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RELATIONSHIP BETWEEN LEARNING STRATEGIES AND STUDENT PERFORMANCE IN PHYSICS IN PUBLIC SECONDARY SCHOOLS IN NAKURU EAST SUB-COUNTY, KENYA

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Abstract:
Education is a key pillar in the Kenya vision 2030 and is also critical to the attainment of sustainable development goals (SDG's). Dismal academic achievement by students across all levels of education is therefore detrimental to the realization of these noble goals. The study purposed to establish the relationship between learning strategies and student performance in physics. The objective of the study was to establish the relationship between self-directed strategies and student performance in physics in public secondary schools in Nakuru East Sub-County. The study was based on Structuralist Theory of Learning by Steffe and Gale (1995) and Social Cognitive Theory of Self-Regulation by Bandura (1986). The study adopted correlational design with mixed approaches where qualitative and quantitative data were concurrently analyzed and triangulated. Target population comprised principals, physics teachers and physics students. Students' sample was determined using Krejcie and Morgan (1990) at 95% confidence level and a sampling error of 5%. Purposive sampling was used for the principals and physics teachers. Research instruments comprised questionnaire, interview guide and document analysis guide in the form of performance blank. Cronbach alpha reliability coefficient was computed to assess the internal consistency. The test yielded an overall reliability of r=0.85 based on standardized items. Data was analyzed using Statistical Package for Social Sciences (SPSS). The study established positive correlations between self-directed strategies and student performance in physics. The study also revealed statistically significant differences in the mean performance of learners using different self-directed strategies. The study further

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established that self-directed strategies jointly accounted for 77.6% of variance in student performance in physics (R^2 = 0. 776). The study recommended that students effectively apply self-directed strategies in their learning so as to optimize their academic achievement. Teachers and schools administration should also create learning environments that encourage the development of self-regulatory skills among learners.

Keywords: cognitive strategies, metacognitive strategies, resource-regulation strategies, academic performance

1. Introduction

The major goal of education is not only to enrich students with enormous amount of knowledge/facts in a given subject, but also to groom them to acquire self-regulatory skills required to achieve academic success and further their education in different fields (Wolters, 2013). The self-directed strategies of learning include cognitive, metacognitive and resource regulation strategies (Vrugt & Oort, 2008). Cognitive strategies are used for attaining a goal regarding the learning subject and they include recall, rehearsal, elaboration, organization and critical thinking (Kingir & Aydemir, 2012). Metacognitive strategies are the approaches and strategies that students devise to achieve specific learning goals, and they include planning, monitoring, and regulation (Pintrich, 2002). Resource regulation strategies on the other hand are those used by learners to manage and perform necessary changes in their learning environment to fit their goals and needs. They include; effort regulation, time management, restructuring of study environment, help seeking and peer learning. Studies have shown that students who effectively apply self-directed strategies in their learning earn significantly higher exam scores than their less effective counterparts (Sungur, 2011). Vermunt (2015) found significant positive correlations between the mean exam score and deep cognitive strategies of organization, elaboration, and critical thinking but found no correlations between academic achievement and memorizing strategies of recall and rehearsal. Similarly, Sperling, Howard, Staley & DuBois, (2014) found small positive correlations between the academic achievement and the use of metacognitive strategies. Research evidence further showed that, relationships exist between resource regulation and academic achievement. Diseth and Kobbeltvedt (2010) found positive correlations between the examination grades in introductory economics course and strategies of time management and organized studying. A study by Kosnin (2007) comparing the high and low achieving second-year engineering students' Self-Regulated Learning (SRL) indicated that resource regulation strategies such as; time management, adjustment of study environment, effort regulation, peer learning and help seeking are strongly correlated to academic achievement.

