical thinking, problem-solving, and decision-making.

Manipulative skills provide students with the opportunity to engage in active learning, which can help to promote a deeper understanding of complex concepts and principles. Manipulative skills can also help to promote student engagement and motivation. Many students become disengaged and demotivated when they are unable to understand complex concepts and principles. Manipulative skills provide students with the opportunity to engage in hands-on activities, which can help to promote student engagement and motivation (Ogunmade, Saibu and Ogunmade, 2024).

One of the major challenges facing educators in teaching Basic Science is the students' inability to understand complex concepts and principles. Basic Science is a practical and applied subject that requires students to have a deep understanding of the underlying principles and concepts. However, many students struggle to grasp these concepts, leading to poor academic performance and a lack of interest in the subject. The use of manipulative skills in teaching Basic Science has been identified as a potential solution to this problem. Manipulative skills refer to the hands-on, practical skills that students use to learn about Basic Science concepts, such as planting, harvesting, and animal care. By using manipulative skills, educators can help students to develop a deeper understanding of complex concepts and principles, and to overcome their inability to understand. One of the ways in which manipulative skills can tackle the students' inability to understand is by providing a concrete and tangible way of learning. Many students are visual or kinesthetic learners, and they require hands-on experiences to fully understand complex concepts. Aina (2013) asserted that teachers need to design ways of making children develop interest in science and thus overcome any negative influence towards learning of science. By this, teachers must strive to develop teaching strategies that will be highly motivating to sustain the interest of the pupils when they were still young.

The concept of manipulative skills is not new in educational research. Studies have shown that manipulative skills are essential in creating interactive and engaging learning experiences, promoting student participation, and enhancing student learning outcomes. However, research on the use of manipulative skills in Basic Science is limited. Most studies have focused on general science education, neglecting the unique needs and challenges of Basic Science.

The study investigated the influence of manipulative skills on the teaching and learning of Basic Science in Secondary Schools in Ikere Local Government Area of Ekiti State. Specifically, the study investigated:

1. the manipulative skills commonly used by Basic Science teachers in teaching and learning of Basic Science students in Secondary Schools in Ikere Local Government Area of Ekiti State?
2. The characteristics of manipulative skills used in teaching and learning of Basic Science in Secondary Schools in Ikere Local Government Area of Ekiti State?
3. The importance of utilizing manipulative skills in teaching and learning of Basic Science in Secondary Schools in Ikere Local Government Area of Ekiti State?

Research Questions

The following research questions were raised to guide the study.

1. What are the manipulative skills commonly used by Basic Science teachers in teaching and learning of Basic Science students in secondary schools in Ikere Local Government Area of Ekiti State?
2. What are the characteristics of manipulative skills used by the teachers in teaching and learning in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State?
3. What are the importance of utilizing manipulative skills in teaching and learning of Basic Science in secondary schools in Ikere Local Government Area of Ekiti State?

Research Hypotheses

The following research hypotheses were formulated for the study

1. There is no significant relationship between the use of manipulative skills and students' academic performance in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.
2. There is no significant relationship between the characteristics of manipulative skills used and academic performance of students in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.
3. There is no significant relationship between the importance of using manipulative skills and the academic performance of students in Basic Science in secondary school in Ikere Local Government Area of Ekiti State.

Methodology

The study adopted descriptive research design of survey type. It is aimed investigate the influence of manipulative skills on teaching and learning of Basic Science in secondary schools in Ikere Local Government of Ekiti State. The survey design was employed because the study covered large area from which sample was selected. A survey research studies a small sample from a large population from where inferences would be draw about the characteristics of the defined population.

The population of this study comprised of Basic Science teachers and Junior Secondary class three (3) students in Ikere Local Government Area of Ekiti State.

The sample of study consisted of 10 Basic Science teachers and 90 Junior secondary class three students selected from the ten secondary schools in Ikere Local Government Area of Ekiti using simple random sampling techniques. The total sample used for the study were 100 respondents. Self-structured questionnaire was used to collect data for the study.

