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A DESIGNED SCIENCE INQUIRY TRAINING PROGRAMME FOR PRE-PRIMARY TEACHERS IN NIGERIA

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Abstract

This paper examined pre-primary school teacher knowledge of inquiry teaching method, objectives of pre-primary education, the teaching of science in the pre-primary classroom, the importance of early childhood education designed and validated an inquiry science program for training the teachers, collection of data analysis of data and results. The study was carried out in Akwanga Local government Area of Nasarawa State Nigeria. It was guided by 3 research questions and one hypothesis. This study was an experimental study and the research design was a true experimental method, and it consisted of an experimental control group. The population was 82 teachers and the sample was of 20 teachers forming (20%) of the population was used. A sampling of the sample was by simple random (hat and draw by replacement) while the instrument was the teacher knowledge of inquiry-oriented Teaching Achievement test (TKITAT) and inquiry features observation checklist (IFOC). Descriptive statics was used to answer the research questions while the t-test was used to test the hypothesis. Results showed that 50% of the pre-primary teachers some level of knowledge

on inquiry teaching method, 17% have 60% knowledge while 33 have 30% knowledge of inquiry teaching method and the type adopted mostly is observation 58% and demonstration method 60% in teaching: in testing the hypothesis, there was no significant difference between the experimental control group in the pre-test but after the training, the experimental group performed better 83.3% than the control group 35.5% and so the null hypothesis was rejected. It was therefore concluded that the designed science program for training the pre-primary teachers on the use of inquiry teaching methods was effective and some recommendations were put forward.

Keywords

Pre-Primary, Teacher Knowledge, Inquiry-Oriented Teaching Method

1. Introduction

Education is the process of receiving and giving systematic instruction, especially at a school or institution. It is a learning process for the individual to attain knowledge, skills, and understanding of higher specific objectives. Education brings desirable changes in the behavior of the human. A good education is attaining value, make a student better. It increases a child's creativity and helps them socialize or communicate with others.

The importance of education is that it gives knowledge of the world around us. It also develops in man a perspective of looking at life and helps socializes an individual (Raghavendra, 2014). This education involves teaching from birth to adulthood. Early childhood education consists of activities and experiences that are intended to effect developmental changes in children. It is from 0-6 years and prepares young children for their transition into elementary school. It also improves children's language and motor skills while developing the learning and cognitive skills necessary to move to primary school.

Early childhood care and education in Nigeria is aimed at improving scientific literacy, emphasize an inquiry-oriented instructional approach to teaching science among pre-primary school pupils, Paker (2007). The guidelines for running early childhood education are given by the National policy on education. The National Policy on Education (the Federal Republic of Nigeria, 2012) for early childhood care and education in one of its objectives states that children at this age should be inculcated with the spirit of inquiry and creativity as they explore their environment, music, and arts. However, pre-primary teachers in Nigeria have little or no knowledge about the inquiry teaching method. Consequently, the teaching of science in pre-primary school classroom has been less successful because it has been dominated by the teacher-oriented method and rote memorization of content (Kazempour & Amirshokoohi, 2014) Teacher knowledge of inquiry

teaching method, professional development in teaching science methods, (Maruti, 2020; Elenita,2020) and effective use of instructional strategies are indispensable components for effective use of inquiry-oriented teaching method in pre-primary schools. Successful use of inquiry teaching methods will provide pre-primary school pupils opportunities for improving critical thinking skills, problem-solving skills, ability to construct their learning experiences, and so on.

Researchers have indicated that teachers' level of experience of inquiry-oriented teaching is one possible predictor of utilizing the inquiry-based method in the classroom (Kuzhabekova, 2015). This is because the teacher determines if the inquiry method is to be used in the classroom or not. Similarly, Capps and Crawford (2013) stated that a lack of understanding and knowledge of inquiry is one of the reasons why teachers do not use the inquiry method in their classrooms. This could be attributed to the fact that many teachers of pre-primary schools did not study science as a subject and have not received in-service training on how to teach basic science Owolabi (2012). Hence, it is difficult for them to handle the inquiry teaching method. I, it is important for teachers to have an adequate understanding of the inquiry teaching method through training. This is because the inquiry teaching method is very complex and sophisticated coupled with the fact that teachers of pre-primary lack adequate understanding, and experience of the strategy.

