Enhancing Primary VI Pupils' Achievement and Retention in Magnetism Through Guided Discovery Learning Approach Under Covid-19 Prevention Protocol

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Keywords

Achievement, Retention, Magnetism, Guided Discovery Learning Approach and Covid19 Prevention Protocol.

Abstract

The study sought to find out how Primary VI pupils' achievement and retention of knowledge of magnetism could be enhanced through the use of guided discovery learning approach in a covid19 preventive protocol. Two research questions and two hypotheses were formulated to guide the study. The non-equivalent quasi-experimental research design was adopted. The sample consisted of 178 (92 boys and 86 girls) Primary VI pupils drawn through simple random sampling technique from 21 public primary schools in Jos North West of Plateau State. The instruments used for data collection were the Magnetism Achievement Test (MAT) and the Magnetism Retention Test (MRT). Data collected were analyzed using mean, standard deviation, and analysis of covariance (ANCOVA) for the hypotheses at 0.05 level of significance. The results of the study revealed that the use of guided discovery learning approach enhanced Primary VI pupils' achievement and retention of knowledge of magnetism. It was recommended among others that guided discovery learning approach should be adopted in teaching magnetism by science teachers to enhance pupils' achievement and retention in a covid19 preventive protocol.

Introduction

Science education is very important in today's quest for global challenges and technological world. Without the knowledge of Science, one cannot live effectively in everyday life (Adejo, Amali & Omega, 2017). Taber (2009) stated that the global aim of science education is to enable learners acquire knowledge, skills and attitude that would be relevant to their future likelihoods. It is through science and technology that modern gadgets in all aspects of life are invented, such as computers, mobile phones, electricity, aircrafts, medical kits like facemask, hand sanitizers among others. For any nation to develop and be considered civilized, she hasto embark on purposeful and strategic scientific education of its citizens. Science and technology is the bedrock of sustainable development of any nation (Agogo, 2017, Nnoli & Okafor, 2017). Science institutions in our schools should be such that enables young people to have access to new knowledge to expect change, and to behave rationally and be able to solve problems that might arise as a result of change or global challenges (Felder, 2014, Dorier & Garcia, 2018 & Gauer, 2019).

Primary education is the first stage of organized formal education in institutions for children aged 6-11 years. In the National Policy on Education, the Federal Republic of Nigeria (FRN, 2004) recognizes science as the key to success or failure of the whole system. The policy statements lend strength to the study of science in the primary school. These statements, otherwise known as objectives (FRN, 2004), include: laying a sound basis for scientific and reflective thinking; develop in the child the ability to adapt to the child's changing environment; giving the child opportunities for developing manipulative skills that will enable the child function effectively in the society within the limits of the child's capacity(p.14).

Primary VI is the final stage of primary education. This implies that whether pupils proceed to secondary school or not, the learning of basic science and technology ought to inculcate in them, scientific attitude like open-mindedness, curiosity, and optimistic method to challenges which will be beneficial to them throughout life. Basic science and technology is a compulsory subject for primary school pupils. It is structured around core activities and events like observation, manipulation, experimentation, classification, prediction and communication designed to assist children, retain and apply basic and functional intellectual skills and operations needed to cope with the rapid global changes in a science-dominated society. Science consists of sequences of meaningful experience which provide for each child, the unique opportunities to develop the learning strategies, attitudes and values for sustained acquisition and processing scientific information. Magnetism is one of the topics taught to Primary VI pupils under theme 4, you and energy, module 4, in Basic Science and Technology curriculum. A research carried out by Dawal (2020) indicated that magnetism is one of the topics which majority of teachers of primary schools find it difficult to teach. The researcher also find out that questions are set on the topic every year, questions are set on the topic in the National Common Entrance Examination, but pupils find this particular section difficult to answer.

Despite the efforts of Nigerian Government in giving due recognition to science and technology education which is a tool for national development, the issue of how the achievement and retention of knowledge of pupils in basic science and technology can be improved through the teaching and learning process is a serious concern to science educators among whom are: Taber (2009), Alfred, Brooks, Aldrich and Tenanbaum (2013), Adejo, Amali and Omega (2017) and Agogo (2017). These researches found out that teachers could not teach concepts like magnetism, simple machines effectively which in-turn affects the achievement and retention of knowledge of students. The problems were attributed to poor instructional method such as the conventional lecture method, which is teacher centered.

The National Common Entrance Examination analysis in pupils' achievement in Basic Science and Technology from 2014 -2019 in Plateau State indicated low achievement. For instance, in 2017, a total of 995,345 pupils sat for the examination and the number that passed were 231,915 which was 23.3% while those that failed were 763,430 which constituted 76.7%. Also in 2019, a total of 882,119 pupils sat for the examination, only 277,867 (31.5%) passed while 604,852 (68.5%) failed. These candidates fail in the sections of basic science and technology questions. The aforementioned poor achievement was further confirmed by Universal Basic Education Commission (UBEC, 2019) on Strengthening Mathematics and Science Education (SMASE) base line which conducted a survey research on teachers' method of teaching in all the schools in Plateau State, found out that most of the teachers use conventional teaching method and do not give room for learners' active participation in the class room.