Questionnaire was used to collect data for the study. The questionnaire was designed for both the teachers and the students different bio- data but the same items. The teachers questionnaire was divided into two (2) sections: Section 'A' consisted of teachers bio-data and section 'B' comprised of 10 items on the assessment of Manipulative Skills used by Basic Science teachers in secondary schools with four – likert scale: SA: Strongly Agree; A: Agree; SA: Strongly Disagree; D: Disagree. The questionnaire for the students was divided into two (2) sections: Section 'A' is on bio-data and section 'B' consisted of 15 items on the influence of manipulative skills on teaching and learning of Basic Science with four – likert scale: SA: Strongly Agree; A: Agree; SA: Strongly Disagree; D: Disagree

The face and content validity of the instrument was done by experts in Test and Measurement and Integrated Science Education. The reliability of the instrument was established through the test re-test method, the two tests scores were thereafter correlated using Pearson product moment correlation which yielded coefficient value of 0.80 for self-structured questionnaire on manipulative skills on the teaching and learning of Basic Science in Secondary Schools. The researcher personally administered the questionnaire to the respondents.

Data collected were analysed using descriptive and inferential statistics. Research questions raised were answered using descriptive statistics such as means and standard deviation. While the research hypotheses were analysed using chi square analysis. All hypotheses were tested at 0.05 level of significance.

Results

Descriptive Analysis of Research Questions

Research Question 1: What are the manipulative skills commonly used by Basic Science teachers in teaching and learning of Basic Science students in secondary schools in Ikere Local Government Area of Ekiti State?

Table 1: Mean Analysis of manipulative skills commonly used by Basic Science teachers

S/N	STATEMENT	SA	A	D	SD	TOTAL	MEAN	REMARK
1	Thorough planning of Basic Science lessons ensures clear objectives and outcomes	4 5	3 5	10	10	100	3.21	Agreed
2	Use of variety assessment strategies evaluates students learning in Basic Science .	48	32	15	5	100	3.10	Agreed
3	Effective allocation of time and resources enhanced successful implementation of Basic Science plans and lessons.	20	10	45	25	100	2.11	Disagreed
4	Establishment of clear expectations for students' behaviour in the Basic Science classroom.	46	30	12	12	100	3.18	Agreed
5	Consistent enforcement of classroom rules and consequences maintains a productive learning environment.	40	35	15	10	100	2.80	Agreed

Analysis of data presented in table 1 showed that, most of the items on the table were agreed upon and one was disagreed. According to the response, thorough planning of Basic Science lessons ensures clear objectives and outcomes with the mean of 3.21 and Use of variety assessment strategies evaluates students learning in Basic Science with the mean of 3.10; the respondents disagreed that the effective allocation of time and resources enhanced successful implementation of Basic Science plans and lessons with mean of 2.11; Establishment of clear expectations for students' behaviour in the Basic Science classroom with the mean of 3.18; The cluster of 2.80 showed that respondent agreed that Consistent enforcement of classroom rules and consequences maintains a productive learning environment. Most of the common manipulative skills used by Basic Science teacher influence the teaching and learning of Basic Science in schools.

Research Question 2: What are the characteristics of manipulative skills used by the teachers in teaching and learning in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State?

Table 2: Mean Analysis of the characteristics of manipulative skills used by the teachers in teaching and learning in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State

S/N	STATEMENT	SA	A	D	SD	TOTAL	MEAN	REMARK
6.	Good relevant textbooks were necessary to influence effective teaching and learning of Basic Science	50	28	12	10	100	3.29	Agreed
7.	Clear Pictures, models, drawings and specimens influence the teaching and learning of Basic Science	45	28	20	7	100	3.58	Agreed
8.	We have structured, accessible and functional laboratory	60	25	15	-	100	3.62	Agreed
9.	Clear learning objectives and relevant content influence effective teaching and learning of Basic Science.	16	54	4	26	100	3.16	Agreed
10.	Teachers' regular and appropriate use of manipulative skills enhances the teaching and learning of Basic Science.	50	40	10	-	100	3.26	Agreed

