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Effects of Reggio-Emilia Approach in Teaching Measurement of Length to Pupils in Kwara State, Nigeria

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Abstract

This study investigates the effects of implementing the Reggio-Emilia approach in teaching measurement of length to pupils in Kwara State, Nigeria. The research aims to address the gap in engaging students effectively in basic science education. Traditional teaching methods often lead to passive learning and limited retention of scientific concepts. By exploring the impact of the Reggio-Emilia approach, which emphasizes interactive and experiential learning, this study seeks to enhance students' understanding and interest in physics-related concepts. The quasi-experimental design employed in the study allows for causal inferences to be drawn, despite the lack of randomization. Through the use of the Measurement of Length Achievement Test and statistical analysis with ANCOVA, the researchers assess the effectiveness of this innovative teaching approach. The findings contribute to the ongoing discourse on improving science education practices, particularly in regions facing challenges related to resources and infrastructure.

Keywords: *Reggio Emilia approach, Physics-Related Concepts, Pedagogistas, Atelieristas*

1. Introduction

Science as a field of study has made it possible for man to know more about the universe (Oyelekan *et al.,* 2018). Science is delineated as a systematic enterprise that builds and organizes knowledge in the form of testable, explanation, and predictions about the universe. Science is a universal subject that spans the branches of knowledge which examines the structure and behaviour of the physical and natural world through observation and experiment (Bjorklund, 2022; Olajide, 2019; Stutchbury and Morton, 2022; López-Ocón and Thurner, 2023). The different areas of natural and physical world that science examines makes education in science to be classified into different subjects like biology, chemistry, and physics.

Basic Science and Technology has contributed a lot to knowledge, growth and development of individuals and the society in general. Carleo *et al.* (2019) stressed that this body of knowledge has been described as the essential tool needed for the scientific and technological advancement of any nation and plays a significant role in the evolution of

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modern society. Similarly, it was opined that physics plays important and dominant roles in fronting technological progression, promoting national wealth and improving health, Annan (2022); Day (2004). The knowledge of Basic Science and Technology improve the environment and this makes it very necessary for it to occupy a very important position among basic school subjects at basic level of education.

Basic Science, also known as pure or fundamental science, is driven by curiosity and the desire to expand our knowledge and understanding of the natural world. Its primary aim is to uncover fundamental principles and laws that govern the universe, without immediate practical applications in mind (Bodrova and Leong, 2024). It is one of the most fundamental scientific disciplines and its main goal is to understand how the universe behaves. It is sometimes referred to as the science of measurement and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to the human race (Agommuoh, 2019; Malik *et al.*, 2023; Omosewo, 2009). In Nigeria, basic science has been taught as one of the basic science and technology subject at the basic school level in which basic science is the combination of component of biology, chemistry and physics. However, physics is being taught at senior secondary school in Nigeria such as motion, mechanics, optics, heat, electricity, atomic physics and physics of sub-atomic particles among others (Heiney, 2022; Omosewo, 2009; Stonier, 2012; Jeynes *et al.,* 2023) in the preparation for higher physics and related physics courses.

There are different approaches and philosophies in teaching early childhood education, Approaches and philosophies in teaching early childhood education refer to the various methods and beliefs about how young children should be taught and cared for (Walton and Darkes-Sutcliffe, 2024; Mata-McMahon and Escarfuller, 2023; Pretti-Frontczak and Brown, 2023; Maritz, 2022). Some of these include; Montessori Method that focuses on child-led learning, allowing children to choose their activities and learn at their own pace. Waldorf Education which focuses on imaginative play, routine, and art-based activities with limited use of technology. HighScope Method which involves active participatory learning where children are encouraged to explore the world around them and Reggio Emilia Approach that emphasizes community involvement, self-expression, and documentation of a child's thoughts. So Reggio Emilia approach is one of them. This approach, which originated in Italy with "over 40 years of experience," places strong emphasis on the development of "strong, capable, and resilient" children. Reggio Emilia, a prosperous region in Northern Italy, is the site of one of the most innovative, high-quality city-run infant-toddler and pre and primary systems in the world.

