

*Full Length Research Paper*

## **EFFECTS OF A THINKING CONCEPTUAL TRAINING PROGRAMME ON PRIMARY FIVE TEACHERS, UN-PRODUCTIVE QUESTIONING BEHAVIOURS AND PUPILS' BASIC SCIENCE ACHIEVEMENT IN PLATEAU STATE, NIGERIA**

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This study investigated the effects of a Thinking Conceptual Training Programme on primary five basic science teachers' unproductive questioning behaviours and pupils' achievements, in Jos South Local Government, Plateau state in Nigeria. The samples comprised of twelve primary five basic science teachers and 144 primary five pupils. Three research questions guided the study and one null hypothesis was tested at 0.05 level of significance. A pure experimental, pre-test-post-test control randomized group research design was used. Samples were randomized and a pre-test observation was conducted. The treatment groups were exposed to the Thinking Conceptual Training Programme, while the control group was exposed to the usual lecture method observed during pre-test observation. Data were gathered through recordings of classroom interactions between teachers and their pupils. An achievement test was constructed and administered to pupils in the classes of teachers in both experimental and control groups. Frequency counts and percentages were used to answer research questions while the chi-square statistic was used to test the null hypothesis. The results show that the Thinking Conceptual Training Programme produced a significantly positive effect on the unproductive questioning behaviours of primary school basic science teachers as well as pupils' achievement in science. It was recommended that the training should be extended to other primary school pupils and the training should be a continual process in order to improve their questioning behaviours and ensure quality teaching and learning in primary schools.

**Keywords:** behaviours, training programme, pupil

## INTRODUCTION

Teachers' questions are regarded as the driving forces in the business of any classroom interaction and form the basis for effective teaching and learning. Adedoyin (2010) states that teachers' questions are of significant values for many instructional purposes, eliciting student reflection, challenging deeper student understanding and engagement in the classroom. Hence, the qualities of any science teaching and learning depend largely on the quality of teachers' questions. The quality of science teachers' questions can be described in terms of the grammatical correctness of the questions, the ratio of low-level to high-level questions and the wait-time teachers allow pupils to think before and after they have answered questions (Chollom, 2013).

A good classroom atmosphere that promotes effective learning among pupils is that which encourages teacher-pupil interaction (Chollom, 2008). Productive questioning in science classrooms exposed learners to critical thinking activities involving discussion of ideas, thinking, questioning, speaking and being listened to, as pupils fully participate in carrying out the learning activities (Chollom, 2012). Similarly, when teachers use effective wait-time principle it allows pupils to retrieve, process enough information to give meaningful feedback as a response to teachers' questions. These help pupils to develop competency and become critical thinkers, through interacting with peers, instructional materials and with their teachers (Chollom, 2010). Pupils make discoveries and this gives them permanent learning that may likely results

in improve achievement in science. When engaging pupils in inquiry processes, pupils' relationships with supportive teachers' questions are expected to promote a sense of connectedness in the classroom, which would reduce problematic behaviours and enhance pro-social behaviours Brackett, Reyes, Rivers, Elbertson, & Salovey, 2011. In addition, assigning classroom questions to only above average and average ability learners creates a feeling of superiority and inferiority complex among learners, which is capable of reducing pupils achievement in science. This suggests that teachers need to become more knowledgeable about children's perceptions of teacher's questioning behaviours and their effect on relationships with their learners as observed by Eccles et al cited in Davis et al 2011). The unproductive questioning behaviours of teachers in the classroom that were considered for this study include the following.

**Asking Questions without considering level of Pupils' vocabulary experience:** When asking oral questions in the classroom, the teacher should start with the words that pupils are familiar with and gradually introduce and connect new words with their prior knowledge; use correct grammar and complete sentences; ask questions at the time when a point is emphasized and allow pupils enough time to think before giving the answers

**Asking Questions using incorrect interrogative words or phrases:** This art does not help pupils to differentiate between a question and a statement, know when a question is being

asked and what type of response is expected of them.

