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Research Article

Relationship between Teaching Methods and Student Performance in Physics in Public Secondary Schools in Nakuru East Sub-County

Kaptum C. Stephen[1], Dr. Stephen N. Mailu (Ph.D.)[2] and Dr. Peter K. Koech, (Ph.D.)[3]

[1]Department of Educational Communication and Technology, Machakos University, Kenya
[2]School of Pure and Applied Sciences, Machakos University Kenya; P.O.136-90100, Machakos
[3]School of Education, Machakos University, Kenya; P.O.136-90100, Machakos
Corresponding Author Email: kaptumalito@gmail.com

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Abstract: Education is a key development pillar in the Kenya vision 2030 hence teaching approaches used by teachers should promote learners' academic achievement. The study aimed to establish the relationship between teaching methods and student performance in physics in public secondary schools. The study was based on the Theory of Pragmatism by John Dewey (1938). The study adopted correlational design with mixed approaches where both qualitative and quantitative data were concurrently analyzed and triangulated. Target population comprised principals, physics teachers and physics students in public secondary schools. Student sample was determined using Krejcie and Morgan (1990) at 95% confidence level. Purposive sampling was used for the principals and physics teachers. Piloting of instruments was done in 10% of the schools. Validity was assessed through expert judgment and from the results of the pilot study. Cronbach alpha reliability coefficient was computed to assess the internal consistency of the instruments. The test yielded an overall reliability coefficient, ɤ=0.79 based on standardized items. Data collection instruments comprised questionnaire, interview guide and document analysis. Data was analyzed descriptively and inferentially. The study established positive correlations between teaching methods and student performance. Furthermore, statistically significant difference was observed in the mean academic performance of learners taught using different methods. The study recommended that teachers use participatory methods of teaching to ensure that learners take control of their own learning and determine their academic achievement. The information obtained from the study would be of great importance to students, teachers, school management, policy makers and researchers doing research on a similar field
Keywords: Leaner-centered methods, Teacher-centered methods, Academic performance.

1. Introduction

The teaching approaches used by teachers can determine the academic performance of learners (Collins and Robert, 2004). Baran and Maskan (2011) sustain that teaching methods work effectively if they march the subject matter and also suit learners' needs. In the same nerve, Tebabal and Kahssay (2011) stress that, the teaching method used by a teacher should advocate for the realization of 21st century skills which include; critical thinking, collaboration, creativity and communication. Therefore, in order for teaching to be effective, teachers should apply varied teaching methods and align them to students' needs (Chang and Cheng, 2008). DeLong and Winter (2002) opine that the approaches to learning must take

into account learners' cognitive factors in the context of information processing and understandings. If this is done, learning becomes much more effective and student performance will be improved.

The effectiveness of a particular teaching method is reflected in the self-regulated behaviour of the learners, and can be evaluated in terms of student achievement using achievement tests (Miller and Brickman, 2004). Adunola (2011) asserts that when teachers use teaching methods that emphasize learning, establish relevance, and promote student competence; the students become better equipped to self-regulate their learning and attain better educational outcomes.

1.1 Problem statement

Education plays a critical role in the economic and technological development of many countries around the world. In Kenya, education is a key pillar of development in the ambitious vision 2030, which aims to transform Kenya into an industrialized, middle-income country by 2030. Therefore, low academic achievement by students pose a threat to the realization of this vision. Over the years, students' performance in physics in Kenya Certificate of Secondary Education (KCSE) in Nakuru East Sub-County has been on the decline. Studies on factors responsible for this have only looked into environmental factors such as entry behaviour, inadequate facilities, shortage of teachers, limited learning resources, students' absenteeism and indiscipline among other but none has examined the influence of teaching methods. It is on this premise that this study sought to establish the relationship between teaching methods and student performance in physics in public secondary schools.

1.2 Research Objective

To establish the relationship between teaching methods and student performance in physics in public secondary schools in Nakuru East Sub-County.

1.3 Research Hypothesis

There is no significant relationship between teaching methods and student performance in physics in public secondary schools in Nakuru East Sub-County.

2.0 Literature Review

Studies have shown that teaching methods that encourage learner participation in the learning process lead to improvement of student academic achievement than passive methods. In Uganda, Guloba *et al.,* (2010) found that learner centered methods contributed to better student performance when compared to teacher centered methods. A study by Sajjad, (2010) in Karachi Pakistan on effective teaching methods at higher education further found that teaching methods such as class discussions, demonstrations, peer teaching, and class experiments had high positive correlations to student performance while lecture method, seminars, workshops, conferences, and case study had low correlations.

Teacher's ratings about the interesting and effective teaching methods were sought. The study found that teaching methods such as lecture method, individual presentation, seminars, workshops, conferences, and case study were lowly rated in as far as contribution to student performance in science was concerned.