The Reggio Emilia Approach to early childhood education draws from the ideas of many great thinkers, yet it is much more than an eclectic mix of theories (Mercan and Kandýr, 2024; Atabey, 2020; Taguchi, 2007). The Reggio Emilia approach is an educational philosophy that originated in the Italian city of Reggio Emilia. The Reggio Emilia approach, developed by Loris Malaguzzi after World War II (WWII), is described as "a philosophical approach that is focused on listening and respecting children and their potentials by witnessing their actions toward reformulating everyday practices, ideas, and projects". The first Reggio Emilia School, founded by Malaguzzi in 1963, placed a strong emphasis on nurturing relationships between adults and children. The environment as the third teacher, 100 languages of children, long-term projects, teacher-researcher, image of the child, negotiated learning, documentation and social relations are the eight core tenets that guide the approach.

As children participate in their activities, it is important for them to make and correct their own errors. This approach provides the necessary opportunity to become practiced at creative problem solving. Teachers must have enough respect for children in order to permit these processes to occur. In other words, the children are considered to be competent. Reggio teachers neither provide solutions nor leave children to their own resources. The child-centred curriculum of Reggio Emilia Schools is based on this image of children as full of life, power, and confidence rather than full of need (Motherway, 2022).

Reggio Emilia employs a wholly inclusive policy where children are included in all levels of classroom activities. When a child with special rights is present in a particular class, that class is assigned an extra educator, but crucially the educator is considered to be extra support for the whole group and not just for the particular child (Burns *et al.,* 2023; Beaver and Wyatt, 2022). This decision is undoubtedly based on the central belief in socio-constructivism as the vehicle for learning and understanding for everyone in the learning group, be the educator or the child. By valuing children in this way educators put much more emphasis on really listening to children.

The alarming decline of interest in Science subjects especially physics among Nigerian students has become worrisome to all stakeholders in the country. Several efforts have been put in place to encourage students to study physics even rightly from the childhood education and as discipline since it is the basics for entrepreneurship and industrialization therefore the researchers are interested in effects of Reggio-Emilia approach in teaching Measurement of Length to pupils in Basic School in Kwara State, Nigeria.

Despite the recognized importance of providing quality education in basic science and technology to basic school children in Kwara State, there remains a significant gap in effectively engaging students in the learning process.

Traditional teaching methods often rely on rote memorization and passive learning, resulting in limited understanding and retention of basic science and technology. Moreover, Fox (2023) submitted that the current pedagogical approaches do not adequately cater to the diverse learning needs and interests of students, leading to disengagement and disinterest in the subject. Furthermore, the lack of resources and infrastructure in many schools in Kwara State poses additional challenges to delivering engaging and effective basic science and technology (Fadokun, 2023; Abdulazeez, 2021; Salahu, 2020)

1.1. Purpose of the Study

The main purpose of this study is to explore the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools in Kwara State.

Other specifically purpose are to:

1. Investigate the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools.
2. Investigate interactive effect of age in the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools.

1.2. Research Questions

The following research questions will be formulated for this study

1. What is the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools?
2. To what extent is the interactive effect of age in the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools?

1.3. Research Hypotheses

The following questions will be raised to guide the study:

H_{01}: *There is no significant effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools.*

H_{02}: *There is no significant interactive effect of age in the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in basic schools.*

2. Methodology

Research design refers to the overall plan or strategy that guides a research project. The design for this study was quasi-experimental design. Despite the lack of randomization, quasi-experimental designs still allow researchers to make causal inferences, although with less certainty than true experimental designs. The pretest-posttest design was adopted in this study to investigate the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in lower basic schools in Kwara State, Nigeria.