**Asking Ambiguous Questions:** this act arises from the use of the unplanned question, Well-planned questions are likely to be clearly worded and pupils are likely to give correct responses because they understand the intent of the questions. Planning of oral questions involves teachers reflecting on the lesson content, the kind of activity to be carried out and the type of questions they would ask that will stimulate pupils' thinking at different levels during the lesson, all these unproductive questioning behaviours were grouped as grammatical errors in questioning.

**Calling upon a pupil before asking the Question:** This act does not give every pupil equal opportunity to think about the kind of responses they can give in response to the question.

**Asking Questions and giving little or no Wait-time I:** This act does not give the pupil responding enough opportunity to think and retrieve enough information about the kind of responses they can give to answer teachers' question.

**Allowing little or no student pause responds Wait-time:** This period is allowed so that the pupils can think of what they had just said. Perhaps, they may re-consider adding more points to complete their answers or change the initial answer completely

**Not allowing enough Wait-time II:** This act does

not allow pupils enough time after they stop responding to questions and before the teacher allows other volunteers to add to the answer or re-answer the question posed to the class.

#### **Not listening carefully to Pupils' Responses:**

The best way to know when and how to probe learners' deep understanding of learned concepts is to listen attentively to their responses. This act enables basic science teacher to observe when a learner breaks his/her response and keeps silent in order to retrieve more information to continue with the response or when a learner stops speaking in order to change the entire answer to the question or has completed responding to the question, before the teacher decides to direct the question to another learner, make any praise or encouraging remarks, check to make certain that children's responses match the level intended by the question. The teacher can probe them if the level is not appropriate, Martin et al (2005).

**Not asking a variety of Low and High-level Questions in the right proportion:** this act results in poor thinking of pupils if the questions asked are predominantly low-level questions, or frustrate pupils and make them develop negatively to the subject and the teacher if the questions asked are predominantly high-level, that is above the pupils' level of experience.

**Asking Questions and directing them to only Above average and Average Pupils in the class:** This act creates a feeling of superiority and inferiority complex among learners and may result in low achievement in science.

**Teachers asking and answering their own**

**Questions to save time:** this act does not allow pupils to think reflectively in order to learn science effectively as stated in the National Policy on Education. Relevant literature suggests the above challenges can be corrected and teachers questioning behaviours improved. One strategy of doing this is through the Thinking Conceptual Training Programme.

**Thinking Conceptual Training Programme**

The Thinking Conceptual Training Programme is an intervention programmed designed base on the principles derived from the behaviourist and social cognitive interactionist theories, for the purpose of providing corrective measures to the unproductive questioning behaviours of primary school basic science teacher and pupils science achievements during science classroom activities. The treatment is a set of child-centred activities using improvised instructional materials design and implemented through techniques such as set-induction, modelling, systematic questioning, micro-teaching and feedback. Interactions were based on the conduct of science activities that are driven by thought-provoking questions. The training programmed seeks to achieve the following:

1. improve the quality of classroom discussion of primary five science teachers and pupils during classroom interactions.
2. improve primary five science teachers' unproductive question to promote achievements in basic science classrooms.

The treatment was administered on the experimental group during long vocational holidays using the principles derived from the behaviourist and social cognitive interactionist theories, while the control group were exposed to the normal lecture method in different locations. The treatment commenced with the set-induct technique which was used mainly to create awareness on the limitations observed in their questioning behaviours during the pre-test classroom interactions. At this point, the participants were made aware of the limitations inherent in their questioning behaviours which may hinder the achievement of their teaching and learning goals. A training workshop was suggested and accepted by participants, the rules to be followed in the conduct of the workshop were identified by participants and the researcher, as well as the reward to be given to participants who obey the rules and the punishment for participants who fail to obey the rules were made known and agreed upon by all participants.

