

## Research Article

## Teaching effectiveness in the utilization of Montessori approach in early childhood basic science learning in Ika South Local Government Area in Delta State

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doi: [10.33750/ijhi.v6i1.177](https://doi.org/10.33750/ijhi.v6i1.177)**Abstract**

Most learners find science challenging, which may be because of the methodology used in the early years that presents it as difficult and abstract. On the other hand, the Montessori Method uses a hands-on approach to teaching science from the early years. This study, therefore, looks at the effect of the teachers' utilization of the Montessori approach to early childhood education in Ika South Local Government Area (LGA) of Delta State, Nigeria. Two research questions and hypotheses were raised. The research design adopted for the study was a descriptive, pre-test, post-test, quasi-experimental method used to test the differences between the pupils' learning experiences in the two groups. The Taro Yamane formula was used to get the sample size, and a stratified random sampling technique was used to select 77 teachers and 40 nursery pupils, comprising ten each in experimental and control groups, in two schools in Ika South LGA of Delta State. The instruments to be used for this study will be self-designed multiple-choice achievement test questions in early years' science and four-point Likert-type self-structured questionnaires. The result indicates that teachers' knowledge and utilization of the Montessori approach to teaching pre-primary science is more effective than the conventional teaching method. Some suggestions were made for the way forward.

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**1. Introduction**

Education facilitates learning or acquiring individuals' knowledge, skills, values, beliefs, and habits. Education is the interaction between a teacher and a student during which teachers improve a student's skills and behaviors (Vikoo, 2016). According to Odili (2021), the National Policy on Education states in Section 1:3 that education aims to train the mind to understand the world. The policy also stated that acquiring appropriate skills and developing mental, physical, and social abilities and competencies as equipment for the individual to live in and contribute to the development of society are among the goals of education in Nigeria.

The foregoing definitions indicate that education aims to equip the individual in all ramifications regarding knowledge, skills, and competencies. The people around an individual (parents, spouses, children, and other family members) also benefit from the individual's education. Birabil and Ogeh (2020) elaborated further that education, which can be formal or informal, is the recognized method by which a person is made to acquire ideas, beliefs, and attitudes for combating the hazards and problems of life, securing the needs of his or her family, and also fitting into the company of his or her fellow human beings.

Early childhood, beginning with infancy, is a period of profound advances in reasoning, language acquisition, and problem-solving (Vasilyeva & Lourenco, 2012). Moreover, it

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is a period where a child's environment can dramatically influence the degree and pace of these advances. By supporting development when children are very young, early childhood development and education programs can complement parental investments and produce large benefits for children, parents, and society. It is well established that children's experiences in their early years before they enter primary school are very important in affecting their long-term cognitive and social development. Children's development, in turn, affects not only their personal well-being but also their capacity to contribute to society's general well-being (Biggeri & Santi, 2012).

Teachers are conditioned to think that the traditional method—in which the instructor assumes the role of the principal controller in the classroom, and the students serve as passive listeners throughout the discussion—is more effective from the perspective of learning (Boaler, 2002; Deslauriers et al., 2019). When students are denied the freedom to voice their opinions and collaborate and communicate with their peers, this becomes one of the management problems in the classroom. This approach is also the least effective way to deliver education; it causes many issues with students' performances and learning, depriving them of their ability to take the initiative and engage in conversation. If the value of transparent communication between educators and students is not addressed, boredom will follow, leading to eventual disorder. Although this strategy has been utilized in teaching for a long time, Nwabuwe et al. claim that it is insufficient for addressing the needs and interests of the students because it does not provide them the chance to participate, work together, or report (2016).

Early childhood/pre-primary education is the instruction given to support a child's entire development (Sooter, 2013). Children under six are cared for, developed, and educated as part of this process. The child is obtaining his or her first formal education in a school with this one. Every child, regardless of gender, has the right to free and compulsory basic education as well as equal opportunity for higher education based on individual aptitude, as stated in Article 7 of the Child's Right to Education.

