

School Climate Characteristics and Students' Academic Achievements in Physics in STEM Model Public Secondary schools in Nairobi Metropolitan Kenya

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Abstract: The objective of the study was to examine the influence of school climate characteristics on student's academic achievements in physics in Science Technology Engineering and Mathematics (STEM) model schools in Nairobi Metropolitan region, Kenya. The study used convergent parallel mixed method design. The target population comprised 11 principals, 60 teachers and 1120 students with a sample size of 368. Proportionate stratified sampling and simple random sampling was used to select students while purposive sampling was used to select teachers of physics and principals. Questionnaires, document analysis guide and interview guide were used to collect data. Descriptive statistics (frequencies and percentages) were used to analyze quantitative data. Thematic and content analysis were used for qualitative data analysis. The study found that school climate characteristics influence student's academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya. Having a positive student-school staff and management relationship motivates students to do better in physics. Also, friendly student-student relationships allow them to help each other in understanding physics concepts. The study recommended that principals should advocate for healthy relationships between the principals and teachers, teachers and students and students and students. The school management through the principals should ensure that enough science and computer laboratories are constructed and equipped with the required teaching and learning material such as overhead projectors, robotics kits, audiovisual materials, cathode ray oscilloscopes and digital cameras.

Key words: School climate, adequacy of learning and teaching materials, STEM programme, School climate characteristics, student's academic achievements and STEM model schools

I. Introduction

Science, Technology, Engineering and Mathematics (STEM) education is a curriculum based on the idea of educating students in four specific disciplines namely science, technology, engineering and mathematics (STEM) — in an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications (Homan, 2014, Rinke, Kinlaw, Gladstone-Brown, & Cappiello, 2016). STEM education is a very broad term (Baran, Bilici, Mesutoglu, & Ocak, 2016; Bybee, 2013; Hsu, Lin, & Yang, 2017). This means definitions and STEM parameters may vary from school to school and depends on the country where it is being applied.

STEM Education was an initiative created by the National Science Foundation (NSF) and was originally called Science, Mathematics, Engineering and Technology (SMET), (White, 2014). This educational initiative was to provide all students with critical thinking skills that would make them creative problem solvers and ultimately more marketable in the workforce. Consequently, many countries have infused STEM in the education curriculum in attempt to prepare learners with these 21st century skills. STEM education was first assimilated by United States mainly to resolve various issues in the workforce as there was a noticeable decline in the number of students joining the various STEM disciplines and specific careers as well as decline in academic performance (NRC, 2011). Many other countries incorporated STEM model schools with an aim of responding to similar challenges experienced by USA in performance of STEM related subjects.

STEM Education in whichever form has been around for decades. The four strands of STEM have been staple forms of all students' academic careers; particularly science and mathematics. Science and Mathematics are at the forefront of education mainly because these are the most recognizable fields that most people can relate to in terms of academia. The model of inclusive STEM secondary schools has largely been adopted by developed countries, and the same has been adopted by developing countries seeking to integrate STEM education in secondary education, albeit with some modification to cope with resources constraints in developing nations. As a result, some countries in Asia, largely led by Malaysia and Indonesia have implemented the adopted model STEM secondary schools programme (Barakabitzte, *et al.*, 2019).

The popularity of integrated STEM model schools across the world has been occasioned by the reason that it is an effective venture as it is collaborative and allows for representation of students from different backgrounds. Although STEM model schools have gained popularity in developed economies this may not be true in Africa where Kenya is considered the first country to apply model school concept. South Africa has adopted similar model to a great extent (Hamedani, *et al.*, 2015). However, various countries in Africa have also attempted to integrate STEM model schools albeit informally. For instance, Ghana's and Nigeria Ministry of education have emphasized education policy shift to STEM literacy in secondary schools. This shift has

encouraged non-state actors and private sector to increasingly play a role in promoting STEM education informally in some of the secondary schools (Greenway, 2017).