Figure 1.1 summarizes the average percentage contribution of different teaching methods to student academic achievement

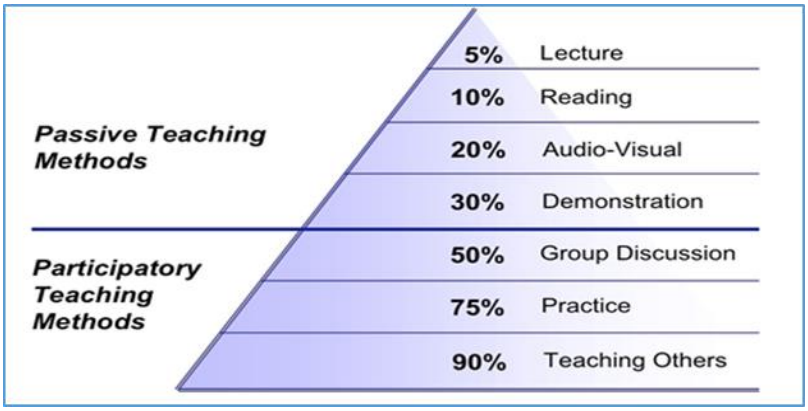

Figure 1.1. Contribution of Different Teaching Methods to Knowledge Retention and Academic Achievement (*Adapted from National Training Laboratories, Bethel, Maine*)

From the figure, participatory methods of teaching have highest impact on student performance when compared to passive methods. Methods such as class discussions, demonstrations, class experiments, peer- teaching and field excursions are found to positively influence student learning and achievement and hence are ranked highly. Heikkilä *et al.*, (2011) opine that teaching can only be result- oriented when students are willing and teachers are well disposed using the appropriate teaching and learning methods.

2.1 Theoretical Framework

The study was based on the theory of pragmatism by John Dewey (1938). The theory emphasizes on 'hands-on' approach to learning where learners learn by doing. According to the theory, learners should be allowed to explore their environments through the use of learner-directed approaches which place emphasis on the needs and interests of the learner. In Dewey's view, students should be allowed to freely pursue their interests and construct their own paths for acquiring and applying knowledge. The teacher should observe the interests of the students and then help them develop problem solving skills. In this case, the teacher serves more as a facilitator than an instructor.

3.1 Research Design

The study adopted correlational design with mixed methods where both quantitative and qualitative data were concurrently analyzed and triangulated. The combination of quantitative and qualitative techniques provides strength and offsets the weakness of a single technique as the two support conclusions made. It also provides various dimensions of the same phenomenon thereby increasing reliability as well as validity of the findings through consistency and convergence.

3.2 Research Instruments

Questionnaire and interview guide were used to collect primary data whereas document analysis guide in the form of a performance blank was used to obtain raw scores in physics from student progressive records. The student questionnaire was adopted from Achievement Motivation Scales (AMS) but the constructs were modified to suit the scope and context of the current study. The teacher's questionnaire, interview guide and document analysis were developed by the researcher.

4. Data Analysis, Results and Discussions

This section presents the results obtained from the research findings. It exposes three study variables, as the most influential factors of the findings.

4.1 Descriptive Analysis

The statements on teaching methods were based on the scale of: Very Often (VO); ranked 1, Often (O); ranked 2, Sometimes (S); ranked 3, Rarely (R) ranked 4, and Never (N); ranked 5. Table 4.1 presents the descriptive analyses.

Table 4.1. Teacher methods used by teachers in physics (n=210)

Teaching Method	VO %	O %	S %	R %	N %	$\bar{X}$	Sk
Our teacher asks questions and gives each student an opportunity to answer	16.2	17.6	8.6	36.7	21.0	3.91	0.42
Our teacher places us in discussion groups based on academic our abilities	13.3	14.8	8.1	58.6	5.2	3.88	1.17
Our teacher reads to us from the text book while teaching in class	23.8	23.8	27.1	14.3	11.0	2.32	-0.36
Our teacher practically demonstrates physics concepts in class	0.5	12.4	69.0	16.2	1.9	3.45	1.62
Our teacher uses simulations to illustrate abstract/complex ideas	2.4	7.1	17.1	54.8	18.6	4.15	1.05
Our teacher organizes class experiments for all of us	1.4	7.6	14.3	76.7	0.0	3.84	2.02
Our teacher lets us make presentations to our peers in class	10.0	15.2	18.6	26.2	30.0	3.82	0.09
Our teacher guides us discover and develop scientific concepts on our own	8.1	15.2	16.7	21.9	38.1	4.39	0.47
Our teacher takes us for field trips/excursions for practical lessons	0.0	0.0	11.9	49.0	39.0	4.27	-0.36

From Table 4.1, 36.7% of teachers rarely pose questions to their students and give each of them an opportunity to answer. The findings indicate that majority of teachers do not consider individual abilities of the learners when forming discussion/study groups (58.6%; mean=3.91).