**STATEMENT OF PROBLEM**

Research by Chollom (2010 and 2013) shows that most basic science teachers in Plateau state Nigeria, engage in un-productive questioning as well as mismanagement of the wait-time principle. These include allowing pupils short wait-time before responding to high-level questions and longer wait-time to respond to a low-level question, as well as allowing no wait-time at all when teachers answer their own questions. Gall (2006), pointed out that most basic science teachers received very little or grossly inadequate training in the use of the

productive questioning technique to promote thinking in the classroom. Yet, good questioning behaviours of teachers promote thinking and pupils' achievement in science. It is against this backdrop that this study is designed to find out the effects of Thinking Conceptual Training Programme on Teachers' un-productive questioning behaviours and Pupils' Achievement,

### PURPOSE OF STUDY

Specifically, the study was designed to:

1. determine primary school basic science teachers' unproductive questioning behaviours in the classroom.
2. determine the association between primary school teachers' unproductive questioning behaviours and pupil's achievement in science.

### RESEARCH QUESTIONS

The study provided answers to the following questions:

- 1 What is the frequency of occurrence of unproductive questioning behaviours of primary school basic science teachers in Jos South Plateau state, Nigeria.
- 2 What are the effects of the Thinking Conceptual Training Programme on primary school basic science teachers' unproductive questioning behaviours and pupils' achievement in science in Jos South Plateau state?
- 3 What are the effects of Thinking Conceptual Training Programme on primary school pupils' basic science achievement in Jos South Plateau state?

**Hypothesis.** There is no significant association between the Thinking Conceptual Programme treatment on the quality of teachers' unproductive questions and pupils' achievements in science test scores.

### METHODOLOGY

The study employed a pure experimental pre-test-post-test randomized control group research design using the pre-test- post-test control and randomized group treatments. Twelve basic primary five teachers and 144 pupils in government- approved public primary schools in Jos South Local Government Area of Plateau State of Nigeria were sampled for the study. The schools were randomly selected from the same location as Local Government as samples. The samples that form the three experimental groups were located in the same area for easy transportation to the training centres but were located at a little distant environment to the control group avoid information leakage about the training Programme. Pre-test data were collected on all teachers and pupils to determine the baseline on their unproductive questioning behaviours and pupils' achievements in science. Also to determine the type of training and techniques that were used for the training.

Teachers were randomised into experimental and control groups to ensure equivalence. The experimental group I comprised of three primary five basic science teachers and 36 pupils who were both exposed to the Training Programme. Experimental group II comprised of three primary five basic science teachers and 36 pupils where only the teachers were trained. Experimental group III comprised of three primary five basic

science teachers and 36 pupils where only the teachers were trained. The control group comprised of three primary five science teachers and 36 pupils within the same location different from the experimental groups. Both teachers and pupils were not exposed to Thinking Conceptual Training Programme, Post-test data were collected on both experimental and a control groups to determine the effects of training

Programme on teachers 'unproductive questions and pupils' achievement in science.

### Results

Research Question 1- What is the frequency of occurrence of unproductive questioning behaviours of primary school basic science teachers in Jos South Plateau state?

**Table 1. The Frequency of Primary Five Basic Science Teachers' Unproductive Classroom Questions at Pre-test**

| Unproductive Question Types              | Total No  | Unproductive |            |
|------------------------------------------|-----------|--------------|------------|
|                                          | Questions | Questions    | Percentage |
|                                          | F         | F            | %          |
| Grammatical Errors                       | 1309      | 600          | 45.8       |
| Predominant low-level questions          | 1309      | 1309         | 100        |
| Unproductive wait-time I                 | 1309      | 571          | 43.6.      |
| Unproductive wait-time II                | 1309      | 740          | 56.5       |
| Teacher Ask & Answer Question            | 1309      | 268          | 20.5       |
| Teacher Appoints before Asking Questions | 1309      | 141          | 10.8       |

Results in Table 1 show the teachers in the experimental and the control groups asked a total of 1309 questions at pre-test classroom interactions. However, the percentages of un-productive questioning behaviours inherent in teachers' questions are: grammatical errors which were 600 (45.8%), Predominant use of low-level questions were 1309 (100%) Un-productive wait-times I was 571 (43.6%) and unproductive wait-time II was 740 (56.5%). Others include teachers asking and answering their own question which was 268 (20.5%) and appointing pupils before asking questions were 141 (10.8). Post-test observations of classroom interactions were conducted for three lessons on each teacher.

