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Original Article

Effect of Differentiated Instructional Approach on Learners' Participation and Academic Achievement in Biology in Public Secondary Schools in Mbeere North Sub-County, Kenya

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ABSTRACT

Secondary school education forms the academic foundation for the acquisition of knowledge in higher institutions. Science Education is the bedrock for technological advancement in Kenya and the world at large. Biology is a key science subject and forms the foundation of various fields; therefore, it is an essential discipline. The performance of students in Biology has generally been low for the last few years. The ordinary Conventional Instructional Approach used by teachers in increasingly diverse classrooms may have contributed to the minimal performance. This study aimed to assess the effect of the Differentiated Instructional Approach (DIA) on Learner Participation and Academic Achievement in Biology in Public Secondary Schools. Quasi-Experimental Research Design was used in particular, Solomon Four Control Group Design. The target population was 2405 form two Biology students. Purposive sampling was used to select 8 Co-educational County Secondary Schools with a sample size of 360 students. Simple random sampling was used to select and assign the participating schools to Experimental and Control groups. Descriptive statistics was used to analyse the data, while the Statistical Package for Social Sciences (SPSS) software version 26 was used for data analysis. The results showed that there was a statistically significant difference in all three hypotheses, with the first objective giving ($F_{117.220}$, $p<0.05$), the second objective giving ($F_{54.049}$, $p < 0.05$) while the third objective gave ($F_{65.417}$, $p < 0.05$) significant values. The results indicated that learners subjected to the Differentiated Instructional Approach did better than those instructed using Conventional Teaching Approaches. The study also concluded that DIA improved learners' Participation and Academic Achievement. The findings of this study would be significant to curriculum developers, educators, administrators and will also contribute to the knowledge base for the Differentiated Instructional Approach, forming the basis for further research.

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INTRODUCTION

In the world of academia, a learner's acquisition of skills and knowledge mostly depends on the mode of delivery. Teachers apply various teaching approaches, including the conventional teaching approach and modern innovative approaches such as DIA.

Differentiated instruction is a teaching and learning approach that tailors instruction to meet individual learner needs. The approach consists of the efforts of teachers to respond to variance among learners in the classroom. Learners differ from one another due to unique qualities, economic variations and specific needs that may have an impact on the learning process (Tomlinson, 2013). Teaching and learning activities are the tasks which the teacher and the learner perform in the class, which include but are not limited to the development of the teaching activities, giving proper stimulus for timely responses, drilling the learnt responses and increasing the responses by extra activities. A teaching approach results in a didactic activity for teaching and learning by combining and optimally organising methods, means and forms of grouping learners (Hamroev, 2019). Each learner's cognitive processes are determined by his or her own unique situation; hence, teachers must use teaching approaches that meet each learner's individual intellectual needs. According to Wang and Eccles (2013), meaningful learner-tailored instruction motivates learners and results in increased learning.

The teacher, who is the instructor, should find an appropriate formula to combine methods, procedures, techniques, means and forms of organisation that lead to a successful instructional process (Tomlinson, 2013). The teacher should not commit to one particular teaching approach but should consider the nature of learners, their interests, maturity, background and the resources available before deciding on the Instructional Approaches to use. The approaches adopted by the teacher must ensure maximum participation of the learner (Muthomi & Mbugua, 2014). Teachers should encourage the learners by displaying their own enthusiasm and providing interesting, enjoyable and relevant clas activities (Dimkpa, 2015).