The objectives of early education are to:

- Get the kid ready for a responsible existence in the world.
- Maximize the child's potential in terms of personality, talent, and physical and mental development.
- Strengthen traditional values and good cultural norms.
- Encourage respect for personal independence.
- Support the maintenance of international harmony, African solidarity, and national and territorial integrity.

Regardless of the evaluation tool, educators and policymakers concur that educational efficacy is evidenced when students' learning improves (Paulley & Buseri, 2019). Also, it is widely agreed that by using the knowledge and abilities that the teacher presents to the student, learning in school advances in the direction of graduation goals (Corbelt et al., 2008; Wiek et al., 2014). To ensure that children are successful after high school, the definition of instructional

effectiveness must include progress in student learning (Alliance for Excellent Education 2007).

It was initially thought that teachers' personality traits contributed to their ability to instruct students effectively, and studies were made specifically to find those traits. Later, it was determined to be a result of instructional strategies and determined after extensive research to be the outcome of classroom management. The phrase "educational effectiveness" is used by Seidenberg (2013) to refer to both academic and instructional success. School-level conditions that foster effectiveness are referred to as "school effectiveness," and teacher- and classroom-level conditions that foster effectiveness are referred to as "instructional effectiveness."

Initially, instructors' personality traits were thought to impact how well they taught, and studies were developed to identify those traits. It was eventually recognized as a result of the educational strategies and was identified as the outcome of classroom management after extensive investigation. Seidenberg (2013) refers to both academic and instructional effectiveness when using the phrase "educational effectiveness." "School effectiveness" refers to conditions that increase effectiveness at the school level, and "Instructional effectiveness" refers to variables that increase effectiveness at the teacher and classroom levels.

Etuk (2017) argued that it is difficult to communicate the idea of teacher effectiveness, and there is not a single term that applies to it all because it is so fluid and complicated. The researchers used an operational definition of teacher effectiveness, which refers to teaching effectiveness criteria that are obtainable from the relationship between the process (methods) and the product (successful outcome) variables of teaching, in order to avoid becoming bogged down in the complexities of explaining the concept of teacher effectiveness. In other words, how teachers conduct themselves in the classroom, particularly how they engage with students, is a key factor in determining their effectiveness. Taylor in Etuk (2017) emphasized the academic credentials and subject-matter expertise, teacher enthusiasm, workloads, effective instruction delivery, setting and marking exams, attitudes of teachers toward students and overall student motivation, availability of the teacher in class, and teacher personality as the criteria for teaching effectiveness (self-reliance and confidence).

The Maria Montessori curriculum is rich in all aspects of science and starts as soon as the child enters pre-school (Montessori, 2013). Science is all around, and young children start interacting with nature as soon as they are able to observe the world around them. A school that is based on the true Montessori philosophy presents science to the child in an inclusive manner. The Montessori Method caters to the children individually while teaching them to love science and that science is all around them (Gordon & Browne, 2016).

As taught in the Montessori approach, science is known for introducing children to advanced topics in their early years, preparing them for a lifetime of discovery. The Montessori sciences are broken down into various categories, like zoology, human biology, botany, earth science, physical science, mechanics, and technology. The Montessori

teacher's ideal attitude toward the child is to allow them to be led by their own curiosities and drive them to be in control of how deeply they dive into the science. This is done by providing the appropriate learning materials at each given period.

The studies on teaching effectiveness in utilizing the Montessori approach in early childhood education explore the theory and practice of Montessori education in nursery schools in Nigeria. The Federal Government, in line with Montessori ideology that says "children have an absorbent mind in their window period," which means within this nursery age is the window period where learning can easily take place, had made pre-primary education a compulsory schooling period. The Montessori approach, one of the innovative methods of instruction that believes so much in children's exploration of the world around them, introduces science to children at an early age to develop their critical thinking skills and problem-solving abilities (Izuagba et al., 2017). Based on this, pupils with the creative and technological mindset to invent things, be able to face the competitive job market, and become self-reliant are produced. Thus, a Montessori teacher should introduce science to the children early by allowing them to discover things themselves and by providing an enabling environment and materials for the level appropriate, while the conventional method presents science to the pupils as theories and laws that should be memorized to reproduce them to pass examinations (Lillard, 2017; Lamrani & Abdelwahed, 2020).