2. Literature Review

Pre-primary school is where children receive initial formal training in science; and science teachers require adequate knowledge of inquiry teaching method, critical for achieving the National policy objective for early childhood care and education. However, pre-primary school teacher knowledge of inquiry-oriented teaching methods has not been given the necessary attention as many studies have focused on the professional development of teachers on teaching and content. It is the starting point of a child's formal learning process and the foundation of the educational system, particularly in Nigeria. The first pre-primary school education in Nigeria was established in 1816 by Robert Owen. During pre-independence, early childhood education was left to the voluntary sector and government gave little or no support to the running of the sector Until, 1977 when the Military government of Nigeria gave official recognition to pre-primary school in the National Policy on Education (NPE) and revised it in 1981, 1998; subsequently by Civilian Government in 2004, 2007 and 2012 (Hassan & Abul, 2013). Since the inauguration of the sector, appreciable progress has been made especially in the last six years, where the Federal government stated that every public primary school should have a pre-primary school linkage, where the children will begin their education before transiting to the primary school.

One of the operational objectives of the policy for pre-primary school as contained in the NPE is the inculcation of the spirit of creativity and inquiry through the exploration of nature, environment, art, music, and playing with toys and so on. While the National Policy on Education provided the guidelines for operating Pre-primary schools, failed to established guidelines for supervision and inspection to ensure that standards and quality are maintained

Pre-primary schools consist of the crèche, nursery, and kindergarten. The age brackets of the children are 3-5years. The curriculum of pre-primary schools, is non-formal and the purpose is to guide and help teachers, caregivers and parents in the development of the whole child, thus, making it easier for formal teaching which will take place at later stages. The focus of the curriculum is to develop certain basic skills or behavior which will provide readiness and support for child development, including teaching practice, relationship with parents, and school.

Inquiry-based teaching is a multifaceted activity that involves making an observation, posing questions, examining books and other sources of information to see what is already known, planning investigations, reviewing what is already known in the light of experimental evidence, using tools and critical thinking to gather, analyze, interpret data, proposing answers, explanations and predictions, and communicating results.

The inquiry teaching method assists learners to develop problem-solving skills through the inquiry process through manipulative skills and so involves hands-on activities. The more one practices, the more one is likely to generalize what has been learned into a style of problem-solving or inquiry that serves for any kind of task encountered.

Schwab (2012), states that to teach science as inquiry means to show students how knowledge arises from the interpretation of data and to show students the interpretation of data needed, even the search for data.

Inquiry teaching begins with asking questions, presenting problems, or scenarios-rather than simply presenting facts or knowledge. The process of inquiry teaching is often assisted by a facilitator. It is a pedagogical approach that invites students to explore academic content by posing, investigating, and answering questions (Parker, 2007). A teacher who is to teach basic science at the pre-primary schools must have content knowledge of science, as well as the pedagogical knowledge. One of the ways to achieve that goal, according to Kiernan (2015) is through professional development programs on inquiry teaching methods. Professional development programs are formal in-service training, often delivered by outside experts to upgrade the content knowledge and pedagogical skills of the teachers. Most pre-service teachers often are not grounded in content knowledge and instructional strategies for science. Therefore, researchers have emphasized the need to expose them to training while such training program should focus on

content knowledge, active learning, support collaboration, provides coaching and expert support, offers feedback and reflection and should also be of a sustained duration (Darling-Hammond, Hyler & Gardener, 2017).