**Table 2--The Frequency of Primary Five Basic Science Teachers' Unproductive Questioning behaviours at Post-test**

| Unproductive Question Types                 | Total No<br>Questions<br>F | Unproductive<br>Questions<br>F | Percentage<br>% |
|---------------------------------------------|----------------------------|--------------------------------|-----------------|
| Grammatical Errors                          | 1158                       | 327                            | 28.2            |
| Predominant low-level questions             | 1158                       | 799                            | 68.9            |
| Unproductive wait-time I                    | 1158                       | 315                            | 32.6            |
| Unproductive wait-time II                   | 1158                       | 349                            | 32.3            |
| Teacher Ask & Answer Question               | 1158                       | 120                            | 10.4            |
| Teacher Appoints before Asking<br>Questions | 1158                       | 45                             | 3.9             |

Results in Table 2 show that the teachers asked a total of 1158 questions. The result generally show a decrease in the percentage of Grammatical errors which decreased from 600(45.8%) at pre-test to 327 (28.2%) at post-test, Predominant use of low-level questions from 1309 (100%) to 799 (68.9%) at post-test, Un-productive wait-time I which decreased from 571 (43.6%) to 378 (32.6%) at post-test and wait-time II from 749 (56.5%) at pre-test to 375 (32.4%). Others include the incident of teachers asking and answering their own question which was 268 (20.5%) at pre-test decreased to 120 (10.4%) at post-test and situations where teachers appoint pupils before asking questions which also decreased from 141 (10.8) at pre-test to 45 (3.9%) at post-test respectively. This is an indication that the Thinking Conceptual Training Programme has positively improved the unproductive questioning behaviours of primary school basic science teachers.

Research Question 2 - What are the effects of the Thinking Conceptual Training Programme on primary school basic science teachers unproductive questioning behaviours

**Table 3- The Effects of the Thinking Conceptual Training Programme on the frequency of primary school basic science teachers' unproductive questioning behaviours at pre-test**

| GROUPS                |     | Predominant<br>Low Level<br>Question<br>asked<br>F | Un-<br>productive<br>Wait-time I<br>F | un-<br>productive<br>Wait-time II<br>F | Teachers<br>Asked<br>Answer<br>their<br>Questions<br>F | Teachers<br>Appoint<br>pupils before<br>Asking<br>Questions<br>F |
|-----------------------|-----|----------------------------------------------------|---------------------------------------|----------------------------------------|--------------------------------------------------------|------------------------------------------------------------------|
| Experimental<br>group | 290 | 671                                                | 284                                   | 371                                    | 131                                                    | 70                                                               |
| Control group         | 310 | 638                                                | 287                                   | 369                                    | 137                                                    | 71                                                               |

Results in Table 3 show that teachers in the experimental and the control groups were generally deficient in the use of productive questions in the classrooms. This is evident as the results show varying frequency of occurrence of the unproductive questioning behaviours of

teachers in both the three experimental and control groups. This result implies that primary five basic science teachers need to be trained to use productive questioning behaviours to promote pupils 'achievements in basic science

**Table 4-**The Effects of the Thinking Conceptual Training Programme on the frequency of primary school basic science teachers unproductive questioning behaviours at post-test

| GROUPS             | Grammatical<br>Errors<br>F | Low Level<br>Questions<br>asked<br>F | Un-<br>productive<br>Wait-time I<br>F | Un-<br>productive<br>Wait-time II<br>F | Teachers<br>Asked &<br>Answer the<br>own<br>Questions<br>F | Teachers<br>Appoint<br>the<br>pupils before<br>Asking<br>Questions<br>F |
|--------------------|----------------------------|--------------------------------------|---------------------------------------|----------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------|
| Experimental group | 79                         | 230                                  | 125                                   | 132                                    | 40                                                         | 11                                                                      |
| Control group      | 248                        | 569                                  | 253                                   | 233                                    | 80                                                         | 34                                                                      |

Results on Table 4 show that post-test frequency of unproductive questioning behaviours of teachers in experimental groups was greatly improved compared to the results of teachers in the control group. This may be as a result of the fact that these teachers were not exposed to the treatment. This implies that the Thinking Conceptual Training Programme has positively

improved unproductive questioning behaviours of teachers

Research Question 3 - What are the effects of the Thinking Conceptual Training Programme on primary school pupils' basic science achievement in Jos South Plateau state?