The STEM model school climate is one with a culture that inspires learners to excel in science and mathematics through programmes, policies, and processes within and outside classrooms. School climate is closely associated with positive teacher-student relationship, collaborative and cooperative learning, shared vision, team work, high self-concept among other things (CEMASTE, 2017). The Committee for Children (2012) defines STEM climate as the 'prevailing mood, attitudes, standards, and tone that students and teachers feel when they are in STEM classroom'. The current study will explore the influence of school climate on student's academic achievement in physics regarding how motivating teachers, management and parents are, the culture inculcated by the school, policies that are inviting and helps learners to love STEM subjects, the activities inside and outside classroom that interest learners to learn STEM subjects and the adequacy of infrastructure.

Statement of Problem

School climate is one of the critical elements which contribute to holistic success of any school. A climate of a school involves collaboration between human, physical and material resources. Adeogun and Olisaemeka (2011) defines school climate as an aggregate measure of school characteristics, such as relationships between parents, teachers, administrators as well as physical facilities on the ground. A sustainable, positive school climate fosters youth development and learning necessary for a productive, contributing and satisfying life in a democratic society. This climate includes norms, values and expectations that support people feeling socially, emotionally and physically safe. People are engaged and respected. Students, families and educators work together to develop, live and contribute to a shared school vision (Huebner, & Patton, 2010).

Despite the importance of school climate in enhancing the students' academic performance, studies show that performance of STEM related subjects particularly physics at secondary level in Kenya has been dropping significantly raising an alarm to society. A baseline survey by the Kenya National Examinations Council (2019) witnessed candidates' alarming failures in science and mathematics in the year 2017. There were very low pass rates recorded in physics, biology and mathematics. Mathematics scored a mean of 32.03 percent, Physics 34.35 percent, Biology 33.5 percent and Chemistry 36.21 percent as compared to languages such as English (57.92 percent), Kiswahili (52.73 percent) and French (63.02 percent). In addition, there is limited literature on influence of school climate characteristics on student's academic achievements in physics in STEM model schools. This study sought to bridge this gap by establishing the influence of school climate characteristics on student's academic achievements in physics in STEM Model Schools in Nairobi Metropolitan region, Kenya.

Objective of the Study

The objective of the study was to examine the influence of school climate characteristics on student's academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya

II. Literature Review

School climate is closely associated with positive teacher-student relationship, collaborative and cooperative learning, shared vision, team work, high self-concept among other things. A school where care, respect trust and optimism are the norm is said to be inviting (CEMASTE, 2017). A survey by Greenway (2017) was done to determine a correlation between school climate and student achievement in middle schools in the state of Georgia in USA. Findings indicated statistically significant, positive relationship between school climate and student learning achievement in middle schools in this region. Mitchell, Bradshaw and Leaf (2010) viewed student-teacher relationships as one of the school levels factors that influenced school climate. Hattie and Gan (2011) observe that the learning environment supports motivation when learning and mastery goals are emphasized, rather than grades or performance goals, and when teachers provide support, recognize effort and improvement, treat mistakes as learning opportunities, give students opportunities to revise their work, emphasize learning when evaluating, minimize individual competition and comparison, and group students by topic, interest, or choice. Students need a sense of physical and social-psychological environment safe for learning to occur, since apprehension and anxiety undermine cognitive capacity and blinds the learning process. However, there was a methodological gap in Greenway's (2017) study which was quantitative. The current study will use both qualitative and quantitative evaluation design.

An academically excellent and high-performance school is one in which the teachers set high expectations that can reasonably be attained by the students, in a learning environment where the teachers faithfully believe in the students' ability to achieve academic success (Noor, 2020). Jenkins (2014) posited that creating a positive school climate is intricate because it involves keeping teachers, parents and management happy and keeping students both happy and challenged. Huebner and Patton (2010) posit that many researchers suggested that variables associated with school climate such as social support, caring classroom, teacher commitment, and student-teacher relations not be only desirable but prerequisites for positive behavioral change. Making the school environment inviting and conducive for learners is not a one's man activity. Warm, caring, supportive student-teacher relationships, as well as other child-adult relationships, are linked to better school performance and engagement, greater emotional regulation, social competence, and willingness to take on challenges (Osher et al., 2018). Teachers as the facilitators have a great role in improving the STEM climate to be welcoming, be it in classroom or outside classroom. Students should be

sensitized in promoting and nurturing positive peer relationship and friendly instructions which in turn create a conducive atmosphere that may cultivate interest in learning physics which in turn may impact on learning outcome positively.