Many educators agree with the theory of the Differentiated Instruction Approach, but there are still many unanswered questions regarding its practicability (Abramovich et al., 2019). Learners of equivalent ages differ in readiness to learn, interest, learning style, background knowledge and life circumstances (Kubat, 2018). These differences impact not only the learners but also the pace at which they learn it. Maximum learning takes place when teachers continually and vigorously adjust the curriculum in response to individual learners' readiness, interest and learning profile. These are all addressed in classrooms where teachers use the Differentiated Instructional Approach (Tomlinson, 2017). When teachers develop an instruction program appropriate to learners' readiness levels and

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interests, they are able to draw upon prior knowledge and learners' experiences outside the school environment (Ambrose *et al.*, 2010 A differentiated classroom differs from a conventional classroom in that more than one approach is used to complete a lesson for any given topic, and the instruction process is designed around the needs of the learners. Learners' academic needs are more readily met in a classroom where teachers utilise the Differentiated Instructional Approach, which ensures that each learner experiences effective and challenging instruction (Ismajli & Imami, 2018).

A differentiated instructional approach involves a generalised plan that includes structure, instructional objectives, and an outline of planned learning activities necessary to achieve the lesson objectives. Teachers face increased pressure to ensure that every learner demonstrates high academic achievement. According to Thakur & Kalpana (2014), teachers should use a Differentiated Instructional Approach to enable all learners to achieve the set objectives and have high-quality education. Teachers can organise many teaching methods like flexible groupings and collaborative learning to build differentiated instructed classrooms to satisfy the various needs of the learners. Additionally, administrators' support is paramount in the provision of resources for the successful implementation of DIA (Adebayo, 2014). Teachers need professional development that defines differentiated instruction and implementation, understands the learners better, and observes other teachers implementing the approach. DIA is of more benefit to learners who may be struggling in the classroom as it acknowledges not only the strengths and differences among learners but also the increasing diversity in the modern classroom (Muthomi & Mbugua, 2014). DIA requires the teacher to realise that the classroom should be a place where teachers pursue the best understanding of teaching and learning and that no practice is best practice unless it works for the individual learner. Classrooms are full of learners who have enormous differences in their readiness, interests, cultural backgrounds, prior knowledge, and learning profiles (Tomlinson, 2013).

Teachers have a major influence on the learning success outcomes of their learners; hence, there is a need to use an instructional approach that focuses on individual learners' academic needs and general classroom participation. Conventional instructional teaching and learning approaches seem to be inadequate in supporting learning in classrooms for learners with diverse needs. Most studies on differentiated instruction are conducted in Western or urban settings, leaving a gap in understanding how these approaches work in rural contexts. Therefore, there is lack of long-term studies examining the sustained impact of differentiated instruction on student outcomes over multiple years in rural settings (Dixon *et al*., 2014).

This study investigated the effect of a Differentiated Instructional Approach on Learner's Participation and Academic Achievement in Biology in Public Secondary Schools in Mbeere North Sub-County, Kenya.

MATERIALS AND METHODS

Location of Study

The study was conducted in Public Secondary Schools in Mbeere North, Sub-County, Kenya. Findings from differentiated instructional approaches in other regions cannot be generalized to Mbeere North due to significant contextual differences. These differences may include cultural practices, socio-economic status, educational infrastructure, teacher preparedness, and student demographics. Mbeere North has unique characteristics that could influence the effectiveness and implementation of differentiated instruction, necessitating a localized study to capture these nuances. The researcher, therefore, found a research gap, hence the need to conduct the study in the area.

Research Design

The study was conducted in selected public secondary schools in Mbeere North Sub-County, Kenya. The researcher used the quasi-experimental research design and, in particular,

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Solomon's four control group design. The quasi-experimental design aims to establish a cause-and-effect relationship between independent and dependent variables. It is a useful tool in situations where true experiments cannot be used for ethical or practical reasons. In quasi-experiments, participants are not randomly assigned, but instead, they are placed in the experimental and control groups, both with similar entry behaviour. The design allows researchers to carry out studies in natural and real-life settings using probability samples over an extended period of time (Gopalan, Rosinger & Ahn, 2020).