**Table 5-** The Effects of the Thinking Conceptual Training Programme on primary school pupils' basic science achievement at Pre-test

| GROUPS             | Above   |         | Below   |
|--------------------|---------|---------|---------|
|                    | Average | Average | Average |
|                    | F       | F       | F       |
| Experimental group | 11      | 41      | 20      |
| Control group      | 1       | 26      | 45      |

Results on Table 5 show that pupils' achievements were generally poor at pre-test, the majority of the pupils in the classes of teachers in the three experimental and the control groups performed below average. This result shows that samples were homogeneous and indicates an urgent need for the pupils to be trained on the use of productive questioning behaviours in order to promote their achievements in basic science

**Table 6-** The Effects of the Thinking Conceptual Training Programme on primary school pupils' basic science achievement at Post-test

| GROUPS               | Above   |         | Below   |
|----------------------|---------|---------|---------|
|                      | Average | Average | Average |
|                      | F       | F       | F       |
| Experimental group I | 13      | 33      | 26      |
| Control group        | 2       | 26      | 44      |

Results on Table 6 show that majority of pupils taught by teachers in the experimental group perform mostly average and above average in their basic science achievements test, while those taught by teachers in the control showed no improvement in their achievement test scores. This is an indication that the Thinking Conceptual Training Programme has the potentials to improve the questioning behaviours of primary school basic science teachers and their pupils' achievements.

**Hypothesis.** There is no significant association between the Thinking Conceptual Programme treatment and pupils' achievements in science test scores. The data on Table 5 were subjected to a chi-square test at 0.05 level of significance and the result shows that the Calculated  $X^2$  is 0.209 is less than the table value of  $X^2$  which is

5.99 with a degree of freedom of 2. Hence, the pre-test data do not show enough evidence to reject the null hypothesis. When teachers were exposed to the training, the results of post-test in Table 6 were subjected to a chi-square test at 0.05 level of significance. The result shows that the calculated  $X^2$  is 21.31 was greater than

Table  $\chi^2$  of 5.99 at a degree of freedom of 2 and a contingency coefficient ( $C_c = 0.36$ ). even though the result showed enough evidence to reject the null hypothesis. Which mean that there is a significant association between the Thinking Conceptual Programme treatment on the frequency of teachers' unproductive questions and pupils' achievements in science, the result shows that a weak association exist between the variables.

### Discussion of Results

Results in table 1 show percentage of teachers' unproductive questioning behaviours such as grammatical errors, the predominant use of low-level questions, unproductive wait-time I and II, teachers asking and answering their questions as well as teachers appointing pupils to answer questions before asking the questions in basic science classrooms. The results suggest that primary school basic science teachers need to be trained to improve the quality of their classroom questions. After the training, the results in Table 2 show a significant decrease in the frequency of unproductive questioning behaviours of the teachers.

Similarly, results in Tables 4 show that the Thinking Conceptual Training Programme has the potential to improve the questioning behaviours of primary school basic science teachers. This is evident from the result in Table 4 which indicate that the post-test results of teachers in the the experimental group were greatly improved Results on Table 6 also show that the majority of pupils in the experimental group scored average and above average in their science achievements test, compared to

the results of pupils taught by teachers in the control group. These teachers were not exposed to the treatment. This may likely be the reason for the poor performance of their pupils in the achievement test. Even though the pupils taught by teachers in the control group were trained using the lecture method, the improvement in their test scores was not as encouraging as that of pupils taught by teachers in the experimental group. However, the performance of pupils in the experimental group indicated that the Thinking Conceptual Training Programme has the potential to not only improve the questioning behaviours of primary school basic science teachers but also improve the achievement of pupils.

### Recommendation

Based on the finding of this study, both teachers and pupils should be trained using the Programme to improve the questioning behaviours of teachers and pupils' achievements science classrooms respectively.

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