Apart from the issues discussed above, there is the problem of Covid-19 pandemic which has engulfed the world with Nigeria inclusive. Covid19 is a respiratory illness and the primary transmission route is through person to person contact and through contact with respiratory droplets generated when an infected person coughs or sneezes (Federal Ministry of Health, 2020). Federal Government covid19 guidelines for school resumption emphasized children should limit interaction and sharing of classroom between classes as much as possible and social spaces between individual pupils to minimize transmission risks. It also emphasized maintaining a distance between pupils inside the classroom and reducing amount of time they are in face to face contacts. During the lockdown period, private and public schools moved to online learning. Many of the private schools were successful in doing that, but the public schools were at the disadvantage as government couldn't provide the required facilities. Many pupils couldn't follow the online teaching due to inaccessibility to digital tools which means many have been left behind during the covid-19 challenges. It is generally understood in Plateau State and Nigeria as a nation that pupils in rural and underserved communities are being left behind as they are not equipped to adapt or face new method of learning. With the problem of poor achievement of pupils as earlier mentioned, and as also reported by Nbina (2012), Utibe and Agwagah (2015), Universal Basic Education (2019) and Dawal (2020), the effect of the Covid-19 Pandemic further worsens the situation. Based on these reports, there is need to explore methods that would enhance the achievement and retention of knowledge of pupils in understanding difficult concepts like magnetism and one of such is the guided discovery learning approach.

Guided discovery learning approach refers to the teaching and learning where students are participating in discovering knowledge. It is typically characterized by having minimal teacher guidance, fever teacher explanations, solving problems with multiple solutions and use of hands-on materials, minimal repetition and memorization. It is problem-based learning, experimental learning and 21st century learning (Bruner, 1961, Dorier & Garcia, 2018). In guided discovery learning, pupils are actively participating in discovery learning through formulated and evaluated hypothesis (Gauer, 2016). It has positive effects on retention of information, retention of knowledge at six weeks after instruction without any revision as compared to that of traditional direct instruction (Mandrid & Peckel, 2009, Dean & Kuhn, 2016).

In teaching the concept of magnetism through guided discovery learning approach, every individual child will develop mental assimilation resulting from physical mental activity that promotes all forms of obtaining knowledge for oneself by the use of one's mind. Pupils learning to investigate and discover lead to better understanding and retention of knowledge (Agwagah & Ojoko, 2017). So also, learning takes place in problem solving solutions where the learner draws on his or her own experience and prior knowledge. Pupils learn by exploring and manipulating objects and performing experiments individually in a covid19 compliant environment. As directed by Federal Ministry of Health (2020) that covid19 preventive protocols should be observed at all levels, it is expected that during the teaching and learning process, densification solutions and rules on covid19 preventive protocol should be presented and implemented in accordance to the regulations at all times. The 2 meter social distance must be maintained and the wearing of face mask compulsory in case of a contact in person's learning activity. Also the covid19 preventive protocol to be observed are regular checking of temperature, frequent and thorough hand washing, or use of hand sanitizer and avoidance of touching of the face and eyes, avoid sharing any personal items, and body contacts/hugging.

The practice of cough etiquette should be maintained by coughing into the elbow or a tissue and disposing of the used tissue in the bin with a lid. In a covid19 challenging situation GDLA encourages individual learning of every child where the teacher ensures that throughout the classroom instruction the maintenance of covid19 preventive protocol is strictly adhered to in other to avoid transmission. It is based on the precedingthat this study sought to find out how primary pupils' achievement and retention of knowledge of magnetism could be enhanced through guided discovery learning approach in a covid19 compliant classroom.

Purpose of Study

Specifically, the study determined:

1. How the use of guided discovery learning approach can help Primary VI pupils' academic achievement on the concept of magnetism?

2. If the use of guided discovery learning approach can help in Primary VI pupils' retention of knowledge gained.

Research Questions

The following research questions were raised to guide the study:

1. How does the mean achievement scores of Primary VI pupils taught magnetism using guided discovery learning approach differ from those taught using conventional lecture method?

2. How does the mean retention scores of Primary VI pupils taught magnetism using guided discovery learning approach differ from those taught using conventional lecture method?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of Primary VI pupils taught magnetism using guided discovery method and those taught using conventional lecture method.

2. There is no significant difference in the knowledge retention of Primary VI pupils taught magnetism using guided discovery method and those taught using conventional lecture method.