Solomon Four Group Design is among the most rigorous designs that can be used in quantitative studies as it involves two control groups compared to other experimental designs (Mai and Takahashi, 2020). The design enables the researcher to make more complex assessments on the cause of changes in the dependent variable and shows if the changes in the dependent variable are due to some interaction effect between the pretest and the treatment. The design permits four meaningful comparisons on a particular dependent variable. The research design controls threats to internal validity, such as bias and external validity, such as pretest sensitisation, so that the observed effect on the dependent variable can be attributed only to the treatment. The research design allows the researcher to exert complete control over the variables and to check that the pretest will not influence the results ((Mai and Takahashi, 2020). The researcher worked with the entire class, which was constituted by the school. The pretest was used to determine the entry behaviour of the learners, while the post-test was used to determine the effect of the treatment on the experimental group. The pretests were treated as normal tests administered to the learners while teaching and were administered by the regular teachers to avoid anxiety. Four groups were involved in the study, comprising experimental groups 1 and 2 coded as E1 and E2, respectively and control groups 1 and 2 coded as C1 and C2, respectively (*Figure 1*).

Figure 1: Solomon Four Group Design

Group I (EI) ……...01	……	X……..…….02
Group II (C1) ....…….03	……..	
Group III (E2) ……..……	.X	…….05
Group IV (C2) ……..……	..……	...06

Key: (EI)- Group subjected to pretest, treatment and post-test; (C1)- Group subjected to pretest and post-test; (E2)- Group subjected to treatment and post-test; (C2)- Group subjected to post-test; X- Treatment (DIA)

Source: Shuttleworth, 2009

Group I (E1) is the experimental group, which was subjected to a pretest 01, received the treatment (X) and then post-test 02. Group II (C1) is the control group that received pretest 03 and was instructed using the conventional instructional approaches. Then, it finally received post-test 04. Group III (E2) is the experimental group which received treatment (X) and a post-test 05. Group IV (C2) is the control group, which received post-test 06 only and was instructed using convectional instructional approaches.

Target Population

A target population is the larger group to which the researcher hopes to generalise the findings (Fraenkel et al., 2012). In this study, the target population was 2405 form two Biology students in public secondary schools in Mbeere-North Sub-County. The sample size was 360 form two biology students from the sampled eight co-educational county schools. The sub-county has 47 public secondary schools, 1 National school, 7 Extra-County schools and 39 County and Sub-County Co-educational schools. Purposive sampling was done to identify eight Co-educational County Schools which participated in the research.

Data Collection

Data was collected in 2023 in the months of August, September and October when the sample schools were visited. The researcher used purposive sampling to sample the eight co-educational county schools to ensure that the

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representative population was sampled without bias. Simple random sampling was used to assign the school as either an Experimental or Control group. Three schools had two streams that took Biology, and both streams were subjected to a similar approach. However, only one stream in each school was considered for analysis, and this was identified through simple random sampling. Learners remained in their respective streams as constituted by the school management.

Likens (2022) argues that the sample size depends upon the number of variables in the study, the type of research design and the method of data analysis. For experimental studies, at least 30 students per group are recommended. In this study, one from two classes in each school was used for analysis. The actual sample size was 360 form two students.

Research Instruments

Instruments used to collect data in this study were the Participation Observation Schedule (POS) and the Biology Achievement Test (BAT).

Participation Observation Schedule (POS)

A participation observation schedule (POS) was used to measure learners' class participation in biology. The researcher engaged an observer to observe learners' behaviour and activities in order to determine their level of participation in the class. The observer recorded the number of learners who responded or performed a particular activity at an interval of three minutes during the lesson. Eleven items were constructed, and the observer was required to record the number of learners who participated in various classroom activities as guided by the instrument.

Biology Achievement Test (BAT)

The Biology Achievement Test was used to measure the learner's achievement in Biology on the topic of Excretion and homeostasis. BAT had ten items with a total of twenty-five marks testing the various levels of the cognitive domain in both pre and post-tests.