1.1 Statement of the Problem

Low academic achievement at any level of education is not only disturbing to the students themselves but to the teachers, parents, and other stakeholders in the education sector in many counties around the world. Over the years, students' performance in physics in Kenya Certificate of Secondary Education (KCSE) in Nakuru East Sub-County has considerably been declining. This trend is unwarranted as many students continue to miss opportunities to build on their careers and take part in national development. Efforts to improve the situation have born no noticeable fruits; given the concern that most of the interventions target the teachers and little was being done to ensure that learners take charge of their own learning. Studies have shown that self-directed learning positively influence academic achievement of learners. However, no such studies have been done in Nakuru East Sub-County. This study therefore sought to establish the relationship between self-directed strategies and student performance in physics in public secondary schools

1.2 Research Objective

The objective of the study to establish the relationship between self-directed strategies and student performance in physics in public secondary schools

1.3 Research Hypothesis

There is no significant relationship between self-directed strategies and student performance in physics in public secondary schools

1.4 Significance of the Study

The study findings may help learners understand that they play a critical role in their academic success; hence, they need to direct their learning processes and effectively apply strategies in their learning. Teachers may also realize the importance of equipping learners with self-regulatory skills through the use of learner-centered approaches of teaching. School administration may also be guided on the need to create school environments that encourage the development of self-regulatory behaviours among learners. Policy makers in education may use the study findings to formulate policy guidelines on how to support learners develop/acquire effective learning skills

2. Literature Review

Researches have shown that self-directed strategies are related to academic (Vermunt, 2015; Zimmerman & Schunk, 2008). Some studies have also evidenced that some self-directed strategies are less related to study success (Phan, 2010) and that the correlation between study success and the aspects considered as favourable for learning are low or even negative; though significant (Cazan, 2012; Richardson *et al*., 2012). Studies have further demonstrated that self-directed learning is intertwined with other favourable aspects of students' learning such as deep approach to learning and optimistic learning

strategy (Heikkilä *et al*., *2011*). Furthermore, studies on diverse student profiles have established that, student groups with profiles consisting of favourable aspects of learning such as deep approach, self-regulation, and optimistic strategies tend to succeed more in their studies. However, there is a common understanding that, to achieve academic success, learners must be able to self-regulate their actions and maintain their academic goals despite difficult academic tasks (Richardson et al., 2012)

2.1 Theoretical Framework

Structuralist Theory of Learning (Steffe and Gale, 1995) views learning as a self-regulated process in which learners improve their ability to learn through selective use strategies. Learners can monitor, control or regulate certain aspects of their own cognition, motivation and behavior, as well as some features of their environment. Social Cognitive Theory of Self-Regulation by Bandura (1986) proclaims that students have goals and during their learning activities, they observe, judge and react to their perceptions of goal processes. According to the theory, self-regulation is a self-directed process through which students transform their mental abilities into academic skills. Based on the two theories, it is evident that, if students effectively use self-directed strategies in their studies, it is expected that their learning outcomes will be enhanced.

3. Research Design

The study adopted correlational design with mixed research methodology where both quantitative and qualitative techniques were concurrently analyzed and triangulated. According to Creswell (2012), the design is appropriate as it allows the researcher to gather information that uses the best features of both quantitative and qualitative data collection and analysis.

3.1 Research Instruments

Questionnaires, interview guide and document analysis guide were used. The questionnaire was adopted from Motivated Strategies for Learning Questionnaire (MSLQ) but the constructs were modified to suit the scope and context of the current study. The questionnaire contained Likert items on the scale of; Very Often (VF), Often (O), Sometime (S), Rarely (R), and Never (N). Interview guide was used for principals while the document analysis was done in student progressive records to obtain student performance in physics.

4. Research Findings

The statements on self-directed strategies were based on 5-point Likert scales where responses were offered on the scale of; Very Often (VO), Often (O), Sometimes (S), Rarely (R), and Never (N). Table 4.1 presents the findings

Table 4.1: Extent of Use of Self-Regulated Strategies by Students in Physics

Strategy	VO %	O %	S %	R %	N %	$\bar{X}$	Skew
When studying physics, I make summarized notes of lesson notes	1.0	6.7	22.9	46.7	22.9	3.84	-0.59
I use symbols to help me remember important concepts/ideas in physics	3.3	12.9	29.0	32.9	21.9	4.12	0.23
I make simple charts to help me organize complex concepts in physics	9.5	18.6	19.5	22.4	30.0	4.24	-0.14
I enjoy studying material that require critical thinking and application	0.5	3.8	14.8	43.3	37.6	4.14	-0.86
I set goals for myself and ensure that I accomplish them	1.0	11.0	20.0	51.9	16.2	3.71	-0.64
In case a topic becomes difficult, I change the approach of studying it	28.1	23.3	23.3	16.2	9.0	2.55	0.36
I monitor my progress by reviewing my past performance in physics	4.3	21.4	43.3	27.1	3.8	3.05	-0.13
I have a personal timetable that guide my studies in physics	5.7	10.5	21.4	50.0	12.4	4.05	1.1
I have a conducive place where I conduct my private studies in physics	0.0	1.9	13.8	59.0	25.2	4.08	-0.46
When a topic become difficult I give up, or only study the easy parts	27.6	27.6	15.7	14.8	14.3	2.90	0.23
I ask the teacher to clarify concepts I don't understand well in physics	0.0	2.4	19.0	47.6	31.0	4.07	-0.44