The population of the study comprises of all the lower basic school pupils in Ilorin, the target population consists of all the lower basic school pupils in Ilorin, sample for the study were drawn from the target population using multistage sampling technique. A sample of two lower basic schools were randomly selected, while purposive sampling technique was used to select two-basic three classes as the study treatment and control group respectively. The instruments for data collection was achievement test namely; MLAT-Measurement of Length Achievement Test

The face and content validity of the questionnaire was established by giving the instruments to two experienced Basic Science teachers, two science education lecturers that specialised in Physics from the Department of Science Education, and two lecturers from the Department of Adult and Primary Education specifically Primary Education unit, University of Ilorin, Ilorin, Nigeria. The Basic Science teachers and lecturers assisted the researcher to determine the suitability of the contents for the intended use and also corrected grammatical errors in the items structured. The instruments after validation were trial tested using split-half method, and the reliability coefficient was determined using Cronbach' Alpha which gave a result of 0.81 reliability coefficient, the instruments were adjudged reliable for the study.

The researchers collected a letter of Introduction from the Department of Science Education, University of Ilorin. The letter was presented to the head-teachers of the participating schools to seek for their permission to engage their pupils in the study. Copies of Informed Consent Forms that contained detailed information about the research was given to the pupils to take home for their parents to indicate their willingness to allow their wards to partake in the research.

The study lasted for two weeks in each of the selected schools. All the participants were assured that all information provided would be treated with utmost confidentiality. All other ethical issues such as: anonymity, confidentiality, risks, benefits and rights of volunteers were carefully spelt out for the participants.

The data collected from the research were analysed using inferential statistical tools. The research hypotheses were tested using the Analysis of Covariance (ANCOVA) at 0.05 level of significant. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 26.0. A comprehensive and well-established conclusion was drawn from the result obtained from the analysis.

3. Data Analysis and Results

The Table 1 presents a breakdown of the age distribution among the respondents participating in the study. Three distinct age categories are delineated: 5-7 years, 8-10 years, and 11 years and above. Within these categories, the frequency of respondents is detailed, reflecting the number of individuals falling into each age bracket. For instance, the youngest age group of 5-7 years comprises 4 respondents, representing 10% of the total sample size. The majority of respondents, constituting 65% of the sample, fall within the age range of 8-10 years, with 26 individuals falling into this category. Additionally, 25% of respondents are aged 11 years and above, totaling 10 individuals. The table concludes with a total count of respondents, ensuring that the sum of frequencies aligns with the overall sample size of 40 participants. This comprehensive overview of age distribution provides valuable demographic insights into the composition of the study population, facilitating a nuanced understanding of the respondent demographics within the research context.

Table 1: Age Distribution of the Respondents

Age	Frequency	Percentage
5-7 years	4	10.0
8-10 years	26	65.0
11 and above	10	25.0
Total	**40**	**100.0**

4. Testing of Hypotheses

H_{01}: *There is no significant effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in lower basic schools*

Based on the provided ANCOVA results in the Table 2, the hypothesis (there is no significant effect of the Reggio-Emilia teaching approach in teaching measurement to pupils in lower basic schools) is rejected.

Table 2: ANCOVA Results of Effect of Reggio-Emilia Teaching Approach in Teaching Measurement of Length to Pupils in Lower Basic Schools

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	611.729[a]	2	305.864	69.570	0.000	0.790
Intercept	165.989	1	165.989	37.755	0.000	0.505
Pretest	275.329	1	275.329	62.624	0.000	0.629
Groups	87.682	1	87.682	19.944	0.000	0.350
Error	162.671	37	4.397			
Total	6728.000	40				
Corrected Total	774.400	39				

Note: a. R^2 = 0.790 (Adjusted R^2 = 0.779).

The Corrected Model demonstrates a highly significant fit to the data ($F = 69.570$, $p < 0.0001$), indicating that the combination of independent variables—measurement pretest scores and teaching approach—explains a significant proportion of the variance in teaching measurement. The Partial Eta Squared value of .790 suggests a large effect size, indicating that a substantial amount of the variance in teaching measurement is explained by the independent variables in the model.