Data Analysis

This study employed both descriptive and inferential statistics to analyse data. Descriptive statistics included frequencies, percentages, means and standard deviations, while inferential statistics were the t-test and One Way Analysis of Variance (ANOVA). Bonferroni Post Hoc was used to analyse the results further. The results were summarised using simple descriptive statistics with the help of Statistical Package for Social Sciences (SPSS V26.0). The researcher finally interpreted all the data on the basis of the findings obtained in the analyses.

Table 1: Summary of the variables and statistical tests

Hypotheses	Independent Variables	Dependent Variables	Statistical Test
H_{01}: There is no statistically significant difference in Class Participation among learners subjected to Differentiated Instructional Approach and those instructed using Conventional Teaching Approaches.	Differentiated Instructional Approach	Enhanced learner Class Participation	Independent t-test ANOVA
H_{02}: There is no statistically significant difference in Academic Achievement among learners subjected to Differentiated Instructional Approach and those instructed using Conventional Teaching Approaches.	Differentiated Instructional Approach	Improved Academic Achievement	Independent t-test ANOVA

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RESULTS AND DISCUSSION

Background Information for Students

In group E1, there are 47 males and 42 females, resulting in a total of 89 individuals. This group has a slightly higher number of males than females. Group C1 also consists of 88 individuals, with 45 males and 43 females. Similar to E1, C1 has a slightly higher number of males than females. Group E2 has 44 males and 46 females, totalling 90 individuals. E2 has a slightly higher number of females than males. Group C2 had 43 males and 46 females, making up a total of 89 individuals. The total by gender was 177 females and 179 males, totalling 356 respondents. The overall gender analysis is indicated in *Table 3*.

Table 2: School by gender

	Male	Female	Total
E1	47	42	89
C1	45	43	88
E2	44	46	90
C2	43	46	89
Total	**179**	**177**	**356**

Table 3: Overall, Gender Analysis

	Frequency	Percent	Cumulative Percent
Male	179	50.3	50.3
Female	177	49.7	100.0
Total	**356**	**100.0**	

From *Table 3*, the distribution of respondents by gender was almost balanced, with males making up slightly more than half of the respondents (50.3%), while females accounted for a percentage slightly below half (49.7%). This implied that both male and female respondents were well-represented

Analysis of Pretests

In order to find out the entry behaviour and homogeneity of students on Class Participation and Academic Achievement in Biology, the Experimental group (E1) and control group (C1) were pretested using POS and BAT before the onset of the treatment. *Table 4* presents the means and standard deviations of POS.

Means and SD on POS

The data indicated in *Table 4* shows that the mean of pretest score for E1 was 7.78 and the standard deviation of 2.66, while the standard error of the mean was 0.28. The mean of pretest score of C1 was 7.73, and the standard deviation was 2.96, with a standard error of the mean of 0.31. It is observed that both groups had relatively similar mean pretest scores, with E1 having a slightly higher mean score. To find out if the difference was significant, a t-test was run, and the findings are indicated in *Table 5*.

Table 4: Pretest Means and SD on POS

		Pretest Mean			
		N	Mean	Standard Deviation	Standard Error of Mean
Learning type	E1	89	7.78	2.66	.28
	C1	88	7.73	2.96	.31
	Total	**177**			

Independent Samples T-Test on POS

The results indicate a t-statistic of 0.147. In both cases, the p-values (0.04 and 0.046, respectively) are below the conventional significance level of 0.05. This indicated a 5.6% probability of obtaining a difference as extreme as the observed one, assuming equal means. This suggests that, based on the available pretest data and the results of the statistical analysis, there is no strong statistical evidence to support the presence of a

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significant difference in pretest means between the Experimental and Control groups.