Professional development program can enhance the competencies of teachers in inquiry teaching, but most of such professional development program is reported to be one-time workshops which are insufficient to build the capacity of teachers to foster students' knowledge and higher-order skills (Darling-Hammond, Hyler & Gardener, 2017). The professional development program that can enhance teachers' instructions of science, should be for many hours as 50 hours of instruction, practice, and coaching before the new strategy is mastered.

3. Purpose of the Study

The purpose of this study is to determine the effects of a designed science education training program on pre-primary teacher knowledge of inquiry-oriented teaching methods. The objectives of the research are to:

- Develop a science training program for pre-primary teachers to know how to use the inquiry teaching method.
- Validate the science training program to see the effects on pre-primary teachers' classroom teaching.
- Test pre-primary teacher's knowledge of the inquiry teaching method before and after the training.

4. Research Questions

These research questions were formulated to guide the study:

- What is the level of pre-primary school teachers' knowledge of inquiry-oriented teaching methods before the training?
- Which of the inquiry processes do pre-primary school teachers predominantly use in teaching science to pre-primary school pupils?
- What methods are predominantly being used currently by pre-primary teachers to teach science among pre-primary school pupils?

5. Hypothesis

This null hypothesis was tested at 0.05 level of significance.

Ho: There is no significant difference between the pre-test and post-test mean scores of teachers who participated in the science education training program in their knowledge of inquiry teaching method and those who did not participate in the training

6. Methodology

6.1. Research Design

The research design for the study was a true experimental design. True experimental design is a scientific research method that is defined as ‘observation under control conditions. It consists of two groups: the experimental and control, sees illustration below.

Table 1: *Illustration of Pretest-Posttest Equivalent Groups*

Randomization	Groups	Pretest	Treatment	Post-test
Random assignment	Exp. group	O_1	x	O_2
Random assignment	Control group	O_3		O_4

Keys:

Where O_1 = pre-test for the experimental group

O_2 = post-test for experimental group

O_3 = pre-test control group

O_4 = post-test for control group

X = for treatment

R = Random assignment

The broken lines (---) indicates no treatment for the control group

6.2. Population and Sample

6.2.1. Population

The population of the study consisted of all pre-primary school teachers of private and public pre-primary schools totaling 69 schools with 82 teachers (both males and females) in Akwanga metropolis. The choice of this population was informed by the fact that the teachers are the ones who teach pre-primary pupils.

6.2.2. Sample

The sample of the study comprised 20 teachers which represent 20% of the population of 82 teachers. The sample was drawn from 14 schools in Akwanga metropolis. This Sample of the teachers was made up of 4 teachers with a Bachelor's degree in education (B. Ed) and 16 teachers with National Certificate in Education (NCE), giving a total of 20 teachers. Both rural and urban schools formed the sample, 6 schools were selected from rural and 6 from urban, giving a total of 12. They have been teaching pre-primary for some years and are professional teachers.

6.3. Sampling Techniques

A simple random sampling of hat and draw by replacement was used to draw the sample for the study, where participants were selected from the population. The names of the teachers were written on pieces of paper and dropped in a basket. The researcher asked a teacher to make random picks and replaced. This process was repeated until the 20 required teachers have been selected.

The sampled teachers were assigned randomly into the experimental and control groups.

6.4. Instruments for Data Collection

The instruments for collecting data included: Teacher Knowledge of Inquiry-oriented Teaching Achievement Test (TKITAT) and Inquiry features observation checklist (IFOC).

Teacher Knowledge of Inquiry-Oriented Teaching Achievement Test is an instrument designed by the researcher based on the pre-primary school science syllabus. The questions were framed in line with inquiry teaching methods for pre-primary school pupils, such as observing, predicting, measuring, and explanation. This instrument was used to collect data from both the experimental and control groups at pre-test and post-test. The purpose was to measure the teachers' initial knowledge of inquiry-oriented teaching strategy and their subsequent attainments after the intervention.

The instrument (TKITAT) consisted of two sections, A and B. Section A contained the general background information of the participants which included school location, and educational qualification of the teachers and Section B achievement test items. The instrument contains 20 multiple-choice items with options A-D. The items were developed in duplicates for the pre-test and post-test, and the positions of the post-test questions swapped. Each question was allotted five marks. A total of 100% was earned for all correctly answered questions.