Analysis of data presented in table 2 showed that, most of the items on the table were agreed upon and one was disagreed. Good relevant textbooks were necessary to influence effective teaching and learning of Basic Science; Clear Pictures, models, drawings and specimens influence the teaching and learning of Basic Science; we have structured, accessible and functional laboratory. Clear learning objectives and relevant content influence effective teaching and learning of Basic Science. Teachers' regular and appropriate use of manipulative skills enhance students' performance illustration of Basic Science lesson. According to the respondents, Instructional materials to be used must be visible to every student in the class; the respondents agreed that the simplicity of instructional materials influence the teaching and learning of Basic Science. This implies that the characteristics of manipulative skills used by the teacher influence the teaching and learning of Basic Science in Secondary Schools.

Research Question 3: What are the importance of utilizing manipulative skills in teaching and learning of Basic Science in secondary schools in Ikere Local Government Area of Ekiti State?

Table 3: Mean Analysis of the importance of utilizing manipulative skills in teaching and learning of Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.

S/N	STATEMENT	SA	A	D	SD	TOTAL	MEAN	REMARK
11	Demonstrating practical skills to enhance students understanding	70	25	3	2	100	3.70	Agreed
12	Supervising and guiding students during practical activities in Basic Science ensures their safety and learning	40	35	15	10	100	3.40	Agreed
13	Motivational value has influence the use of instructional materials in teaching and learning of Basic Science	60	30	10	-	100	3.50	Agreed
14	Providing opportunities for students to ask questions and explore enhance their curiosity and improve their performance in Basic Science	55	24	20	1	100	2.73	Agreed
15	Manipulative skills encourages students critical thinking and problem solving skills in Basic Science	70	29	1	-	100	3.46	Agreed

Table 3 present data analysis of response on the importance of utilized instructional materials in Basic Science on students' academic performance in secondary schools in Ikere Local Government Area of Ekiti State. All the items patterning to the importance of utilized instructional materials in Basic Science on students' academic performance in secondary schools Ikere Local Government Area of Ekiti State agreed upon except one. Respondents agreed with a mean of 3.70 that demonstrating practical skills enhance students understanding. Also respondent also agreed with mean of 3.40 that Supervising and guiding students during practical activities in Basic Science ensures their safety and learning. Respondents agreed with the mean of 3.50 that motivational value has influence on the use of instructional materials on students' academic performance in Basic Science. Respondents agreed with a mean of 2.73 that providing opportunities for students to ask questions and explore enhance their curiosity in Basic Science. Respondent agreed with the mean of 3.46 that manipulative skills encourages students' critical thinking and problem solving skills in Basic Science. This implies the importance of utilizing manipulative skills in teaching and learning of Basic Science in Secondary Schools.

Testing of Hypotheses

Hypothesis One: There is no significant relationship between the use of manipulative skills and students' academic performance in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.

Table 4: Chi-square analysis result for relationship between the use of manipulative skills and students' academic performance in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State

X^2	X^2 Crit	df	& level
71.53	21.04	12	0.05

X^2 Cal = Chi-square calculated, X^2 Crit = Chisquare critical value df = Degree of freedom & level= Alpha level From table 5, it was revealed that there was a significant relationship between the use of manipulative skills and students' academic performance in Basic Science in secondary schools. This was because the chi-square calculated (X^2 Cal) 71.53 is greater than chi-square critical (X^2 Crit) 21.04 and therefore the null hypothesis was rejected. This implied that the use of manipulative skills can influence the learning and improve the performance of students in Basic Science in Secondary Schools.

Hypothesis Two: There is no significant relationship between the characteristics of manipulative skills used and academic performance of students in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.

Table 5: Chi-square analysis result for relationship between the characteristics of manipulative skills used and academic performance of students in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.