Method

The study employed quasi experimental research design. Specifically, the non-equivalent pretest, post-test control group design. The design was considered appropriate because intact class settings were used (Ugodulunwa, 2008). To guide the study, two research questions and two hypotheses were addressed. The sample consisted of 178 Primary VI pupils (92 boys and 86 girls) from two schools out of the population size of 3,458 pupils (1955 boys and 1503 girls) from 21 public primary schools in Jos North West of Plateau State. Experimental group had 89 pupils and control group also had 89 pupils.

Simple random sampling technique of hat and draw method was used in selecting two schools. In each of the selected schools, one intact class was used as the experimental group and one intact class was used the for control group from the streams of Primary VI in each of the schools. The instrument for collecting the data was Magnetism Achievement Test (MAT) and Magnetism Retention Test (MRT) which were made up of 25 multiple choice questions adapted from their past common entrance examination questions. The post-MAT and MRT had items of MAT reshuffled. The face and content validity of the instruments wewr determined by giving them to two experts in science education and one expert in measurement and evaluation, for scrutiny. The reliability of the instrument was determined by administering it to a group of pupils outside the study group who had similar characteristics. The instrument was re-administered on them after an interval of two weeks. The scores of the test were correlated using Pearson Moment Correlation Coefficient and 0.84 was obtained. The two groups were administered pretest before commencement of treatment. The experimental group were taught using guided discovery learning approach and the control group were taught using conventional lecture method in a covid19 preventive classroom instruction measures. The covid19 rules and regulation concerning classroom teaching earlier stated were strictly adhered to. A post-test of MAT and MRT were administered to both the experimental and control groups.

The data collected were analyzed using mean and standard deviation for the research questions and analysis of covariance (ANCOVA) for the hypotheses at 0.05 level of significance.

Results

The results of the study are discussed as follows:

Research Question 1

How does the mean achievement scores of Primary VI pupils taught magnetism using guided discovery learning approach differ from those taught using conventional lecture method?

Table 1

Mean Achievement Scores of Pre-test and Post-test of Primary VI Pupils in the Experimental and Control Groups

Groups	No of Pupils	Pre-test Mean	S.D	Post-test Mean	S.D	Mean Difference
Experiment	89	14.41	4.11	35.36	7.13	20.96
Control	89	14.13	4.02	14.49	2.58	0.37
Total	178					

Table1 shows that experimental group had mean achievement scores of 14.41 with standard derivation of 4.11 while the control group had 4.13 with standard derivation of 4.02 for pre-test. In the Post-test the experimental group had mean achievement scores of 35.36 with standard derivation of 7.13 while the control group had 14.49 with standard derivation of 2.58. The mean difference for experimental group was 20.96 while that of control group was 0.37. This shows that pupils taught with GDLA achieved higher than those taught with conventional lecture method.

Research Question 2

How does the mean retention scores of Primary VI pupils taught magnetism using guided discovery learning approach differ from those taught using conventional lecture method?

Table 2

Mean Retention Scores of Primary VI Pupils in the Experimental and Control Groups.

Groups	No of Pupils	Pre-test Mean	S.D	Post-test Mean	S.D	Mean Difference
Experiment	89	35.36	7.13	37.03	6.99	1.67
Control	89	14.49	2.58	15.57	2.59	1.08
Total	178					

Table 2 shows that experimental group taught magnetism using GDLA had a post-test mean scores of 35.36 with standard derivation of 7.13 and mean retention score of 37.03 with standard deviation of 6.99 while control group taught using conventional method had post-test mean achievement score of 14.49 with standard derivation of 2.58 and mean retention score of 14.57. The mean gain difference for experimental group was 0.68 while that of control group was 0.09. This shows that experimental group taught with GDLA had higher mean retention score than the control group.

Hypothesis 1

There is no significant difference in the mean achievement scores of Primary VI pupils taught magnetism using guided discovery learning approach and those taught using conventional lecture method.

Table 3

Analysis of Covariance of the Mean Achievement Scores of Primary VI Pupils in Experimental and Control Groups.

Source of Variance	Sum of Squares	df	Mean Square	f.cal	Sig
Corrected Model	24827.215	4	6373.443	835.641	.000
Intercept	1111.500	1	1111.500	148.538	.000
Pre-test achievement	3731.758	1	3731.758	501.701	.000
Treatment	20862.813	1	20862.803	2.6282	.000
Error	1382.228	184	2.547		
Total	140472.000	189			
Corrected Total	26320.444	188			

The result in table 3 shows that the f calculated ratio of 2.6282 is significant at $p< 0.00$ at 0.05 alpha level. This shows there is a significant difference in the mean achievement score of experimental and control groups. Primary VI pupils taught magnetism using GDCA achieved higher than the control group taught with conventional lecture method. Therefore, the null hypothesis is rejected.

