Efficacy of Combined Analogy and Demonstration Methods of Teaching on Students' Academic Performance in Basic Technology

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Abstract
This study examine the efficacy of combined analogy and demonstration methods of teaching on students' academic performance in Basic technology. A quasi-experimental pre-test post test non equivalent control group was adopted. The total number of students in the class was considered. The schools were randomly assigned to one of the two groups. Two research questions and two hypotheses were raised and the data collected were analysed using Welch and homogeneity test while the hypotheses were tested using Analysis of Variance (ANOVA) at 0.05 level of significance. It was therefore concluded based on the resultsthat Basic Technology is better understood when taught using combined analogy and demonstration method of teaching the conventional lecture method. It was therefore recommended among others that Basic technology should be taught using combined analogy and demonstration method of teaching.

Keywords: Combined Analogy and Demonstration Methods, Teaching, Students' Academic Performance and Basic Technology

Introduction

The effectiveness of any teaching method is measured by students' academic performance. It is generally believed that there is no single method of teaching considered as the best to teach all subject matter as today the effort of educationists is to find out teaching method that is more appealing to teach each subject matter. Teaching method according to Dorgo (2015) is defined as a technique or strategy through which a teacher present his/her subject matter to the learner based on some pre-set instructional objectives to encourage learning in the students. Teaching is the unique way adopted by the teacher for conveying knowledge and abilities to the student. The use of instructional materials to encourage learning and achieve the stated objectives is referred to as teaching devices used by a teacher to give a lesson.

Gill (2020) when discussing teaching methods, noted that a well-designed teaching method for a specific classroom scenario allows a teacher to achieve specific goals in a certain subject area. In order words, teachers are expected to adopt a well-designed teaching method that can provide the right information and also make an impact on student's modelling. Some teaching methods recommended for teaching of Vocational-Technical Education (TVE) subjects of which Basic technology is one are demonstration, field-trip, problem-solving, simulation and role play, project method among others (Ahmed, Nordin, Ali, Md & Latip, 2017). To achieve the desired objectives, Krishnakumaryamma and Venkatasubramanian (2018) observed that teaching a technical based subject like Basic Technology which emphasized more on knowledge and skill acquisition requires a specialized teaching method that is based on high order thinking and creative skills.

Basic technology is a pre-vocational subject for Junior Secondary School designed in the new curriculum by the Nigerian Education Research and Development Council (NERDC) for nine years basic education programme. The objective is to provide pre-vocational orientation for further training in technology, to promote creativity and innovation, and to provide basic technical literacy for everyday living. Basic technology as a subject deals with the following subjects:

Technical Drawing
Ceramics
Electricity
Electronics
Building construction
Metalwork
Woodwork
Plastics

Teachers and students are faced with the challenges of teaching and learning basic technology in Nigerian Junior Secondary Schools (Ifeyinwa, 2017). One of the challenges being faced is the practice of traditional (lecture) methods by teachers in most Nigerian Secondary Schools in all the subject matters that even require the acquisition of practical skills (Elom & Okolie, 2014). In the traditional teaching method, the teacher stands by the chalkboard and delivers lessons through verbal instructions, while the students serve as passive listeners and take notes after the lesson (Sharma & Kumar, 2018). This approach may deprive students of learning the right skills and knowledge because critical thinking skills and problem-solving which are the ingredients for learning technical trades are not encouraged. Shabiralyani, Hasan, Hamad and Iqbal (2015) earlier observed that teachers who make use of traditional teaching methods in their classrooms over-rely on textbooks in the process of disseminating knowledge. This makes the student work in relative isolation only on tasks that require lower-order thinking, rather than higher-order thinking. This is a challenge that necessitates a shift from a method based on behavioural learning theories to those in constructivism and cognitive theories

(Ertmer & Newby, 2013). The researcher attempts to integrate Analogy and Demonstration as a single technique to teach basic technology in comparison to the lecture method frequently employed by basic technology teachers on this primary face. Analogy instructional technique is a teaching method based on constructivism theory, which claims that knowledge is actively built up by cognizing subjects rather than passively acquired (Fermando & Marikar, 2017). Humans produce knowledge and meaning through interactions between their experiences and ideas, thus pupils will learn best by attempting to make sense of something on their own, with the teacher acting as a guide to assist them. An analogy is a comparison of one notion with another topic that shares comparable characteristics for ease of comprehension. The difference between the notion and the learner's experience is what makes a concept challenging (Abimbola & Danmole, 1995). Demonstration teaching, on the other hand, is a method of teaching students how to manufacture or perform something step by step. Demonstration is frequently used when students are unable to connect theories to actual practice or when students are unable to comprehend how ideas are applied. Okoranka and Wada (2014) observed that difficult concepts can be understood more easily by analogizing with familiar concepts.