n=210

The analysis in Table 4.1 shows that students apply self-directed strategies to varied extents in their studies. On the use of cognitive strategies, 80.6% of the students don't enjoy studying physics material that require critical thinking (mean=4.14). Almost a similar percentage (69.6%) also rarely make a summary of their lesson notes (mean=3.84). Still on cognitive strategies, 54.8% of students hardly use symbols to remember important concepts (mean=4.12). Likewise, about half of students (52.4%) hardly use simple charts to help them organize complex concepts in physics (mean=4.24). On the use of metacognitive strategies, 55.2% of students usually change their approach of studying a topic when it gets difficult (mean=2.55). However, 51.8% of them rarely set goals for their learning (mean=3.71). Further still, 43.3% of students sometimes monitor their progress by reviewing their past performance (mean=3.8). Concerning the use of resource regulation strategies, half of students (50%) never prepare personal timetables to guide them in their studies (mean=4.05) while almost a similar percentage (59%) do not have a conducive place where they can conduct their private studies in physics (mean=4.07). Furthermore, 55.2% of students easily give up when a topic became difficult (Mean=2.90). In addition, 47.6% of students rarely ask their teacher to clarify challenging concepts (mean=4.07). On the distribution of the responses, most of the statement registered negative values of sleekness implying that respondents rated them highly while the few with positive skewedness meant low respondent ratings.

From the findings, it is evident that majority of students do not satisfactorily apply self-directed strategies in the learning of physics. This implies that, students are yet to realize that they bear the greatest responsibility of planning, directing and controlling their own learning. Bogdanovic *et al*., (2015) observes that students who possess and apply self-directed strategies demonstrated a wide range of learning skills and tended to be more successful in academics. This implies that, without elaborate learning approaches that are learner-directed, no effective learning can take place.

The study further categorized the students according to the extents to which they applied self-directed strategies in their studies. Figure 4.1 presents the findings.