Table 5: Independent samples t-test on POS

		T	df	Sig. (2-tailed)
Pretest Mean	Equal variances assumed	.147	178	.04
	Equal variances not assumed	.123	175.013	.046

Means and SD on BAT

The Experimental Group E1 had 89 participants. The mean score for this group is approximately 6.32, with a standard deviation of 3.17. The Control Group C1 consisted of 88 participants. The mean score for this group was 8.27, with a standard deviation of 1.70. E1 and C1 exhibited distinct mean scores and standard deviations, where E1 had a lower mean score but a higher standard deviation compared to the C1, indicating that the E1 had more spread out from the mean compared to the C1. Further statistical analysis of the t-test was run, and the results are reflected in *Table 7*. Independent Samples t-test on BAT

Table 6: Pretest means and SD on BAT

Descriptive Statistics Dependent Variable: Pretest			
Group	**N**	**Mean**	**Std. Deviation**
E1	89	6.3236	3.16763
C1	88	8.2701	1.70121
Total	**177**	**11.2968**	**2.71670**

Table 7: Independent Samples t-test on BAT

Independent Samples Test						
		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Pretest Mean	Equal variances assumed	126.381	.000	5.136	178	.062
	Equal variances not assumed.			5.264	136.398	.051

Results in *Table 7* show that the differences in scores attained by E1 and C1 were not statistically significant (t_{178} =5.136 P>0.05). This implied that the result of the biology test between the two groups on biology assessment test abilities was not different; hence, there was equal entry behaviour.

Effect of Differentiated Instructional Approach on Learner's Class Participation

The first objective of the study was to investigate the effect of the Differentiated Instructional Approach on Class Participation in Biology among learners who were subjected to the Differentiated Instructional Approach and those instructed using Conventional Teaching Approaches. To achieve this, the active involvement of learners in a spectrum of biology practices, such as asking questions, providing point explanations, participating in group discussions, answering questions, participating in experiments, comparing results, and inferring conclusions, was conducted. To find out the effect of the difference in class participation in biology among learners who were subjected to the Differentiated Instructional Approach, students were subjected to POS after five weeks of treatment. The scoring of POS was structured to a maximum of ten learners' responses/activities. The number of students who responded to the activities was recorded at an interval of three minutes. The POS post-test scores and standard deviation are presented in *Table 8*.

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Table 8: POS post-test scores

		Post-test Mean			
		N	**Mean**	**Standard Deviation**	**Standard Error of Mean**
Group	E1	89	14.77	1.23	.13
	E2	90	12.53	2.32	.24
	C1	88	8.18	2.07	.22
	C2	89	9.24	1.35	.14

E1 had a post-test mean score of 14.77 compared to the pretest mean of 7.78. This was an improvement mean of 6.99, which could be attributed to the treatment (DIA). E2 had a post-test mean score of 12.53. The post-test mean for C1 is 8.18 compared to the pretest mean of 7.73, while the C2 post-test mean score is 9.24. The post-test means data reveal differences in the mean scores across the four groups, suggesting variations in the outcomes or performance levels. E1 has the highest mean, followed by E2, C2, and C1 with the lowest mean.

Table 9: ANOVA on POS Post-test

ANOVA Post-test Mean					
	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	1142.857	3	380.952	117.220	.000
Within Groups	1156.959	357	3.250		
Total	**2299.816**	**360**			

The choice of activity has a statistically significant impact on participants in different schools. ($F_{117.220}$, $p<0.05$) shows that there is a statistically significant difference in the performance outcomes (POS) between the groups using Differentiated and Conventional Instructional Approaches, with a p-value 0.05 indicating strong evidence that there are genuine differences in performance outcomes among the groups. Results indicate that there is a statistically significant difference in performance outcomes between the groups that used Differentiated Instructional Approaches and Conventional Instructional Approaches. This suggests that the choice of learning method has an impact on the performance of the individuals. However, to understand the nature and direction of these differences, the posthoc test was carried and the results are indicated in *Table 10*.

