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Examining Differentiated Instruction Approach in Improving Students' Academic Achievement in Biology in Ibadan Secondary Schools in Nigeria

by

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Abstract

This study is tailored toward meeting students' interests, needs, and strengths. As a result, differentiated instruction and traditional method were used. A pretest –posttest quasi-experimental design was used. Ibadan is divided into four educational zones, one was chosen by random and purposive sampling, and 134 students were purposively selected in four schools from an arm of the SS2 science intact class in each school. Three instruments were used: Achievement Biology Test (ABT) (r = .76), Differentiated Instruction Guide (DIG), and Traditional Method Guide (TMG). Two hypotheses were used at p = 0.05. The data analysis used were t-test and ANOVA. The result revealed that there is no initial significant effect of differentiated instruction and traditional method on pre-test of students' academic achievement ($t_{(132)} = -.628$, $p = .53$) while the post–test of treatments has a considerable impact on the academic achievement of students ($t_{(132)} = 19.88$, $p = .00$); [$F_{(1,133)} = 10159.64$), $p = .00$] while there is no significant interaction effect of treatment and students' gender on students' academic achievement [$F_{(1, 133)} = .012$, $p = .91$]. It is recommended that differentiated instruction should be encouraged and adopted during teaching/learning of Biology.

Keywords: Differentiated instruction, traditional method, teaching and learning

Examining Differentiated Instruction Approach in Improving Students' Academic Achievement in Biology in Ibadan Secondary Schools in Nigeria

Differenciated Instruction is a teaching strategy in which teachers adapt their instruction to accommodate a variety of learning needs. The pedagogical strategy known as differentiation instruction, which adapts instruction to each student's requirements, is frequently proposed as a way to address the difficulties posed by a diverse student body (Suprayogi and Valcke, 2016). Differentiation, however, can also be broadly described as an active teaching strategy that takes into consideration the uniqueness of students and groups of students and as well a continuous and ever-changing process (Roila & Polso 2020). Differentiation, on the other hand, includes all useful teaching techniques and ideas that let educators take into account each student's unique qualities to best assist their education. Differentiated instruction is an ongoing and constantly evolving process. It involves various teaching strategies and principles that allow teachers to consider students' individual characteristics, ensuring that they receive the support they need to succeed in their learning and schooling. This modified instruction is designed to help students with diverse needs master challenging academic content (Kado, Dorji, Dem & Om, 2021).

Student centred pedagogies, which place learners at the centre of the learning process, can meet learners' individual learning needs and styles and engage them in the process of learning (An & Mindrila, 2020).One practical application of constructivism's tenets is differentiation. Another key idea in differentiation is the zone of proximal development. Vygotsky (1978) uses it to describe the gap between a student's current developmental stage and the potential level that they could reach with teacher assistance. According to Vygotsky (1978), the zone of proximal development is distinct and age-independent. Differentiation is based on the idea that teachers can provide appropriate challenges for every student by knowing their zone of proximal development. Each student would complete assignments that align with their zone of proximal development in an ideal differentiation scenario. By increasing students' engagement and dedication to the learning process, differentiation approaches learning from their interests. In more specific terms, differentiation is an active, student-centered strategy that goes beyond all teaching, according to

the 5D paradigm. As it moves from general to specific, the model promotes the use of differentiation in the five areas of instruction - teaching techniques, teaching environments, teaching arrangements, support materials, and assessment.

Objectives of the Study

1. To determine the effect of differentiated instruction and traditional method on students' academic achievement in Biology
2. To determine the interaction effect of treatment and students' gender on students' academic achievement.

Hypotheses

Based on the objectives of the study, the researchers formulated the following null hypotheses.

1) There is no significant difference in the academic achievement in Biology between students in differentiated instruction and students' in traditional method
2) There is no significant interaction effect of treatment and students' gender on students' academic achievement.