About half (47.6%) of students reported that the teachers often read to them directly from text books as they hurry to cover during a lesson (mean=2.32). This could be attributed to the hurry to cover the syllabus in time.

The findings further reveal that, 69.0% of teachers sometimes conduct practical demonstrations in class (mean=3.45), but rarely organizes class experiments for all students (76.7%; mean=3.84).

In the same nerve, 38.1% of teachers hardly guide students to discover and develop scientific concepts on our own (mean=3.8238); neither do they take students for field trips/excursions for practical lessons (88%, mean=4.2714). 54.6% of teachers also rarely use simulations to illustrate abstract/complex ideas (mean=4.15).

From the results in the table, it is further evident that about three-quarters of the statements are a negatively skewed signifying high rating of students on the statements, which implies low levels of use of the specific methods by teachers. The findings reveal that teachers mostly apply teaching methods to varied extents in their teaching. However, the minimal use of learner centered strategies is of concern as Adunola (2011) asserts that, when teachers use teaching methods that emphasize learning, establish relevance, and promote student competence; the students become better equipped to self-regulate their learning.

Tebabal and Kahssay, (2011) further stress that, the teaching method used by a teacher should advance the realization of skills required of the 21st century learner which include; critical thinking, collaboration, creativity and communication. This implies that teachers should regularly use teaching methods that emphasize learning, establish relevance, promote student competence, equip learners with self-regulated techniques and enable learners attain better educational outcomes.

Teaching methods were ranked in order of their perceived effectiveness in promoting academic performance in physics. In the ranking list, one (1) represented highest rank while nine (9) represented the lowest rank. Figure 4.1 below summarizes the findings.

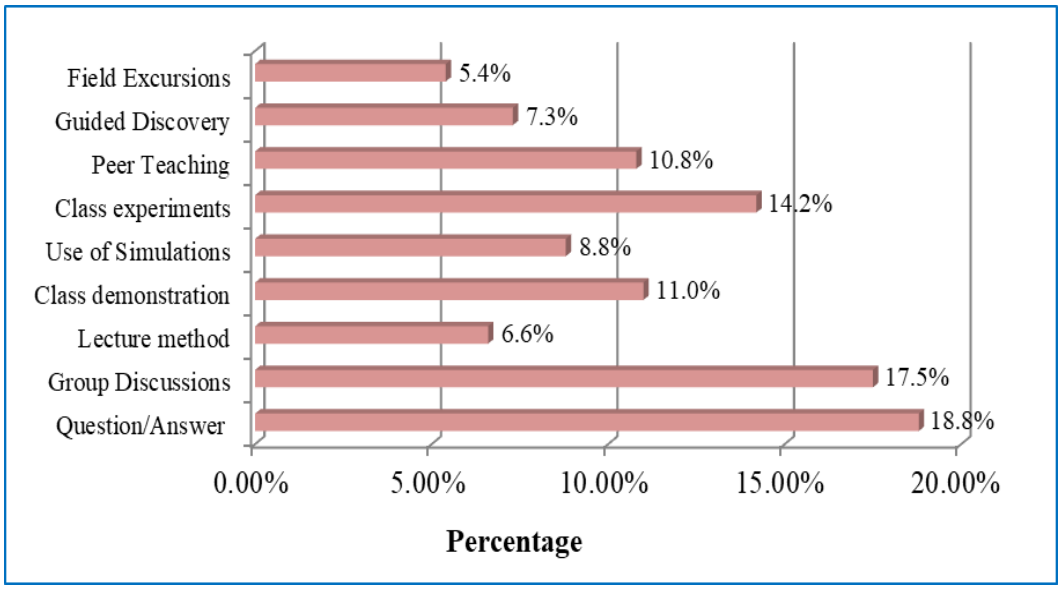

Figure 4.1. Ranking of Teaching Methods in Order of Perceived Effectiveness

From Figure 4.1 question/answer method was ranked highest (18.8%), followed by group discussions(17.5%), class experiments (14.2%), class demonstrations and peer teaching (10.8%) in that order. Methods that were ranked the least were field excursions (5.4%) and lecture method (6.6%). The findings share similarity in trend with those from National Training Laboratories, Bethel, Maine (as captured in Figure 1.1).

Collins and Robert (2004) also observed that teaching methods that encourage learner participation in the learning process lead to high retention of knowledge and improved student academic achievement than those methods that are passive.

4.2. Inferential Analysis

Table 4.2 provides the results of bivariate analysis of the relationships between teaching methods and academic performance in physics.