The studies on teachers' effective utilization of the Montessori approach in early childhood education explore the theory and practice of Montessori education in nursery schools in Nigeria and Delta State. The Federal Government, in line with Montessori ideology that says, "children have an absorbent mind in their window period," which means within this nursery age is the window period where learning can easily take place, had made pre-primary education a compulsory schooling period. The Montessori approach, being one of the innovative methods of instruction that believes so much in children's exploration of the world around them, introduces science to children at an early age to develop their critical thinking skills and problem-solving abilities. Based on this, pupils with the creative and technological mindset to invent things, be able to face the competitive job market, and become self-reliant are produced. And so, a Montessori teacher should introduce science to the children early by allowing them to discover things themselves and by providing an enabling environment and materials for the level appropriate.

Despite all the attributes of the Montessori approach to learning as it is practiced, our products do not seem to possess the qualities associated with pupils trained with this approach, and there is a need for a solid educational foundation that begins from the cradle. The problem specifically is the low interest in science and related science courses, which has incapacitated technological growth and invention in Nigeria. Could the method of teaching be the cause? Nwabuwe et al. (2016) opined that the Montessori approach, as an innovative instructional method, is better than the traditional method. Therefore, the problem this study wishes to address is, "Could

the teachers' effective utilization of the Montessori approach in teaching science be affecting early childhood education"?

The following research questions were raised to guide this study:

- Do teachers in the Ika South Local Government Area of Delta State know the Montessori method in teaching basic science in nursery school?
- Do these teachers use the Montessori approach to teach basic science in pre-primary classes?

To guide this study, the following hypotheses were generated from the research questions:

- Ho1: There is no significant difference between the mean responses (scores) of the teacher's knowledge in teaching sciences in pre-primary classes and the pupils' academic performance.
- Ho2: There is no significant difference between the mean responses (scores) of teachers who utilize the Montessori approach in teaching sciences in pre-primary classes and the academic performance of the pupils.

## 2. Method

### 2.1. Design of the Study

A descriptive, pre-test/post-test, quasi-experimental design was used. There were 70 pre-primary school teachers and two thousand, five hundred, and fifteen (2,515) children in Ika South L.G. public pre-primary schools (source of information: Delta State Universal Basic Education Board, SUBEB). The 70 teachers were used for the study since the numbers were few, and forty (40) pupils were randomly sampled to be distributed into four classes of ten pupils each in two experimental schools and two control schools for the two schools that were used. With permission from the sampled schools, the pupils were randomly selected in an equal number by gender to make up ten pupils per class of multi-ages (3-5 +). This is in accordance with the Montessori philosophy of education. There was a pre-test for both the control and experimental groups, then treatment for five weeks before the post-test was conducted.

### 2.2. Data Collection

A self-structured questionnaire on Montessori activity (SSQMA) of Likert four-point structure containing twenty-five (25) items was used for the teachers, and a self-structured achievement multiple-choice science question (SSAMCSQ) was used for the pupils. The instruments were subjected to peer review among colleagues in the early childhood and science education departments who are pre-primary classroom educators. The attention and contributions of experts in the field of measurement and evaluation were also consulted.

### 2.3. Data Analysis

The reliability of the instruments was determined using the split-half test method for the Self Structured Science Achievement Multiple Choice Test Questions (SSAMCTQ) for the pupils and the Self Structured Questionnaire on Montessori Activities (SSQMA) for the pre-school teachers in a school that was not involved in the study. Some copies of

the questionnaire were given alongside the split-half science multiple-choice questions test. The reliability coefficient was calculated using the Spearman-Brown formula, and reliability coefficients of 0.75 and 0.78 were obtained, showing that the instruments were reliable.