Inquiry feature observation checklist (IFOC) is a self-assessment tool for science teachers to assess their implementation of inquiry teaching method in the classroom (Darling-Hammond, Hyler & Gardener, 2017). It singles out a specific aspect of the inquiry-based practice. For example, is the teacher's instruction more of teacher-centered or student-centered? The instrument has inquiry indicators, which teachers are to reflect on during the science lesson taught for the day. The (IFOC) was adopted from the National Research Council (NRC, 2000).

6.5. Data Collection

Teacher Knowledge of Inquiry-oriented Teaching Achievement Test (TKITAT) was administered to the control and experimental groups before the intervention to collect base-line data. After which the science inquiry program was for eight weeks to the experimental group, and was followed by the posttest. Inquiry features observation checklist (IFOC) was used by the

researcher to observe the teachers' implementation of the inquiry features during science lessons. For the 20 questions in TKITAT, each correctly answered question earned 5 marks; and all correctly answered earned a total of 100%.

6.6. Data Analysis

Descriptive statistics were used to answer the research questions, while t-test for the independent sample was used to test the hypothesis.

7. Results

See figures 1-3 analysis for the presentation and explanation to answer the research questions.

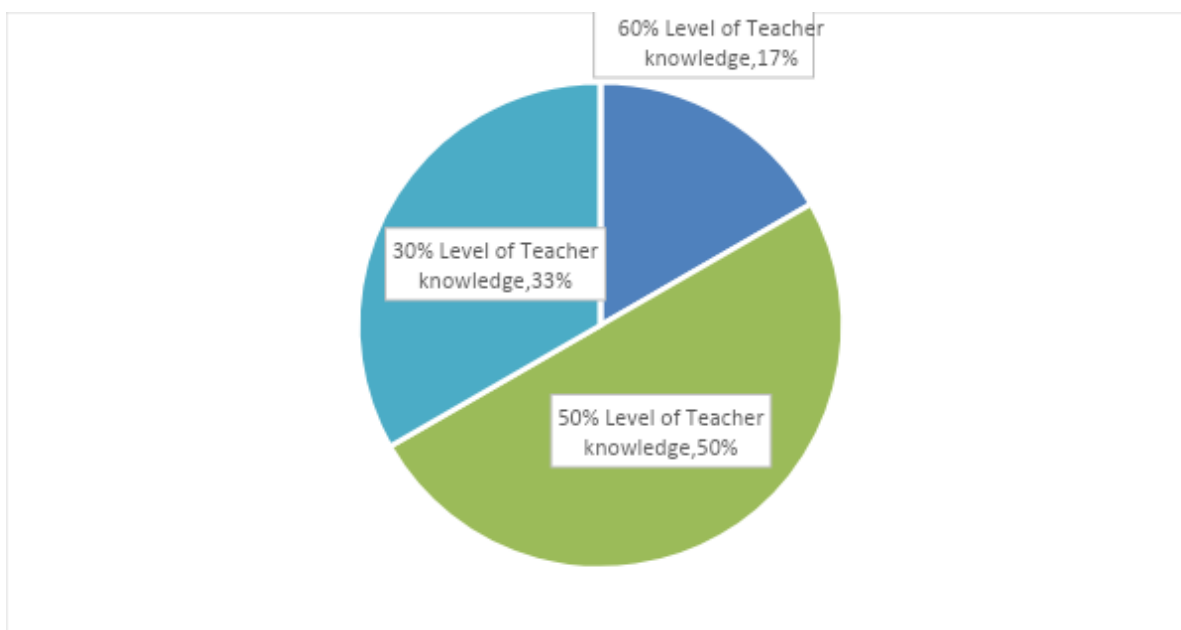


Figure 1: *Percentage Levels of Teachers' Knowledge of Inquiry-Oriented Teaching*

Source: Analysis of the Data

The result in figure 1 shows that half (50%) of pre-primary school teachers have (50%) level of knowledge of inquiry teaching method, while 17% of the teachers have (60%) knowledge of inquiry teaching method, 33% of the teachers have (30%) knowledge of the method. The result, therefore, shows that the pre-primary school teachers have an average knowledge level of the inquiry-oriented teaching method.