In their review of the school climate study on Social emotional learning in high school in Stanford California, Skiba et al. (2014), found a significant association between school-level climate variables, especially principals' perspectives on discipline and racial disparities in out-of-school suspension and expulsion. Explicit teaching of interpersonal skills, conflict resolution, and problem solving creates a virtuous circle of responsible behaviour (Hamedani, Zheng, Darling-Hammond, Andree, & Quinn, 2015). Studies have found that even in elementary school, students who learn and practice conflict resolution skills become more inclined to work out problems among themselves before the problems escalate which is synonymous to STEM model school climate. When students experience the love of the teachers, teaching emphasis on values, norms, and shared approaches and practices they feel confident and would want to do their best to perform better in those subjects where teachers are welcoming. However, this study did not point on the relationship between school climate and students performance. As such the current study will include school climate as a moderating variable in the relationship between effectiveness of integrated STEM activities and student's academic achievements.

A learning environment where students feel they belong and teachers engage in practices that help them know their students well so that they can respond to student's specific needs, interests, readiness for learning, and opportunities for growth can produce positive learning outcomes. This study was quantitative biased which might have suffered the in-depth understanding of exactly in which aspect of school climate would contribute to learning outcome (Huebner, & Patton, 2010). Thus, the current study will assess whether STEM school climate has positive influence on students' academic achievement. The concept of academic achievement is an intricate aspect. Lehmann *et al* (2018) posits that identifying the factors that influence academic performance is an essential part of educational research. Mokaya (2013), carried out a study on the influence of school infrastructure on students' achievement in public secondary schools in Kajiado county Kenya. The study applied survey with teachers and students as the target population. The participants were from four students. Study reported that improved academic achievement is associated with adequate infrastructure. The infrastructure should not only be adequate but also well maintained, relevant and serving the purpose. However, the study applied survey approach of which it lacks qualitative aspect which might have given further information concerning infrastructure and student's achievement. The current study will fill this gap by employing both qualitative and quantitative design.

School facilities have a significant and positive relationship with learner achievement as reflected in positive and significant coefficients for all the subjects assessed in this study. For example, students in schools with more school infrastructure and facilities scored 0.7 points higher in Physics, than their counterparts in schools that with less. The Ministry of Education working in hand with CEMASTEAM should do regular monitoring to ascertain that the learning resource and facilities provided are sufficient and are used appropriately. As much as this study was on relationship between school environment and students' academic achievement, it did not address the school climate as moderating variable in the relationship between integrated STEM program and student's academic achievement hence the current study will fill this gap.

A School climate is closely associated with positive teacher-student relationship, collaborative and cooperative learning, shared vision, team work, high self-concept among other things (CEMASTEAM, 2017). The success of a school initiative depends on the learning resources allocated and the quality of education provided. A baseline study was carried by (CEMASTEAM, 2017) on how availability of infrastructure as part of school climate affects enrolment on STEM subjects and performance. The results revealed a worrisome trend and the need to improve the STEM related facilities in the four aspects: adequacy, cleanliness, arrangement and maintenance. Further most schools were somewhat inviting. Although these schools had basic equipment to teach sciences effectively, negligence and poor storage negatively impacted on the STEM climate. Many of the schools that had a positive and inviting climate students tended to perform better and the enrolment of those taking STEM related courses was high.

Although there was a gradual growth in performance except in Biology in 2009, many STEM schools' performance in mathematics and science is either low or average. Further the results showed that most STEM schools laboratories are forlorn places with little semblance of 21st century learning environment. For STEM program to produce effective results, the government and non-state actors have to invest heavily on infrastructure which must be well maintained by the schools. This calls for an evaluation to ascertain whether any relationship exist between School climate versus student's academic achievement. Schools showing academic improvement are more likely to have strong organizational managers (Horng & Loeb, 2010). The school managers should support the teachers in stipulating policies that does not discriminate on students who select STEM related subjects and has teachers who are happy and friendly to students. This is likely to have positive learner outcome. In as much as these studies highlight the school climate factors that affect the implementation of STEM programmes in Kenya, they fail to test how they influence students' academic achievements in physics. The current evaluation will fill this gap.

Conceptual Framework

The conceptual framework in Figure 1, depicts the relationship between the independent variable (school climate) and the dependent variable (student's academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya).