### 3. Results

Data collected alongside the formulated hypotheses of the study were analyzed with descriptive statistics like the mean (with a benchmark for acceptance of 2.50) and standard deviation, while the t-test statistical tool of data analysis was used respectively to analyze the formulated hypotheses at the 0.05 level of significance using the Statistical Package for Social Sciences (SPSS) version 25.

#### 3.1. Research Question 1

Does the teacher's knowledge of the Montessori approach affect the academic performance of pre-primary class pupils in science?

Table 1. Descriptive statistics on teacher's knowledge of Montessori approach:

S/N	teacher's knowledge of Montessori approach N=70	$\bar{X}$	SD	Remark
1.	The class is arranged in the two-to-one seat with pupils facing the blackboard.	2.97	0.92	Agreed
2.	Children are taught in class by following the subject on the timetable	3.40	0.92	Agreed
3.	Children can be rewarded by giving them sweets or biscuits	2.60	0.92	Agreed
4.	Practical life fosters independent and respect for the environment and others.	2.81	1.13	Agreed
5.	Children are allowed to play outside the class.	2.19	0.62	Disagreed
6	There should be age-appropriate seats arranged in group of 4-6 per table in the class	2.20	1.07	Disagreed
7	You have to be trained in Montessori approach to function well.	2.31	1.00	Disagreed
8	Children are taught sensorial by using specific learning materials like a smell jar, sound cylinder, color tablet, etc.	2.20	1.08	Disagreed
<b>Grand Mean</b>		<b>2.59</b>	<b>0.96</b>	<b>Agreed</b>

Respondents agreeing to items 1 to 3 and disagreeing with items 5 to 8 above show that the teachers have little or no knowledge of Montessori approach.

#### 3.2. Research Question 2

Does teachers' utilization of the Montessori approach in teaching science in pre-primary classes affect their academic performance?

Table 2. Descriptive statistics on teachers' utilization of the Montessori approach in teaching science in the pre-primary class

S/N	Teachers' utilization of the Montessori approach N=70	$\bar{X}$	SD	Remark
9.	Teachers do not teach but provide appropriate materials and guide the children.	2.30	1.00	Disagreed
10.	Children are allowed to make their choice of material to play with and learn	2.29	1.01	Disagreed
11	Flogging is not a way of correcting a misbehaved pupil in Montessori class.	2.31	1.03	Disagreed
12.	Pupils of different ages are placed in a class to learn.	2.23	1.11	Disagreed
13.	The teacher stays in front of the class to teach	2.41	0.77	Disagreed
14	Children learn to be careful when collecting learning materials by taking turns.	1.99	0.55	Disagreed
15	The approach promotes decision-making skills, problem-solving, and inquiry skills.	2.80	0.91	Agreed
16	The approach fosters social interactions by children asking for materials from one another.	3.09	0.97	Agreed
17	Children are taught the sense of smell by asking them to touch their noses and say what it is used for.	2.89	1.04	Agreed
<b>Grand Mean</b>		<b>2.48</b>	<b>0.93</b>	<b>Disagreed</b>

From the above responses, item 9 to 14 show disagreement by respondents, which implies non – utilization of the Montessori approach in teaching since the approach should involve a positive response to all those items if it is being utilized.

#### 3.3. Test of Hypothesis

##### 3.3.1. Ho1

There is no significant difference between the mean responses (scores) of teacher knowledge in teaching sciences in pre-primary classes and the academic performance of the pre-primary pupils.

Table 3. Summary of independent sample t-test on difference between the mean responses (scores) of teacher knowledge in the teaching of sciences in pre-primary classes and the academic performance of the pre-primary pupils.