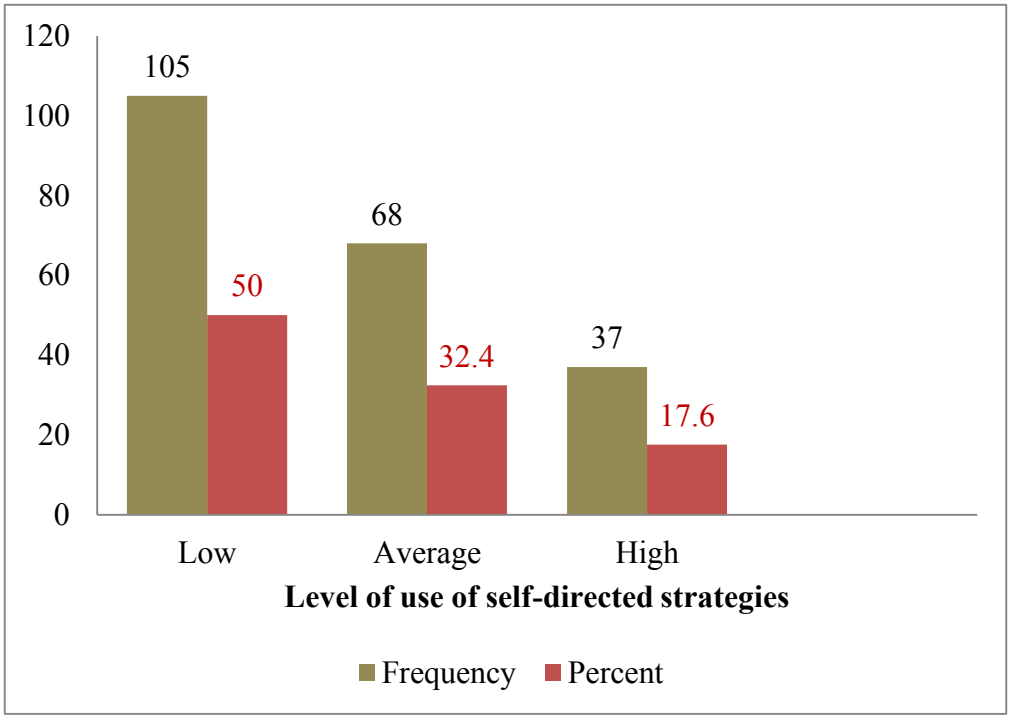

Figure 4.2: Levels of Use of Self-Directed Strategies in Physics

From figure 4.1, half (50%) of the students have low levels of use of self-directed strategies while 32.4% and 17.6% use them to average and high extents respectively. This implies that majority of the students are less self-directed in their learning. The findings are in tandem with evidence from a study by Virtanen and Nevgi (2010) which showed that quite a number students lack self-regulatory skills; and have unrealistic conceptions of their use of learning strategies. A cross-tabulation between the level of use of self-directed strategies and academic performance was conducted to establish whether an association existed between them (Table 4.2)

Table 4.2: Cross-Tabulation between Self-directed Strategies and Academic Performance

		Level of Performance in physics			
		Low	Average	High	**Total**
Level of use of self-directed strategies	Low	38.6%	11.4%	0	**50**
	Average	2.4%	29.5%	0.5%	**32.4**
	High	0%	5.2%	12.4%	**17.6**
Total		**41.0**	**46.1**	**12.9**	**100%**

The results in Table 4.2 show that students with high levels of use of self-directed strategies performed comparatively better than students with average and low levels respectively. The finding are consistent with Vrugt and Oort (2008) who observed that effective self-regulated students often performed better than their less effective counterparts. This implies that, for students to perform well in physics, they must be able to take control of their learning by developing and effectively applying self-directed strategies in their learning processes. Linear relationships between self-regulated strategies and student performance in physics were determined by carrying out bivariate correlation analysis to obtain a correlation matrix as indicated by Table 4.3

Table 4.3: Correlation Matrix of Self-Directed Strategies and Academic Performance

	CSL	**CSL**	**CSL**	**CSL**	**MCS**	**MCS**	**MCS**	**RRS**	**RRS**	**RRS**	**RRS**	**AP**
CSL	1											
CSL	.473**	1										
CSL	.118	.217**	1									
CLS	.660**	.338**	.181**	1								
MCS	.596**	.468**	.118	.535**	1							
MCS	.185**	.187**	.190**	.163*	.131	1						
MCS	.519**	.391**	.136*	.390**	.448**	.129	1					
RRS	-.029	.102	.169*	.057	.020	-.159*	-.002	1				
RRS	.853**	.407**	.138*	.594**	.544**	.110	.494**	-.004	1			
RRS	-476**	-342**	-.101	-336**	-347**	-.025	-334**	-.017	-449**	1		
RRS	.437**	.332**	.219**	.400**	.465**	.090	.347**	.066	.464**	-.364**	1	
AP	.789**	.556**	.192**	.664**	.675**	.172**	.622**	.008**	.756**	.518**	.533**	1
Sig	0.00	0.00	0.01	0.00	0.00	0.013	0.00	0.912	0.00	0.00	0.00	

** Correlation is significant at the 0.01 level (2-tailed); (P<0.01; N= 210)

Key: CSL-Cognitive Strategies, MCS- Metacognitive Strategies, RRS-Resource Regulation Strategies, AP-Academic Performance

Table 4.3 shows that self-directed learning is positively correlated to academic performance in physics. Cognitive strategies of making summary notes (organization) was highly correlated (r=0.789, p<0.01) followed by the critical thinking (*r* =0.664, p<0.01). The cognitive strategy of using symbols to remember important concepts (elaboration) was moderately correlated (*r*=0.556, p<0.01) while the strategy of using simple charts to present complex concepts was weakly correlated to academic performance (*r*=0.192), p=0.05). Metacognitive strategies of goal setting (*r*=0.675, p<0.01) and monitoring progress by reviewing past performance (*r*=0.622, p<0.01) were strongly and positively correlated to academic performance. However, the strategy of changing

study approach when a concept gets difficult was very weakly correlated to performance (r=0.172, p>0.01). Resource management strategies were also positively correlated to academic performance. Having a conducive place for private studies was strongly and positively correlated to academic performance (r=0.756, p<0.01). The strategy of persistence during difficulty and help seeking were moderately correlated to academic performance at (r = 0.518, p<0.01) and (r = 0.533, p<0.01) respectively. Having personal study timetable was however not correlated to academic performance (r=0.008, p>0.05).