Combining analogy and demonstration method of teaching have the following advantages:

i. It assists pupils in acquiring a deeper understanding of the subject by bringing out analogies in the real world;
ii. It helps students to remain active in the teaching-learning process;
iii. It provides visualization of abstract ideas;
iv. It leads to permanent learning;
v. It accounts for principles of reflective thinking;
vi. It helps in arousing the spirit of discovering among students and
vii. vii. It aids in the development of interest in a topic, which may serve as a motivator for students.

Despite the potentials that analogy might have in promoting the learning of science and technology some authors like Duit (1991), Abimbola and Mustapha (2001) observed that there is a tendency that students may confuse analogy with reality except the teacher is capable of showing where the analogy breaks down from reality. Physicscatalyst (2017) also observed that some of the disadvantages of using the demonstration method alone are the lack of experienced teachers to carry out the demonstration, it can be costly as it requires costly materials and can be time-consuming. However, by combining the procedure with an analogy, all of these obstacles can be overcome. If a teacher feels that the presentation is taking too long, pupils who comprehended the teacher's comparison can be invited to the table to show the experiment or any challenging concepts.

Research Questions

1. What is the mean pre-test score difference between students who were taught Basic

Technology using the Combine Analogy and Demonstration strategy and students who were taught using the lecture method?
2. What is the mean post-test score difference between students who were taught Basic Technology using the Combine Analogy and Demonstration methodology and students who were taught using the lecture method?

Hypothesis
Ho1: Students in group A and group B were not homogeneous before giving them treatment.
Ho2: The post-test mean score of students who were taught Basic technology using the combine Analogy and Demonstration technique and those who were taught using the lecture method of instruction did not differ significantly.

Methodology
In this study, a quasi-experimental pretest-posttest non-equivalent control group design was adopted. Subjects were picked from entire courses, just as they would in conventional schools and classrooms. That is to say, the total number of students in the class was consideredand the standard time and duration from the school timetable were applied. According to Arbaugh and Benbunan-Fich (2006), this allows controlled factors to generate the intended outcomes. The schools were randomly assigned to one of two groups (A or B) in this experiment. Four junior secondary schools from the Yola North local government district made up the groups. Government Junior Secondary School Dubeli and Government Junior Secondary School Karewa were assigned as group A While Government Junior Secondary School Gwadabawa and Government Junior Secondary School Luggere were assigned as group B
In the experiment, there was one treatment and one control group: The combined demonstration and analogy technique was used to teach Basic Technology to Group A, whereas the traditional lecture method was used to teach Group B (control group). The Basic Technology Performance Test (BTPT), which was created by the researcher, was employed in the research. To determine the subjects' entering behavior, the pre-test was given to both groups before any therapy was administered. Finally, all two groups were given a post-test to see what their mean scores were. Descriptive statistical approaches were used to evaluate the data collected. At a 0.05 alpha level, the hypotheses were tested. Hypothesis one was tested with the Welch and Homogeneity test (Levene's, O'Brien's, and Brown and Forsythe tests), whereas hypothesis two was tested with Analysis of Variance (ANOVA). When P 0.05 was less than 0.05, the null hypothesis was rejected.

Table 1:

Variable	Mean
Pre CM	15.360
Pre LM	14.880

Table 2:

Welch's Test for Mean Differences

Source	Df	F	P
Between	1.0	0.17	0.6805
Within	97.0		

Table 3:

Homogeneity Test

Homogeneity of Variances	F	P
Levene's Test	0.70	0.4049
O' Brien's Test	0.69	0.4098
Brown and Forsythe Test	0.43	0.5126

Table 4:

Variable	Mean
PostCM	65.920
PostLM	46.980

Table 5:

Welch's Test for Mean Differences

Source	Df	F	P
Between	1.0	96.15	0.0000
Within	86.4		

Table 6:

Homogeneity Test

Homogeneity of Variances	F	P
Levene's Test	9.29	0.0030
O' Brien's Test	9.10	0.0033
Brown and Forsythe Test	6.59	0.0118

Table 7:

One-Way ANOVA for: PosttestCM PosttestLM

Source	DF	SS	MS	F	P
Between	1	8968.1	8968.09	96.15	0.0000
Within	98	9140.7	93.27		
Total	99	18108.7			

Discussion

The pre-test mean scores of students who were taught Introductory Technology using CM and those who were taught using LM are shown in Table 1. Group A (CM) had a mean score of 15.360, whereas group B (LM) had a score of 14.880. Table 2 also confirmed that the P-value for the mean difference test is 0.6805 which is greater than 0.05. This indicates that the two groups were similar before the treatment.