Table 10: Bonferroni post- test POS

Multiple Comparisons Dependent Variable: Post-test Mean Bonferroni				
(I) Group	**(J) Group**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**
E1	E2	4.76000*	.26874	.030
	C1	2.59133*	.26874	.000
	C2	1.53344*	.26874	.000
E2	E1	3.54000*	.26874	.030
	C1	2.35133*	.26874	.000
	C2	1.29344*	.26874	.000
C1	E1	3.59133*	.26874	.000
	E2	4.35133*	.26874	.000
	C2	1.05789*	.26874	.001
C2	E1	2.53344*	.26874	.000
	E2	3.29344*	.26874	.000
	C1	1.05789*	.26874	.001

**. The mean difference is significant at the 0.05 level.*

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Experimental vs. Control Groups: Both Experimental Group 1 and Experimental Group 2 showed significantly higher mean post-test scores compared to both Control Group 1 and Control Group 2. This suggests that students instructed using DIA outperformed those instructed using Conventional Approaches in the post-test assessments. Experimental Group 1 vs. Experimental Group 2: Among the differentiated learning groups, Experimental Group 2 performed significantly better than Experimental Group 1 in the post-test. Control Group Comparisons: Control Group 1 had significantly lower mean post-test scores than Control Group 2, indicating differences in post-test outcomes among conventional learning groups.

With a $p<0.05$, we reject the null hypothesis and conclude that there was a statistically significant difference in Class Participation in Biology among learners subjected to Differentiated Instructional Approach and those instructed using Conventional Teaching Approaches. A Similar study conducted by Dixon *et al*., (2014) revealed differentiated instruction to lead to significant improvements in student performance compared to traditional methods. Students in the differentiated instruction group showed higher engagement and academic achievement.

Effect of Differentiated Instructional Approach on Biology Achievement

The second objective of the study was to determine the effect of the Differentiated Instructional Approach on Academic Achievement in biology among learners subjected to Differentiated Instructional Approach and those instructed using Conventional Teaching Approaches. To achieve this, students were subjected to BAT after five weeks of treatment. The scoring of BAT was structured to a maximum of 25 marks with ten questions. BAT post-test scores and standard deviation are presented in *Table 11*.

Table 11: Post-test Means and SD on BAT

Descriptive Statistics Dependent Variable: Post-test			
Group	**N**	**Mean**	**Std. Deviation**
E1	89	11.6781	.93382
E2	90	13.0418	2.94599
C1	88	12.1651	.35637
C2	89	9.8301	.65797
Total	**356**	**11.6788**	**1.97190**

The results in *Table 11* indicate that the mean scores for groups E1 and E2 were 11.68 and 13.04, respectively. E1 had a pretest mean of 6.32, indicating an improved performance by 5.32. High mean scores in Experimental groups could be attributed to the treatment (DIA). Control groups C1 and C2 means were 12.17 and 9.8 respectively. C1 had a pretest mean of 8.27, indicating an improved performance by 3.9. The descriptive statistics reveal variations in both the means and standard deviations across the different groups. Experimental Group 2 has the highest mean score and the highest standard deviation, indicating higher average performance and greater variability among its participants. On the other hand, Control Group 2 has the lowest mean score and a moderate standard deviation, suggesting lower average performance and moderate variability.

To determine whether this difference was significant on achievement in Biology, ANOVA was run as indicated in *Table 12*.

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Table 12: ANOVA on BAT Post-test

Tests of Between-Subjects Effects Dependent Variable: Post-test					
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	496.067	3	165.356	65.417	.000
Intercept	49101.786	1	49101.786	19425.440	.000
Group	496.067	3	165.356	65.417	.000
Error	899.863	356	2.528		
Total	**50497.716**	**360**			
R Squared = .355 (Adjusted R Squared = .350)					

The ANOVA results indicate that the independent variable group (E1, E2, C1 and C2) was significant ($p < 0.05$) in explaining the variance in the dependent variable. This led to the rejection of the null hypothesis, which stated that there was no statistically significant difference on Academic Achievement in Biology among learners subjected to Differentiated Instructional Approaches and those instructed using Conventional Instructional Approaches. To determine which group differed Bonferroni test of multiple comparisons was run, as shown in *Table 13*.