7.1. Inquiry processes predominantly used by pre-primary school pupils to teach science classrooms.

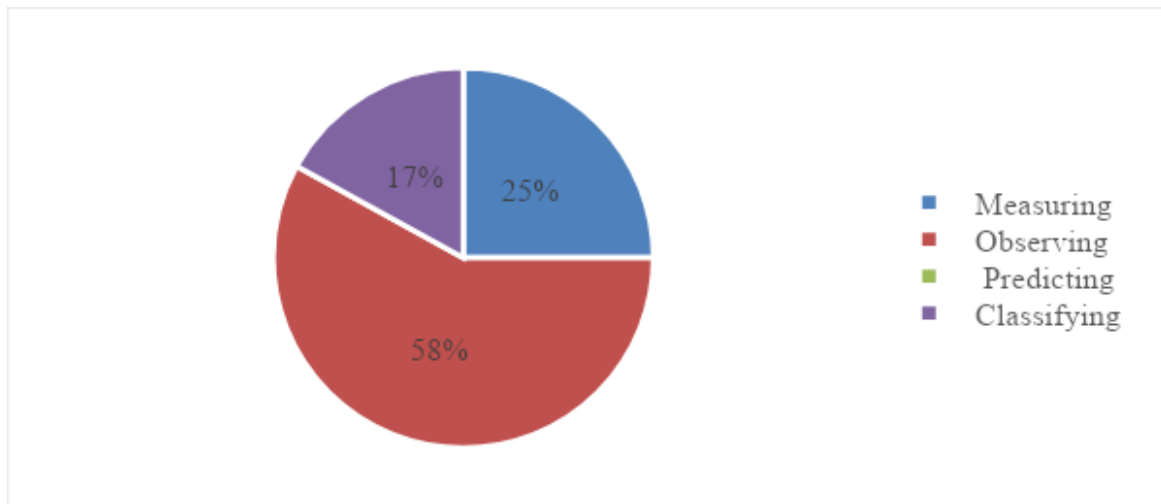


Figure 2: Inquiry Process Predominantly used in Pre-primary Science Instruction

Source: Analysis and Findings of this Research

Results in figure 2 show that pre-primary school teachers used the inquiry process of observing predominantly with (58%), followed by measuring (25%); classifying (17%) respectively. Predicting is not used at all.

7.2. Teaching methods predominantly used currently by pre-primary teachers to teach science among pre-primary school pupils?