Table 4.2. Correlation matrix of teaching methods and academic performance

	QA	GD	LM	CD	SM	CE	PT	GD	FE	AP
QA	1									
GD	.001	1								
LM	-.048	.110	1							
CD	.120	.124	-.046	1						
SM	.028	.033	-.098	.360**	1					
CE	.094	.116	-.014	.287**	.169*	1				
PT	.024	.272**	.170*	.091	.078	-.036	1			
GD	.015	.149*	.033	.290**	.297**	.197**	.400**	1		
FE	.187**	.227**	.357**	.065	.062	-.056	.373**	.324**	1	
AP	.011**	.209**	.109**	.131**	.104**	.223**	.158**	.044**	.013**	1
Sig	0.06	0.01	0.05	0.016	0.134	0.00	0.022	0.00	0.01	
** Correlation is significant at the 0.01 level (2-tailed); (P<0.01; N= 210)										

Key: Question/Answer (QA), Class Demonstration (CD), Lecture Method (LM), Group Discussions (GD), Simulations (SM), Class Experiments (CE), Guided Discovery (GD), Field Excursions (FE), Academic Performance (AP)

The results in Table 4.2 reveal weak positive correlations between teaching methods and student performance in physics. Group discursions (χ=0.209, p<0.01) and class experiments (χ=0.223, p<0.01) had better correlation coefficients, followed by peer teaching (χ=0.158, p<0.05), class demonstrations (χ=0.131, p<0.05) and question - answer method (χ=0.11, p>0.05) in that order. Lecture method (χ=0.109, p=0.05), guided discovery (χ=0.044, p<0.01), and field excursions (χ=0.013, p=0.01) were not correlated to academic performance.

The findings reinforce those by Guloba *et al.*, (2010) in Uganda who established that learner centered methods contributed to better student performance when compared to teacher centered methods. A study by Sajjad, (2010) in Karachi Pakistan on effective teaching methods at higher education also found that teaching methods such as class discussions, demonstrations, peer teaching, and class experiments had high positive correlations to student performance while lecture method, seminars, workshops, conferences, and case study had low correlations. Having found positive relationship between teaching methods and academic achievement, the researcher sought to investigate whether significant differences existed in the mean performance of learners based on the teaching methods used. A t-test of independent samples was therefore carried out as outlined in Table 4.3.

Table 4.3. T-test for Independent Samples

		t-test for Equality of Means		
		T- value	**Df**	**Sig. (2-tailed)**
T-Score	Equal variances assumed	15.106	208	.000
	Equal variances not assumed	15.093	174.928	.000

Table 4.3, indicate that at df = 208, t = 15.106 and P<0.01 for equal assumed variances hence it can be concluded that, a significant difference exists in the means performance of students taught using different methods which is less likely to have arisen by chance. The third and final hypothesis of the study which foresaw no significant relationship between teaching methods and student performance in physics was therefore rejected.

4.3 Thematic Analysis

The principals, through an item in the interview schedule, were asked to identify the teaching they would recommend for use in the teaching of physics. From their responses, majority of them recommended the use "*experiments"*, "*simulations"* and "*ICT integration".* Methods such as "*group discussions"*, "*lecture method"* and "*fieldwork"* were also identified but were not highly recommended. Their responses resonated with those from teacher questionnaire on the ranking of methods based on their contribution to knowledge retention and academic achievement. This implies that teachers need to embrace learner centered methods in their teaching as much as possible since they have been found to be effective in promoting student academic achievement. DeLong and Winter (2002), while studying difficulties facing the majority of Greek pupils in understanding science concepts also suggested that approaches to learning must take into account cognitive factors in the learners in the context of information processing and understandings. Similarly, Heikkilä *et al.*, (2011) opine that teaching can only be result- oriented when students are willing and teachers are well disposed using the appropriate teaching and learning methods. If this is done, learning becomes much more effective and student performance will consequently improve.

5.1 Conclusion

The results of this study presented evidence of the existence of the hypothesized relationship between teaching methods and academic performance in physics. The study established positive correlations between teaching methods and academic performance. However, learner centered methods were better correlates of performance than teacher centered methods. This was attributed to the fact that, learner centered methods encouraged active participation of students in the teaching-learning process as opposed to teacher centered methods which are more passive. The more students are involved in the teaching-learning process, the better the understanding of subject matter, and the longer the knowledge will be retained in the long term memory. An investigation into the teaching methods used by teachers showed that most teachers in public secondary schools often used expository methods in their lessons. The persistent use teacher directed approaches to teaching and learning is a source of concern as studies has shown that teacher centered methods are weakly correlated to student performance in physics.

5.2 Recommendations

Teachers use participatory methods of teaching and ensure that learners take control of their own learning and determine their academic achievement. School administration should also by provide teachers with requisite teaching and learning resources to act as reinforcement to their efforts to embrace learner centered approaches in their lessons.

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Conflicts of interest

There is no conflict of interest of any kind.

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