The findings of this study concur with Richardson *et al*., (2012) who found that cognitive strategies of critical thinking and elaboration were moderately and positively correlated with academic achievement. The findings also support Sperling *et al*., (2004) who found positive relationships between the academic achievement and the use of metacognitive strategies but contradict Cazan (2012) who identified weak correlations between performance and cognitive and metacognitive strategies. A study by Kosnin (2007) further indicated that resource management strategies such as; managing time and study environment, regulating effort, peer learning and help seeking are strongly correlated to academic achievement. Diseth and Kobbeltvedt (2010) also found evidence of positive correlations between the examination grades strategies such as time management and organized studying. This implies that student academic performance is pegged on all the three sub-domains of self-directed strategies; and although their influence on achievement is varied, students need to use them complimentarily so as to optimize their academic achievement.

One-way ANOVA was further conducted to determine whether significant differences existed in the mean academic performance of students with different levels of use of self-directed strategies. Table 4.4 presents the results obtained

Table 4.4: One Way ANOVA Analysis of Self-Directed Strategies and Performance

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	81.051	2	40.525	215.484	.000
Within Groups	38.930	207	.188		
Total	119.981	209			

n=210

Table 4.4 reveal that significant difference existed in the mean academic performance of learners with different levels of self-directed strategies (F = 215.484, p < 0.05). This formed the basis for the rejection of study hypothesis. The study further sought to determine the overall predictive ability of self-directed strategies on student performance in physics (results presented in Table 4.5)

Table 4.5: Regression Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.888[a]	.788	.776	6.27515

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28788.954	10	2878.895	71.959	.000[b]
	Residual	7961.469	199	40.007		
	Total	36750.424	209			

a. Dependent Variable: Academic Performance in Physics
b. Predictors: (Constant): Self-Directed Strategies

The regression model shows an overall adjusted R^2 (coefficient of determination) of 0.776 (F= 71.959, $p < 0.01$), implying that 77.6% of the total variance in students' academic performance in physics can be accounted by the use of self-directed strategies. This means that self-directed strategies have high predictive capabilities (weights) on student academic achievement.

Through the interviews, 57.1% principals indicated that learners did not possess the necessary self-regulatory skills required of them to perform well in physics. This is consistent with the earlier findings from descriptive statistics which showed that 50% of students had low levels of self -regulation in physics. When asked for their opinions on the reasons why students fail to direct their learning, the following responses were given: "*they lack self-drive because they have to be pushed to learn*", "*they face challenges sorting out simple problems in physics*" and "*Because of negative influence from their peers*". This implies that students generally do not effectively use self-directed strategies in their learning and this makes it difficult for them to take control their learning processes. Sungur, (2011) asserts that effective self- directed learners earn significantly higher exam scores than their less effective counterparts. Mikkonen and Ruo-honiemi's (2011) also revealed that the most successful students had good resource management skills and habits. Therefore, students must regulate their cognition, control their behavior and manage their learning resources in order to improve their academic achievement

5. Conclusion

The studies found that, majority of students have low levels of use of self-directed strategies in the learning of physics. This implies that implying that they cannot take control of their own learning processes. This was partially attributed to the lack of self-drive and negative influence from peers. Research findings have also shown that self-directed strategies have positive influence on academic achievement; hence students who effectively use them in their learning perform comparatively better than those who rarely use them. Students therefore need to understand their cognitive abilities, and apply the relevant metacognitive strategies to control, regulate and monitor their pace

of learning. They also must also manipulate their learning resources to maximize their learning outcomes.

6. Recommendations

Students need to take charge of their own learning processes and regulate the use of learning strategies so as to optimize their academic achievement. Teachers should also adopt the use of heuristic methods of teaching to ensure that learners are involved in devising learning activities and determining learning pace and outcomes. Curriculum developers should also devise the content in a way that it promotes independent learning through eyes-on, hands-on approaches of teaching and learning. School administrations also need to organize for sessions where students are sensitized on ways of developing good study skills by applying the self-directed strategies boost their academic performance

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