Method

A quasi-experimental design was used. Schools in Ibadan were clustered along four educational zones, three local government areas were chosen at random from each zone totaling 12 local government areas. In order to choose the participants, a purposeful sampling strategy was adopted in selecting coeducational schools. In each school an arm of SS 2 intact class was used. The number of students in an arm of SS 2 intact class of schools used were 23, 20, 24, 21, 22 and 24 totaling 134 students (Male 67 and Female 67). The first and second terms examination scores provided by the biology teachers were used for the participants to be able to identify those that are more knowledgeable in the subject. The instrument used for this study comprised;

1. Achievement Biology Test (ABT)
2. Differentiation Instruction Guide (DIG).
3. Traditional Method Guide (TMG)

Thirty multiple-choice questions with four answer choices made up the test (A, B, C and

D). The questions were derived from six themes in the SS 1 and SS 2 Biology curriculum, with a total of 60 items pilot examined. The researcher created the instrument using a table of specifications that included cognitive areas such as remembering, understanding, and applying. The reliability coefficient of the Achievement Test on Biology was determined using the Kuder – Richardson 20 (KR – 20) method. With discriminating indices of .31 and .45, the item difficulty indices varied from .35 to .67. From the pools of trial-tested products, thirty items were chosen. The multiple-choice test's final selection of items is displayed in the specification table. The coefficient of reliability was 0.76. The criteria used in selecting the 30 test items was based on the objectives of the selected topics as stipulated by the curriculum. The multiple-choice test's specification table indicates that thirty – percent tested remembering, thirty percent tested understanding, and forty percent tested applying. One point was awarded for the correct response, and zero for the incorrect one. The maximum mark obtainable for the multiple–choice was 30 marks.

Table 1

Table of Specification for Achievement Test on Biology

Topics/Objectives	Remembering 30%	Understanding 30%	Applying 40%	Total 100%
Basic Ecological Concepts	1	2	2	5
Functioning Ecosystem	1	2	2	5
Plant and Animal Nutrition	1	2	2	5
The Cell	2	1	2	5
Cell and its Environment	2	1	2	5
Tissues and Supporting System	2	1	2	5
Total	9	9	12	30

Differentiation Instruction Guide (DIG)

The instructional guide was prepared by the researchers to show the various steps the biology teachers followed.

Step 1 - Firstly, before the commencement of the lesson the teacher creates a section in the classroom where students can help one another. As an extension activity, students with greater subject-matter expertise can help those who are having difficulty understanding the topics taught.

Step 2 - Secondly, the teacher constructs questions and answers related to the topic to be taught and experiment to be carried out before the commencement of the lesson for students to be able to ask the teacher or their colleagues questions for better understanding of the topic

Step 3 – Thirdly, the teacher provides card boards containing biological terms, images, and labels. To assist students in remembering.

Step 4 – The teacher provides the students with lesson's content and assignment

Step 5 – The teacher divides the students into reading groups to discuss the assignment or allow students to read individually

Step 6 – The teacher ask the students questions and answers are provided based on the earlier constructed questions and answers and as well allow them to ask questions and answer them. The teacher provides answers when adequately needed.

Traditional Method Guide (TMG)

The instructional guide was prepared by the researchers to show the various steps the teacher followed.

Step 1 – The teacher introduces the lesson. This is done to draw students' attention to the topic.

Step 2 – The teacher explains the new topic

Step 3 – The teacher shows the students instructional materials or carries out experiment where necessary for a better understanding

Step 4 – The teacher asks the students questions on the topic taught to verify the students' understanding

Step 5 – The teacher writes notes on the topic taught on the chalk/whiteboard.

Step 6 – The teacher moves around the class to check the students' note

Step 7 - The teacher evaluates the students and marks and gives corrections where needed

Step 8 – The teacher gives the students an assignment to be submitted in the next class

Analysis

The study enlisted the help of six qualified Biology teachers. For one week, the researchers train the biology teachers on how to implement differentiated instruction and traditional method. In the first week, a pre-test of achievement was given. The treatments lasted for six weeks, thereafter, a biology achievement test was administered on the participants as post-test. There were two different treatment groups. These were differentiation instruction and traditional method. In the differentiation instruction group, N = 67 students. The treatment in this group involved teaching the learners for 1hr for each contact totaling 10 contacts. In the traditional method group, N = 67 students. The treatment in this group involved teaching the students for 1hr for each contact totaling 10 contacts.