Table 13: Bonferroni Post Hoc on BAT post-test

Multiple Comparisons Dependent Variable: Post-test Mean Bonferroni				
(I) Group	**(J) Group**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**
E1	E2	-1.36367*	.23700	.000
	C1	-.48700	.23700	.044
	C2	.84800*	.23700	.000
E2	E1	2.36367*	.23700	.000
	C1	.87667*	.23700	.002
	C2	1.21167*	.23700	.000
C1	E1	2.48700	.23700	.244
	E2	-.87667*	.23700	.002
	C2	1.33500*	.23700	.000
C2	E1	-2.84800*	.23700	.000
	E2	-3.21167*	.23700	.000
	C1	-1.33500*	.23700	.000
*. The mean difference is significant at the 0.05 level.				

The mean difference is -1.36367, with a standard error of 0.23700. The comparison is highly significant ($p < 0.05$), indicating that there is a statistically significant difference in post-test means between the Experimental and Control groups. Experimental Group 1 vs. Control Group 1: The mean difference is -0.48700 with a standard error of 0.23700. The comparison is statistically significant ($p<0.05$), suggesting that Experimental Group 1 achieved a slightly higher post-test mean compared to Control Group 1. Experimental Group 1 vs. Control Group 2: The mean difference is .84800 with a standard error of 0.23700. The comparison is highly significant ($p < 0.05$), indicating that Experimental Group 1 outperformed Control Group 2 significantly in the post-test. The Bonferroni Post Hoc analysis reveals that post-test performance in the biology assessment test significantly differs between various groups, implying a statistically significant difference in Academic Achievement in Biology among learners subjected to Differentiated Instructional Approaches and those instructed using conventional Teaching Approaches. We therefore reject the null hypothesis and conclude that there is a statistically significant difference in

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Academic Achievement in Biology among learners subjected to Differentiated Instructional Approaches and those instructed using Conventional Instructional Approaches. Research done by Santangelo and Tomlinson, (2012) showed significant differences in student performance due to the use of differentiated instructional practices, leading to significant improvements in student performance across various subjects, with experimental groups showing higher mean scores than control groups.

CONCLUSION

The research findings suggest that a Differentiated Instructional Approach has a significant impact on various aspects of Biology teaching and learning. Learners subjected to the Differentiated Instructional Approach showed differences in class participation and academic achievement compared to those instructed using Conventional Instructional Approaches. The research findings indicate that for specific tasks, learners immersed in differentiated instructional environments outperformed those in conventional classrooms. This suggests that when instruction is tailored to meet students at their readiness levels, they are more likely to successfully complete tasks and assignments, fostering a sense of competence and self-efficacy.

The findings also reveal that learners subjected to Differentiated Instructional Approaches consistently achieved higher scores across all levels of the Biology Achievement Test (BAT). This result underscores the pedagogical value of differentiating content and instruction to meet the diverse academic needs of students, ultimately elevating their performance and understanding of the subject matter. These findings highlight the potential benefits of adopting Differentiated Instructional Approaches in high school biology classrooms. The results of the study provide compelling evidence that the choice of instructional approach significantly impacts academic achievement in biology.

Recommendations

Educators should consider incorporating differentiated instructional approaches into their biology teaching practices, catering to the diverse learning needs of students. This will help in utilising the formative assessments to gauge students' prior knowledge and readiness levels in biology. Teachers should receive training and professional development opportunities to effectively implement differentiated instructional approaches in their classrooms. These could include attending workshops, seminars, and professional development sessions specifically designed to equip teachers with the knowledge and skills required for differentiated instruction.

Educators should assess the nature of assignments to determine whether they would benefit from a differentiated approach. Continuous assessment and monitoring of student progress should be conducted to adapt instructional methods to individual learning styles and needs.

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