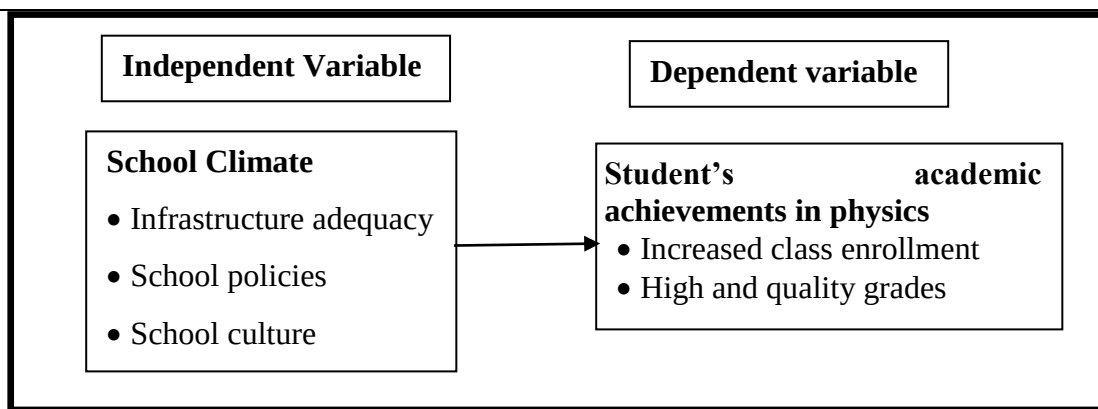


Figure 1: Conceptual Framework

III. Research Methodology

This study employed a convergent parallel mixed-methods design. This is an approach to inquiry that combines both qualitative and quantitative methods concurrently, prioritizing both methods almost equally (Creswell & Clark, 2017, and Creswell, 2014). In this case, the quantitative and qualitative methods complement each other, and provide for the triangulation of findings, hence greater validity of the emerging inferences. Whereas the quantitative approach gave more general understanding of integrated STEM program, the qualitative provided a detailed and in-depth understanding of the phenomena at hand.

The target population consisted of 11 Principals, 110 teachers of physics and who had undergone training on integrated STEM programme and 1100 Form four Physics students. The reason for using form four is that they have been taught by STEM trained teachers for a longer period. The study used both probability and non-probability sampling techniques to draw the sample. Stratified and purposive sampling techniques were used to sample 297 students, 60 teachers and 11 principals respectively from the selected schools.

To collect data, questionnaires, Document Analysis Guide (DAG) and interview guide were used. Before conducting the actual study in the sampled STEM model schools, the evaluators obtained a letter of clearance from the department of Post Graduate Studies in Education, at the Catholic University of Eastern Africa. Permits to collect data were obtained from the National Council for Science Technology and Innovation (NACOSTI) and Regional Director of Education, Nairobi office. The collected data were analyzed using descriptive statistics mainly; counts, percentages, frequencies and mean. Following Creswell (2012) and Khan (2014), qualitative data analysis involved data logging (data documentation) which is the next level after data collection, anecdotes (streamlining data log), vignette (narrative or story investigation on the interpretation of the person knowledge or circumstances that the researcher describes), data coding and then tagging the data related according to specific themes.

IV. Findings and Discussions

The section deals with the presentation, interpretation and discussion of the findings on the objective of the study. To begin with, the data was collected through questionnaire from teachers and students while interview guide solicited data from the principals.

Descriptive Statistics

“The study also sought to examine the influence of school climate characteristics in STEM model schools in Nairobi Metropolitan region, Kenya as per research question three. Effective teaching and learning can be achieved through a friendly and a conducive school climate which results to higher students’ academic achievements. Students were asked to indicate their agreement or disagreement with various statements regarding the way their school reflects the various practices using 1-5 Likert scale where 1 is strongly disagree (SD), 2 is disagree (D) (4), 3 is average (AV), 4 is agree (A) and 5 is strongly agree (SA). This implies that a means less than 1.5 denotes strongly disagree, mean scores between 1.5 and 2.5 denotes disagree, mean scores between 2.5 and 3.5 denotes moderately agree, mean scores between 3.5 and 4.5 denotes agree while mean scores greater than 4.5 denotes strongly agree. The findings are shown in Table 1”.