X^2	X^2 Crit	df	& level
112.4	13.93	8	0.05

X^2 Cal = Chi-square calculated, X^2 Crit = Chi square critical value df = Degree of freedom & level= Alpha level From Table 6 it was revealed that there is significant relationship between the characteristics of manipulative skills used and students' academic performance in Basic Science. This was because the chi-square calculated (X^2 Cal) 13.93 is greater than the chi square critical (X^2 Crit) 112.4 Therefore the null hypothesis was rejected. This implied that Manipulative skills with necessary characteristics can influence students' academic performance in Basic Science positively.

Hypothesis Three: There is no significant relationship between the importance of using manipulative skills and the academic performance of students in Basic Science in secondary school in Ikere Local Government Area of Ekiti State.

Table 6: Chi-square analysis result for relationship between the importance of using manipulative skills and the academic performance of students in Basic Science in secondary schools in Ikere Local Government Area of Ekiti State.

X^2	X^2 Crit	df	& level
113.2	2 1.01	12	0.05

X^2 Cal = Chi-square calculated, X^2 Crit = Chisquare critical value df = Degree of freedom & level= Alpha level Table 6 revealed that there is a significant relationship between the importance of using manipulative skills and students' academic performance in Basic Science. This was revealed by the calculated chi-square value of 113.2 which is greater than the critical value of 21.01. Therefore the null hypothesis was rejected. This indicated that manipulative skills can be used as an important ingredient to influence students' learning and performance in Basic Science.

Discussion

The findings of the study revealed that most of the common manipulative skills used by Basic Science teachers influence the teaching and learning of Basic Science in schools. Manipulative skills in teaching are a crucial aspect of effective education, enabling teachers to intentionally influence student learning, behavior, and attitudes. These skills encompass a broad range of techniques and strategies that teachers employ to create an engaging learning environment, foster critical thinking, and develop essential skills for success. This finding coincided with Anyawu and Anyawu (2013) who stated that textbooks were the most common instructional materials that teachers used to disseminate knowledge.

The findings revealed that the characteristics of manipulative skills used by the teacher influence the teaching and learning of Basic Science in Secondary Schools. This finding is in line with Ogundele (2019) who stated that a good teaching aid must be visible, attractive and hold attention.

The findings revealed the importance of utilizing manipulative skills in teaching and learning of Basic Science in Secondary Schools. This finding was buttressed by Adeyemo (2010) who stated that instructional materials should be used to supplement oral explanation and descriptions. Ogunmilade et al. (2024) stated that using manipulative skills, Basic Science teachers can make complex concepts more accessible, encourage students to explore real-world scenarios, and prepare them for practical applications.

The finding revealed that the use of manipulative skills can influence the learning and performance of students in Basic Science in Secondary Schools. the findings is in line with Ugochukwu, (2012) that Basic Science in the context of this study is a skill oriented subject taught in secondary schools by competent teachers and practical instructors with the objective of impacting skills in crop and animal production into the students

The findings revealed that manipulative skills with necessary characteristics can influence students' learning and academic performance in Basic Science positively. This finding is in line with Ogundele (2019) who stated that a good teaching aid must be visible, attractive and hold attention.

The findings revealed that manipulative skills can be used as an important ingredient to influence students' learning and performance in Basic Science. The findings is in line with Fadzil and Saat (2020) Submission that effective use of manipulative skills leads to improved student outcomes, increased motivation, and enhanced academic achievement.

Recommendations

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

1. Basic Science teachers should endeavour to use and try to improvise instructional materials for effective teaching of Basic Science in the secondary schools.
2. Government should ensure the adequate employment of dedicated and qualified Basic Science teachers to teach the subject in all secondary schools in the study area and in the state.
3. Government should make available funds and sponsor the teachers' attendance at conferences, seminars and workshops on utilization of Basic Science manipulative skills.

4. The government through the Ministry of Education, Science and Technology (MOEST), should make available Basic Science instructional materials for use by teachers to enhance students' academic performance in Basic Science.

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