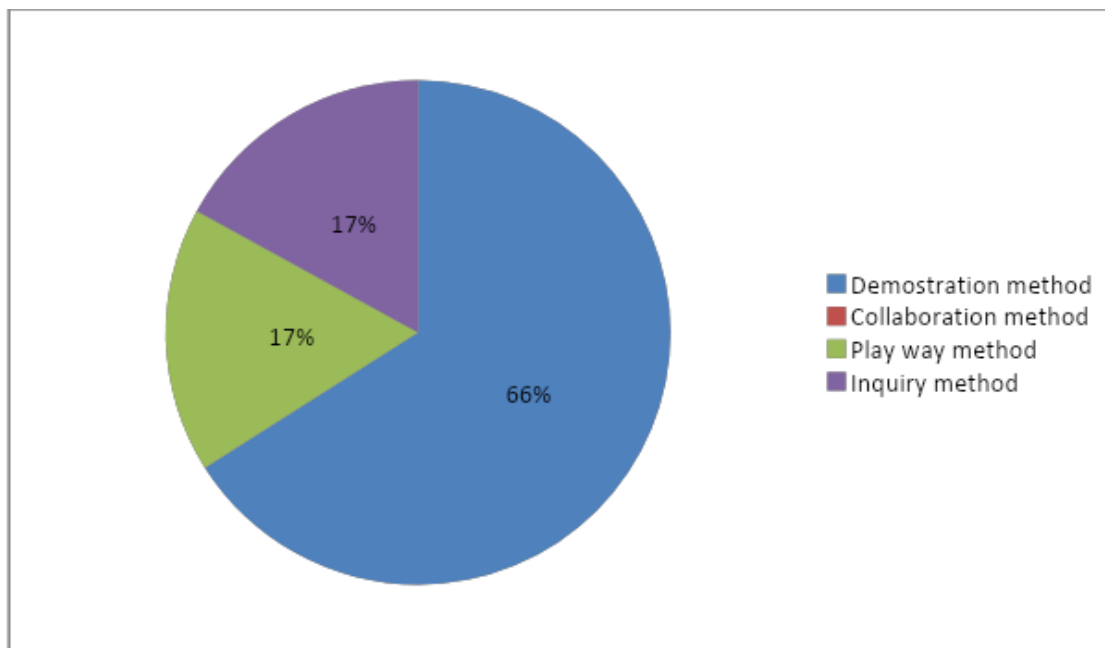


Figure 3: Current Teaching Methods used by Pre-primary School Teachers in Science Classroom

Source: Analysis of the Research Data

Results in figure 3 show the predominant teaching methods being used currently by pre-primary school teachers to teach science as demonstration method (66%); play way method (17%); and inquiry method (17%). The collaboration method from the result is not used by the pre-primary

school teachers in the science classroom. Therefore, the current predominant teaching method by the pre-primary school teachers is the demonstration method.

To test the hypothesis using SPSS

Ho: There will be no significant difference between the pre-test mean scores of teachers who participated in the science education training program in their knowledge of inquiry teaching methods and those who did not participate in the training.

Table 2: *Teacher Knowledge of Inquiry Teaching Method, the T-Test Comparison of the Control and Experimental Groups at Pre-Test*

Group	N	Df	X	S	S ²	t-value	p-value	α=0.05	Remark
Control	6	5	22.50	437.5	58.4	0.85	0.21		Not significant
Experimental	6	5	17.50	237.5	87.5				

The result in Table 2 shows the mean score of the experimental group as 21.50 and 17.5 for the control group. This indicates that there was no statistically significant difference between the experimental and control groups pre-test mean scores; the p-value (0.21) is larger than α= 0.05 therefore, the null hypothesis was upheld, due to lack of sufficient information to reject it.

Ho: There will be no significant difference between the post-test mean scores of teachers who participated in the science education training program in their knowledge of inquiry teaching methods and those who did not participate in the training.

Table 3: *Posttest Result of Teacher Knowledge of Inquiry Teaching Method*

Group	N	Df	X	S	S ²	t-value	p-value	α=0.05	Remark
Control	6	5	35.5	95.5	19.1	-11.4	0.001		Significant
Experimental.	6	5	83.3	433.3	8.8				

The result in Table 3 shows the posttest mean score for the experimental group as 83.3 and 35.5 for the control group. This indicates a significant difference between the experimental and control groups' mean scores; p-value (0.001) is less than α = 0.05, therefore, the null hypothesis was rejected.

8. Discussion

The study investigated the effects of a designed science education training program on pre-primary school teacher knowledge of inquiry-oriented teaching. Results of the investigation revealed that pre-primary school teacher knowledge of inquiry teaching method was very low at first. This is shown by the percentage score of the teachers on their knowledge of the method. Only three out of 12 teachers agreed that their knowledge level of inquiry teaching method was up to 60% which represents 16.7%. Five of the teachers stated that they have 50% level of knowledge of the strategy that is 50%, and four indicated that their knowledge level is just 30% representing 17.3% (see figures, on p 9& 10). This result is consistent with the report of Anderson et.al, (2001), Capps and Crawford (2013) O'Donnell (2011), Gupta (2012), that teachers have an incomplete understanding of inquiry teaching method. This also shows that pre-primary school teachers are likely not to have had the opportunity during their teacher training to learn inquiry teaching methods or in-service training as opined by Garcia (2003) and Kiernan (2015).