Table 1 Students Response on Statements on School Climate Characteristics

	SD	D	Av	A	SA	Mean	Std.
	f (%)	f (%)	f (%)	f (%)	f (%)		
The school management and teachers respect and listens to physics students’ views	25 (11.5)	43 (19.7)	97 (44.5)	32 (14.7)	21 (9.6)	2.91	1.09

Performance of Physics has improved because Students are friendly and collaborate with others to understand physics concepts	38 (17.4)	24 (11)	63 (28.9)	55 (25.2)	38 (17.4)	3.14	1.32
The school climate is conducive and I feel comfortable when learning physics	46 (21.1)	20 (9.2)	87 (39.9)	27 (12.4)	38 (17.4)	2.96	1.33
The school facilities are sufficient, accessible to all students, well maintained and are up to state standards facilitating us learning physics	29 (13.3)	34 (15.6)	50 (22.9)	54 (24.8)	51 (23.4)	3.29	1.34
The technical supports are provided if physics teachers are faced with difficulties	27 (12.4)	15 (6.9)	59 (27.1)	53 (24.3)	64 (29.4)	3.51	1.31
There is computer lab in my school in which I can use to research physics learning contents and to watch physics educational videos and this has greatly improved my performance in physics	65 (29.8)	39 (17.9)	55 (25.2)	37 (17)	22 (10.1)	2.60	1.34
Physics learning materials are gender friendly	31 (14.2)	13 (6)	75 (34.4)	43 (19.7)	56 (25.7)	3.37	1.31
My school has well stated policy that motivates students in subject selection	34 (15.6)	38 (17.4)	78 (35.8)	37 (17)	31 (14.2)	2.97	1.24

Source: Evaluators 2021

From the findings in Table 1, majority 44.5% of the students were neutral that the school management and teachers respect and listens to physics students' views and 28.9% of the students were neutral that performance of physics has improved because students are friendly and collaborate with others to understand physics concepts. The standard deviations for the statements were 1.09 and 1.32 respectively and this implies that the data clustered around their means. Moreover, the mean for the statements were 2.91 and 3.14 respectively. This implies that there were mixed results on whether school management and teachers respect and listens to physics students' views and whether collaboration between students help learner to love physics and help in improving performance in physics. CEMASTEIA (2017) argues that school climate is closely associated with positive teacher-student relationship, collaborative and cooperative learning, shared vision, team work, high self-concept among other things.

Moreover, most 39.9% of the students were not sure that the school climate is conducive and they feel comfortable when learning physics. The standard deviation for the statements 1.33 and this implies that the data clustered around its means. Moreover, the mean for the statement was 2.96 and this implies that most students were not sure whether school climate is conducive hence making them comfortable when learning physics. Gangi and Condon (2012) posits that School climate is intimately linked with positive teacher-student relationship, collaborative and cooperative learning, shared vision and mission, team work, high self-concept among other things.

Additionally, majority 48.2% of the students agreed that the school facilities are sufficient, accessible to all students, well maintained and are up to state standards facilitating us learning physics and this has helped us greatly improve our performance. 53.7% of the students agreed that the technical supports are provided if physics teachers are faced with difficulties. The standard deviations for the statements were 1.34 and 1.31 respectively and this implies that the data clustered around their means. Moreover, the mean for the statements were 3.29 and 3.51 respectively. This implies that in most targeted schools, facilities are sufficient, accessible to all students, well maintained and are up to state standards facilitating us learning physics and technical supports are provided if physics teachers are faced with difficulties. The findings are consistent with Hattie and Gan (2011) who

observes that “the learning environment supports motivation when learning and mastery goals are emphasized, rather than grades or performance goals, and when teachers provide support, recognize effort and improvement, treat mistakes as learning opportunities, give students opportunities to revise their work, emphasize learning when evaluating, minimize individual competition and comparison, and group students by topic, interest, or choice”.

On contrary, 47.7% of the students disagreed that there is computer lab in their school in which they can use to research physics learning contents and to watch physics educational videos and this has greatly affected my performance in physics. This implies that in nearly half of the schools, there are limited computer labs in which they can use to research physics learning contents and to watch physics educational videos in order to improve students’ performance in physics. These findings are in line with Barakabitze et al (2019) who underscored the importance of school characteristics, more so ICT infrastructure and school facilities as key in implementing STEM education programs in Africa through ICT effectively. The lack of very key learning resources might affect academic performance as observed by Usaini and Bakar (2015) who points that adequate facility, adequate teachers and favorable environment influence students’ academic performance.