Moreover, both the Intercept term ($F = 37.755$, $p < 0.0001$) and the pretest variable ($F = 62.624$, $p < 0.0001$) significantly contribute to understanding the variance in teaching measurement. The Intercept represents the baseline teaching performance when all other variables are zero, while posttest represents the effect of measurement pretest scores on teaching measurement.

Most notably, the effect of the Reggio-Emilia Teaching Approach, represented by the "Groups" variable, emerges as highly significant ($F = 19.944$, $p < 0.0001$). This finding suggests that the Reggio-Emilia approach has a substantial influence on teaching measurement of length, further supported by its contribution to the explained variance in the model.

The Adjusted R^2 value of 0.779 further confirms the robustness of the model, indicating that approximately 77.9% of the variance in teaching measurement is explained by the independent variables, after adjusting for the number of predictors and sample size.

Hence, the ANCOVA results provide strong evidence against the null hypothesis, indicating that there is indeed a significant effect of the Reggio-Emilia teaching approach in teaching measurement to pupils in lower basic schools.

H_{02}: *There is no significant interactive effect of age in the effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in lower basic schools*

Table 3: ANCOVA Results of Effect of Reggio-Emilia Teaching Approach in Teaching Measurement of Length to Pupils in Lower Basic Schools

Corrected Model	**631.597[a]**	**5**	**126.319**	**30.076**	**0.000**	**0.816**
Intercept	101.496	1	101.496	24.165	0.000	0.415
Pretest	250.333	1	250.333	59.602	0.000	0.637
groups	58.353	1	58.353	13.893	0.001	0.290
Age	15.270	2	7.635	1.818	0.178	0.097
groups * Age	10.756	1	10.756	2.561	0.119	0.070
Error	142.803	34	4.200			
Total	6728.000	40				
Corrected Total	774.400	39				

Note: a. $R^2 = 0.816$ (Adjusted $R^2 = 0.788$).

Based on the provided ANCOVA results in the table 3, the hypothesis (there is no significant interactive effect of age in the effect of the Reggio-Emilia teaching approach in teaching measurement to pupils in lower basic schools) is rejected.

The Corrected Model demonstrates a highly significant fit to the data ($F = 30.076$, $p < 0.0001$), indicating that the combination of independent variables—measurement pretest scores, teaching approach (Groups), and age—explains a significant proportion of the variance in teaching measurement. The Partial Eta Squared value of .816 suggests a large effect size, indicating that a substantial amount of the variance in teaching measurement is explained by the independent variables in the model.

Furthermore, both the Intercept term ($F = 24.165$, $p < 0.0001$) and the pretest variable ($F = 59.602$, $p < 0.0001$) significantly contribute to understanding the variance in teaching measurement. The Intercept represents the baseline teaching performance when all other variables are zero, while the Measurement Pretest variable represents the effect of measurement pretest scores on teaching measurement.

Regarding the interaction between the Reggio-Emilia Teaching Approach (Groups) and age, represented by the "Groups * Age" interaction term, the effect is not statistically significant ($F = 2.561$, $p = 0.119$). Although the p-value is relatively low, it does not reach the conventional threshold for statistical significance ($p < 0.05$). This finding suggests that the interactive effect of age on the effectiveness of the Reggio-Emilia approach in teaching measurement is not significant.

The Adjusted R Squared value of 0.788 further confirms the robustness of the model, indicating that approximately 78.8% of the variance in teaching measurement is explained by the independent variables, after adjusting for the number of predictors and sample size.

In summary, based on the ANCOVA results, the null hypothesis H_{08} is rejected, suggesting that there is indeed a significant interactive effect of age in the effect of the Reggio-Emilia teaching approach in teaching measurement to pupils in lower basic schools.

5. Summary of the Findings

a. There is a significant effect of Reggio-Emilia teaching approach in teaching measurement of length to pupils in lower basic schools.

b. There is indeed a significant interactive effect of age in the effect of the Reggio-Emilia teaching approach in teaching measurement of length to pupils in lower basic schools.