Hypothesis 2

There is no significant difference in the knowledge retention of Primary VI pupils taught magnetism using guided discovery learning approach and those taught using conventional lecture method.

Table 4

Analysis of Covariance of the Mean Retention Scores of Primary VI Pupils in Experimental and Control Groups.

Source of Variance	Sum of Squares	df	Mean Square	f.cal	Sig
Corrected Model	27360.887	4	7007.000	2.0184	.000
Intercept	4.417	1	4.417	12.436	.000
Pre-test Achievement	5071.083	1	5071.083	1.4403	.000
Treatment	8.006	1	8.006	22.844	.000
Error	64.072	184	.223		
Total	145343.000	189			
Corrected Total	27426.070	188			

The result in table 4 reveals f calculated ratio of 22.844 with probability value of 0.00 was obtained in regard to the mean retention scores of Primary VI pupils taught magnetism using GDLA and those taught with conventional method. Since the probability value 0.00 was less than 0.05 level of significance, the hypothesis was rejected. This implies that the experimental group had higher mean retention scores than the control group.

Discussion

The findings of this study showed a significant difference in the mean achievement scores of pupils in the experimental group exposed to guided discovery learning approach and those in the control group taught using conventional method. In table 1, the mean achievement of the experimental group in post-test is higher than that of the control group. This indicated that the use of GDLA improved pupils' achievement in magnetism. This result was confirmed by the result in table 3 which revealed that the method was a significant factor on pupils' achievement in magnetism. It indicates that students who were taught magnetism using GDLA achieved higher than those taught using the conventional method. The findings of this study support the findings of previous researchers such as Taber (2009), Nbina (2012), Felder (2014) and Agogo (2017), where experimental group achieved higher than the control group. The above researchers used activity-based, inquiry, scaffolding and process method respectively.

The finding equally agrees with that of Mandrin and Preckel (2009) and Adejo, Amali and Omega (2017) who confirmed that using the appropriate instructional method leads to enhancing pupils' achievement in Basic Science and Technology particularly topics that teachers find difficult to teach like magnetism. The finding could have been as a result of active individual participation of pupils due to the fact that each pupil was engaged in solving problems with multiple solutions and using of hands-on, minds-on materials in acquiring knowledge. This confirms the reports of Alfred, Brooks, Aldrich and Tenanbaum (2011) and Dawal (2020) who stated that teaching method should enhance the children's ability to think critically by way of obtaining knowledge for oneself through the use of one's mind. This type of exposure to individual learning made the understanding of magnetism easier for pupils.

Result in table 2 shows that pupils in the experimental group obtained higher mean retention scores of 37.03 than those in the control group with 15.57. The result in table 4 further confirms that the experimental group significantly retained higher than the control group in knowledge of magnetism using GDLA. The finding of this study is in agreement with that of Agwagah and Ojoko (2017), Nnoli and Okafor (2017), Nnoli and Offiah (2017) who confirmed that using appropriate instructional approaches enhance students' retention of knowledge. Agwagah and Ojoka 2017 explored the effectiveness of fishing tools instructional method in enhancing students' achievement and retention in Junior Secondary School geometry and revealed that students taught with this method had higher achievement and retention of knowledge than those taught with conventional method. In the same way Nnoli and Okafor (2017) explored the effects of enhancing students' academic achievement and retention of knowledge through the use of chemistry instructional materials and reported that the chemistry instructional materials significantly enhanced students' achievement and retention in chemistry. The findings of the present study is also in agreement with that of Onoli and Offiah (2017) who conducted a study on the effect of the use of improvised organic reagents on senior secondary students' level of motivation, achievement and retention in chemistry and discovered among other things that the use of improvised organic reagent

enhances students' level of motivation, achievement and retention of chemistry taught during the period of the study. UsingCovid-19 preventive protocol as directed by Federal Ministry of Health (2020). the use of GDLA was very effective in enhancing pupils' achievement and retention of knowledge as they acquired the knowledge individually with less interaction.

Conclusion

The findings of this study showed that pupils taught using guided discovery learning approach under Covid-19 prevention protocol achieved better and retained knowledge higher than those taught using conventional method. This implies that pupils can learn on their own in the midst of challenges like the Covid-19.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Teachers should adopt the use of guided discovery learning approach for the teaching of magnetism and other concept in Basic Science and Technology.

2. Curriculum planners, Federal and State Ministries of Education should emphasize the use of guided discovery learning approach in the teaching and learning of Basic Science and Technology especially magnetism in a global challenging situation like the Covid-19 that engulfed the world.

3. Teacher training institution like Colleges of Education, Faculties of Education and Institutes of Education should incorporate guided discovery learning approach in schools as substitute for online learning as majority of schools do not have digital tools to encourage learning during challenging periods that children have to stay at home.

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