The analysis was conducted using t-test and ANOVA with two treatment groups (Differentiated instruction and Traditional method)

Results

Ho_1: There is no significant difference in the academic achievement in Biology between students in differentiated instruction and students' in traditional method

Table 2

T – test for Pre – test of Treatment and Students' Academic Achievement

Treatment	N	Mean	SD	t	df	Sig
Differenciated Instruction	67	11.70	4.33	-.628	132	.531
Traditional Method	67	12.17	4.46			

In table 2, there is no initial difference between the differentiated instruction group and traditional method group ($t_{(132)} = -.628$, $p = .53$)

Table 3

T – test for Post – test of Treatment and Students' Academic Achievement

Treatment	N	Mean	SD	t	df	Sig
Differenciated Instruction	67	30.48	5.82	19.88	132	.000
Traditional Method	67	13.06	4. 18			

In table 3, the result of the post – test shows that there is a significant effect of treatment differentiated instruction on students' academic achievement in Biology ($t_{(132)} = 19.88$, $p = .00$)

Table 4

ANOVA of Treatment and Gender on Students' Academic Achievement in Biology

Source	Type 111 Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10163902a	3	3387.967	129.772	.000
Intercept	63489.274	1	63489.274	2431.876	.000
Treatment	10159.636	1	10159.636	389.152	.000
Gender	.233	1	.233	.009	.925
Treatment*Gender	.319	1	.319	.012	.912
Error	3393.926	130	26.107		
Total	77057.000	134			
Corrected Total	13557.828	133			

a. R squared = .750 (Adjusted R squared = .744)

Table 4 indicates a summary of the results of the effect of treatment (differentiated instruction and traditional method) on their academic achievement in biology as well as interaction effect of treatment and students' gender on academic achievement. The result shows that there is a significant effect of treatment on students' academic achievement [F ($_{1,133}$) = 10159.64), p = .00] therefore, the null hypothesis is rejected while there is no significant interaction effect of treatment and students' gender on academic achievement [F ($_{1,\ 133}$) = .012, p =.91] Therefore, the null hypothesis is accepted.

Discussion

Differentiation instruction is an active approach to teaching. It is a teaching approach tailored to meet the diverse needs of students, usually proposed to resolve the challenges presented by a heterogeneous student body (Roiha & Polso, 2021). Differentiated instruction is a teaching strategy that can significantly impact the academic performance of low achievers. Although not a new concept, its visibility and importance have increased in educational discussions in recent years. It has been studied extensively, much of this research has focused on teachers' practices and their attitudes toward implementing differentiation in the classroom (Roiha & Polso, 2021). Deunk et al. (2018) indicated that differentiated instruction can be a beneficial teaching approach for students' learning, school satisfaction, and self-concept. A recent review and meta-analysis of differentiated instruction practices in primary education demonstrates that when implemented effectively, differentiated instruction has the potential to improve student outcomes Tambaoan and Gaylo (2019) noted that there was a statistically significant difference in academic performance between the two groups of learners in the experimental group. The performance was moderate before and after the intervention, with the significant difference attributed to differentiated instruction. Grain et al. (2022) found that when students received differentiated instruction, their academic success in English was not influenced by gender. Additionally, Tambaya et al. (2023) revealed that differentiated instruction significantly affects students' academic achievement in Biology;

Conclusion

The study examined the effect of differentiated instruction and the traditional method on students' academic achievement in biology. Based on the findings, the following conclusions were drawn: Differentiated instruction effectively improves students' academic achievement more than the traditional method, and there is no interaction effect between the treatments of students' academic achievement in biology.

Recommendation

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

1. Teachers should be exposed to the use of differentiated instruction.
2. Government at all levels should encourage teachers of Biology to attend seminars, workshops, and in-service training programmes where they could be educated/exposed to new innovative instructional strategies
3. Textbook writers with the help of curriculum designers could incorporate the new innovative instructional strategies and how teachers can use them.

Future research

The areas of study that can be further researched are the use of differentiated instruction and teacher variables such as teaching experience, teaching profession, teacher gender, teacher motivation etc.

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