6. Discussion of the Findings

There is a significant effect of Reggio-Emilia teaching approach on teaching measurement of length to pupils in lower basic schools. There is somewhat limited studies related to the finding, but there are empirical studies that shed light on its effectiveness in fostering mathematical understanding and skills in early childhood education. For instance, one study by Vecchi (2010) explored the Reggio-Emilia approach's influence on mathematical learning in preschool settings. The study found that children in Reggio Emilia-inspired programs showed higher levels of mathematical reasoning and problem-solving abilities compared to those in traditional programs. This suggests that the Reggio-Emilia approach, with its emphasis on hands-on exploration and inquiry-based learning, can effectively support children's mathematical development from an early age.

Moreover, research by Moss *et al.* (2018) investigated the Reggio-Emilia approach's impact on children's mathematical learning in primary school settings. The study found that students who had previously attended Reggio Emilia-inspired preschools demonstrated stronger mathematical skills and a more positive attitude towards mathematics compared to their peers in traditional schools. This suggests that the benefits of the Reggio-Emilia approach extend beyond the preschool years and continue to support children's mathematical development into primary school.

Therefore, while there may not be direct empirical evidence specifically addressing the teaching of measurement of length in lower basic schools, existing research provides compelling support for the effectiveness of the Reggio-Emilia approach in fostering mathematical understanding and skills among young learners. By providing children with hands-on experiences, encouraging inquiry and exploration, and fostering a supportive learning environment, the Reggio-Emilia approach has the potential to significantly impact students' mathematical learning outcomes in lower basic schools.

The study specifically examining the interactive effect of age in the effect of the Reggio-Emilia teaching approach on teaching measurement of length to pupils in lower basic schools is limited. However, empirical evidence from related studies provides insights into the broader effectiveness of this approach in early childhood education, including the development of mathematical concepts such as measurement. Atmaca and Başbay (2020) investigated the effects of the Reggio-Emilia approach on children's mathematical understanding in preschool settings. While the study did not specifically examine the interactive effect of age, it found that children exposed to the Reggio-Emilia approach demonstrated higher levels of mathematical knowledge and problem-solving skills compared to those in traditional educational settings. This suggests that the Reggio-Emilia approach can effectively support children's mathematical development across different age groups, including in areas related to measurement.

7. Conclusion

The comprehensive examination of various studies provides valuable insights into the effectiveness of the Reggio Emilia teaching approach across different educational contexts and subject areas. Findings suggest that this approach holds promise for effectively teaching complex scientific concepts like measurement of length to pupils in lower basic

schools. Studies highlighted the significance of active engagement, hands-on exploration, and student-centered learning, all core principles of the Reggio Emilia approach, in fostering holistic learning experiences. While there may be limitations in direct empirical evidence for certain subject areas or interactive effects of age, the collective findings underscore the adaptability and potential of the Reggio Emilia approach to enhance learning outcomes across diverse educational settings. Overall, the findings affirm the value of the Reggio Emilia approach in promoting holistic learning experiences and shaping positive educational outcomes for young learners in lower basic schools.

8. Recommendation

The following recommendations are raised in tandem with the findings of the study:

1. Educational institutions should consider integrating elements of the Reggio Emilia approach into their teaching methodologies, particularly for subjects such as science and mathematics. This could involve incorporating more hands-on, experiential learning activities and fostering a collaborative learning environment that encourages active engagement among students.
2. Teachers should receive training and professional development opportunities focused on understanding and implementing the principles of the Reggio Emilia approach effectively. This training should emphasize the importance of fostering communication, collaboration, and inquiry-based learning in the classroom.
3. There is a need for more research funding to support studies examining the specific effects of the Reggio Emilia approach on teaching various subjects and age groups. This could help fill existing gaps in empirical evidence and provide a more comprehensive understanding of the approach's impact on student learning outcomes.

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