Variables	N	Mean	SD	T	df	p-value	Decision
Knowledge	70	2.59	0.96	1.785	108	0.001	S
Academic Performance	40	28.98	3.89				

Table 3 summarizes the independent sample t-test on the difference between the mean responses (scores) of teacher knowledge in teaching sciences in pre-primary classes and the academic performance of the pre-primary pupils. It shows a significant difference between the mean ratings of teacher knowledge in teaching sciences in pre-primary classes and the academic performance of the pre-primary pupils ( $t=1.785$ ,  $df=108$ ,  $p=.001$ ). The null hypothesis one was rejected at a .05 level of significance.

3.3.2. Ho2

There is no significant difference between the mean responses (scores) of teachers who utilize the approach in teaching sciences in pre-primary classes and the pupil's academic performance.

Table 4. Summary of independent sample t-test on the difference between the mean scores of teachers who utilize the approach in teaching basic science in pre-primary classes and the pupil's academic performance.

Variables	N	Mean	SD	t	df	p-value
Teacher Utilizing	70	2.48	0.93	6.69	108	0.000*
Academic Performance	40	21.20	4.50			

Data in Table 4 shows a summary of the independent sample t-test on the difference between the mean scores of teachers who utilize the approach in teaching sciences in pre-primary classes and the academic performance of the pupils. It showed that there is a significant difference between the mean responses (scores) of teachers who utilize the approach in the teaching of sciences in pre-primary classes and the academic performance of the pupils ( $t=6.69$ ,  $df=108$ ,  $p=.000$ ). The null hypothesis two was rejected at .05 level of significance.

4. Discussion

The results of the analyzed data were presented in tables. The findings showed a significant difference between the mean ratings of teacher knowledge in teaching sciences in pre-primary classes and the academic performance of the pre-primary pupils. The null hypothesis was rejected at the .05 level of significance. This result is in agreement with the findings of Omotayo (2006); it is described as knowledge in basic skills, academics, technical skills, and discipline. In its broadest sense, it is any act or experience that has a formative effect on an individual's mind, character, or physical ability. In its technical sense, education is the process by which society deliberately transmits its accumulated knowledge, skills, and values from generation to generation through institutions. All these are possible if the teacher knows the Montessori approach to education.

There is a significant difference between the mean responses (scores) of teachers who utilize the approach in teaching sciences in pre-primary classes and the academic performance of the pupils. The null hypothesis two was rejected at the .05 level of significance. This result supports the findings of Amjad and Muhammad (2012), who opined that in the Montessori approach to learning, there is a link between instructors, learners, and parents. To learn effectively, Maria Montessori insisted that learners, teachers, and parents must cooperate so that young children can learn more effectively. In a cooperative learning environment, size does not matter; even a single student learns cooperatively. Thus, the importance of cooperative learning is evident even with one student, and this can only be discovered when the teacher utilizes the method. Although Piaget and Vygotsky greatly respected Dr. Montessori, they were unhappy with her emphasis on a sensorial approach to education. Nevertheless, they utilized the Montessori method as a bridge for constructive accomplishment.

5. Conclusion

The study considered teaching effectiveness by utilizing the Montessori approach to early childhood science education in Ika South L.G.A. of Delta State. Based on the study's findings, it can be deduced that the pre-primary schoolteachers have little or no knowledge of the Montessori approach to teaching science, nor can they effectively utilize the approach to early childhood education. But after the treatment, there was a significant difference between the scores of the control and experimental groups, which can only be associated with the treatment given to the experimental groups. Therefore, teachers must develop their knowledge and ability to utilize Montessori strategies for effective pupil learning of science in Ika South L.G.A. of Delta State.

Based on the study's outcome, the researcher suggests that the Montessori method should be implemented as an instructional method for content delivery at the pre-primary level of education. The government should train teachers in the Montessori approach and monitor its effective implementation. The government should ensure that schools are well funded in order to eradicate the effect of the socioeconomic status of the children's parents on their academic opportunities.

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