Inquiry processes employed by pre-primary school teachers to teach basic science among pre-primary school pupils revealed as follows: The process being used predominantly was the observation that had 58% against all the others. Measuring 25%, predicting had 0%, classifying 17%. The results revealed that most pre-primary school teachers are not familiar with the inquiry processes and particularly not having the knowledge and skills to apply those processes in teaching science. These results are consistent with the report of Anderson, et.al (2001), Kim and Tan (2011), and Lee (2014) that pre-primary teachers do not know scientific practices that align with the inquiry method. This implies that these teachers are not so confident to use the inquiry strategy. Therefore, more training is required. National Policy of Nigeria (Federal Republic of Nigeria, 2012) also affirmed this fact that science teachers should be confident themselves in doing inquiry before teaching the same in the classrooms.

Also, the results show that Pre-primary school teachers do not predominantly use inquiry teaching methods in the science classroom as only 17% of those studied indicated that they use the inquiry method. The predominantly used method was a demonstration with 66%, play way method which is one of the methods recommended by the National Policy in Education (Federal Republic of Nigeria, 2012) to be used for the pupils was being abandoned. The play-way method had 17%, collaboration which is an essential method of learning science to improve pupils' spirit of teamwork and corporate learning had 0%. The result is a clear picture of the nature of science instruction that takes place in Nigerian's pre-primary school science classrooms as also observed by Owolabi (2012). Furthermore, the result is consistent with the work of Hassan and Abul (2013); Anderson

(2002) that teachers' practical knowledge of inquiry is not commensurate with their use of inquiry in the classroom.

Lastly, the training program significantly improved the teacher's knowledge of the strategy. However, the researcher observed a limitation in respect to the duration of the intervention which should have been longer for coaching and support of the teachers to enable full grasp. This finding agrees with the suggestion by Darling-Hammond, Hyler, and Gardener, (2017) and Isiksal-Bostan, Sahin and Ertrepinar (2015) that there is always a difference on teacher knowledge of the inquiry, of those who attend the workshop only from those who attend both workshop and coaching.

9. Conclusion

From the data gathered, the researcher concluded that teacher knowledge of inquiry teaching method is low, which could be attributed to the fact that most of the pre-primary school teachers themselves have not studied science as a subject and have not had the opportunity to receive any in-service training on inquiry teaching method. Also, the designed science training program was effective in equipping the pre-primary teacher's knowledge of the inquiry teaching method. Also, the results show that Pre-primary school teachers do not predominantly use inquiry teaching methods in the science classroom as only 17% of those studied indicated that they use the inquiry method.

The predominantly used method was a demonstration with 66%, play way method which is one of the methods recommended by the National Policy in Education (the Federal Republic of Nigeria, 2012) to be used for the pupils was being abandoned. The play-way method had 17%, collaboration which is an essential method of learning science to improve pupils' spirit of teamwork and corporate learning had 0%. The result is a clear picture of the nature of science instruction that takes place in the Nigerian's pre-primary school science classrooms.

10. Recommendations

Based on the results obtained, the following recommendations are made:

10.1. Pre-primary teachers should be trained on inquiry-oriented teaching methods enough to get them to understand how to implement it in their science classrooms. This is important because inquiry-oriented teaching is a complex teaching strategy as stated by Crawford, therefore, a longer period of teaching and coaching should be given to these teachers to groom them properly as suggested by Darling Hammond et al, (2017).

10.2. Studies on follow up are encouraged to be taken on teachers' implementation of inquiry-oriented teaching methods in the pre-primary classroom.

10.3. Researchers should investigate the teaching methods predominantly being used among pre-primary school pupils in Nigeria primary school.

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