Table 3 shows that group A (students taught Basic Technology using a combination of analogy and demonstration) and group B (students taught Basic Technology using a lecture method) were homogeneous before the treatment, with $P > 0.05$ for Levene's, O'Brien's, and Brown and Forsythe homogeneity tests, respectively, of 0.4049, 0.4098, and 0.5126. As indicated in table 4, the post-test mean scores of students taught using CM and those taught using LM were 65.92 for CM and 46.98 for LM. With a P-value of 0.0000, the difference in mean scores between students taught Basic Technology using CM and those taught using LM is extremely significant, as seen in Table 5. For Levene's, O'Brien's, and Brown and Forsythe homogeneity tests, $P = 0.0030$, 0.0033, and 0.0118, respectively. This implies that the two groups were no longer homogenous. Finally, Table 7 which is a One-way Analysis of Variance (ANOVA) for the post-test scores of CM and LM showed that $P = 0.0000$. this revealed that the difference that exists between the two groups mean scores is highly significant. The results of the analysis revealed that combining the Analogy and Demonstration methods of teaching is superior to using the traditional lecture method alone. This, therefore, proved the findings of Sharma and Kumar (2018) that using the lecture method to teach Basic technology may deprive students of learning the right skills and knowledge because critical thinking skills and problem-solving which are the ingredients for learning technical trades are not encouraged. This may also affect the students' retention ability and performance. Since the students were homogenous before the treatment and have shown significant differences in performance after the treatment, the differences that exist in their mean scores after the treatment can therefore be attributed to the differences in the treatment given to each group. The finding is also in conformity with Shabiralyani, Hasan, Hamad and Iqbal (2015) who observed that teachers who make use of traditional teaching methods in their classrooms over-rely on textbooks in the process of disseminating knowledge which makes the student work in relative isolation only on tasks that require lower-order thinking, rather than higher-order thinking. One of the reasons why students taught using a combination of analogy and demonstration methods of teaching performed better than those taught using the lecture method is that those taught using the lecture method only lack some analogies that can link their previous experience with the target concept, as found by Abimbola & Danmole, (1995). Furthermore, because the teacher did not show, pupils may have difficulty relating theories to practical practice or understanding the application of ideas.

Conclusion

From results of the data analysis it was concluded that students understand Basic Technology better when taught using combine Demonstration and Analogy teaching method than when they are taught using lecture method of teaching.

Recommendations

The following recommendations were made:

1. That Basic technology and some science and technology related courses that require acquisition of practical skills should be taught using combine demonstration and analogy method of teaching.
2. That teachers should choose the most appropriate analogy that would not confused students from the targeted concept.

References

Abimbola I. O. and Mustapha, M. T. (2001). The use of analogy in communicating difficult science concepts to secondary school students: *The Nigeria Teachers Today: A Journal of Teacher Education, (9)11*

Abimbola, I. O., and Damole, B. T. (1995. Origin and structure of science knowledge: Implication for concepts difficulties in science. *Ilorin Journal of Education 15,47-59*

Ahmad, A., Nordin K. M., Ali F. D., Md N. A. & Latip N. A (2017). Practice in vocational teaching method to improve quality of teaching. *The Social Science Medwell Journal 12(3), 413-418*

Dorgo, E. T (2015). Different Teaching Methods: A panacea for teaching effective curriculum implementation in the classroom. *International Journal of Secondary Education, 3(6),7-78*

Elom N. and Okolie C. U (2014). Impediments to effective teaching and learning of basic technology in Nigerian public secondary schools. *Journal of Research and Methods in Education (JOSR-JRME), 4(3), 45-51*

Fermando, Y. J. N. S.and Marikar, M. M. T.F. (2017). Constructivist teaching/learning theory and participatory methods. *Journal of Curriculum and Teaching.*

Gill, E. (2020). What is your teaching style? 5 effective teaching methods for your classroom. https://mail.google.com/mail/?tab=rm&authuser=0&ogbl *Resilient Education.* *https://resilienteducator.com*

Ifeyinwa, C. M (2017). Factors affecting the teaching basic technology in secondary schools in IkaSouth Local Government Area of Delta State. Pen2print.org/2017/01

Krishnakumaryamma, N. A and Venkatasubramanian S. (2018). Technology-mediated pedagogies for skill acquisition toward sustainability education. DOI:10:5772/interchopen.74336

Okoranka and Wada (2014). Effects of analogy instructional strategy, cognitive style and gender on senior secondary school students achievement in some physics concepts in Mubi Metropolis, Nigeria. *American Journal of Educational Research, 2(9),788-792.*

Ertmer A. P and Newby J. T. (2013)Behaviourism, Cognitivism, Constructivism: Comparing Critical Features from an Instructional Design perspective. Performance Improvement Quarterly 26(2) 43-71 Foundation of Learning and Instructional Design Technology.lidtfoundations.pressbooks.

Physicscatalyst (2017). Demostration Method of Teaching Strategy: B. Ed Notes Physicscatalyst.com/graduation/demonstration-method.

Richa, B. (2014). Instructional strategies: Find the best approach to encourage independent lidtfoundations.pressbooks.

Shabirlyani G., Hasan S. K., Hamad N. and Iqbal N. (2015), Impact of Visual Aids in Enhancing the Learning Process case: Research: Didtrict Dera Ghazikhan. *Journal of Education Practice 6(19)*

Sharma A. and Kumar N. (2018), Importtance of Talk and Chalk Methods of Teaching. Dental Students View in Practical Year. *International Journal of Healthcare Education and medical Informatics, 5, 11-15*