Finally, most 45.4% of the students agreed that physics learning materials are gender friendly and 35.8% of the students were undecided that their school has well stated policy that motivates students in subject selection. The standard deviations for the statements were 1.31 and 1.24 respectively and this implies that the data clustered around their means. Moreover, the mean for the statements were 3.37 and 2.97 respectively. This meant that in most targeted schools, physics learning materials are gender friendly and few schools have well stated policy that motivates students in subject selection. Sikolia, Toili, Owiti and Sikolia (2015) notes that “creating an environment in which students feel they have all what it takes to learn and are given the opportunity for agency and contribution can transform social, emotional, and academic behavior and outcomes. Mokaya (2013) posits that improved academic achievement is associated with adequate infrastructure”.

Further, teachers “were asked to indicate their agreement or disagreement with various statements regarding the way their school reflects the various practices using 1-5 likert scale where 1 is strongly disagree (SD), 2 is disagree (D) (4), 3 is average (AV), 4 is agree (A) and 5 is strongly agree (SA). This implies that a means less than 1.5 denotes strongly disagree, mean scores between 1.5 and 2.5 denotes disagree, mean scores between 2.5 and 3.5 denotes moderately agree, mean scores between 3.5 and 4.5 denotes agree while mean scores greater than 4.5 denotes strongly agree. The findings are shown in Table 2”.

Table 2 Teachers Responses on School Climate Characteristics

	SD	D	Av	A	SA	Mean	Std
	f (%)	f (%)	f (%)	f (%)	f (%)		
The school staff and management is caring and respects the students which motivates students and performance of physics has improved	0 (0)	0 (0)	5 (12.8)	28 (71.8)	6 (15.4)	4.03	0.54
Physics performance has improved because Students are friendly and help each other in understanding physics concepts	0 (0)	0 (0)	11 (28.2)	19 (48.7)	9 (23.1)	3.95	0.72
Physics facilities are well maintained and are up to state standards	0 (0)	0 (0)	23 (59)	7 (17.9)	9 (23.1)	3.64	0.84
“The technical supports are provided if physics teachers are faced with difficulties”	0 (0)	0 (0)	26 (66.7)	10 (25.6)	3 (7.7)	3.41	0.64
There is computer lab in my school in which I can use to research physics learning contents and to watch physics educational videos which motivates students to perform better in exams	0 (0)	2 (5.1)	12 (30.8)	16 (41)	9 (23.1)	3.82	0.85
The school has well stated policy that guides students in subject selection	0 (0)	0 (0)	22 (56.4)	8 (20.5)	9 (23.1)	3.67	0.84

Source: Evaluators 2021

From the findings, most 71.8% of the teachers agreed that the school staff and management is caring and respects the students which motivate students and performance of physics has improved. The standard deviation for the statement was 0.54 and this shows that the data was clustered around its mean. Further, the mean score for the statement was 4.03. This implies that the care and respect for students motivates them and also enhances their performance of physics. Gonzale (2015) notes that a learning

environment “where students feel they belong and teachers engage in practices that help them know their students well so that they can respond to student’s specific needs, interests, readiness for learning, and opportunities for growth can produce positive learning outcome”.

Further most 71.8% of the teachers agreed that physics performance has improved because Students are friendly and help each other in understanding physics concepts. This finding was supported by a mean of 3.95. The standard deviation for the statement was 0.72 and this shows that the data was clustered around its mean. This meant that having a friendly relationship among the students help them in understanding physics concepts through discussions and this in turn improves their physics performance. KNEC (2020) notes that school facilities have a significant and positive relationship with learner achievement.

Moreover, most 59% of the teachers were undecided that physics facilities are well maintained and are up to state standards and 66.7% of the teachers were undecided that the technical supports are provided if physics teachers are faced with difficulties. The standard deviations for the statements were 0.84 and 0.64 respectively and this shows that the data was clustered around their mean scores. Further, the means were 3.64 and 3.41 respectively. This implies that almost half of the targeted schools have well maintained and are up to state standards physics facilities and there is provision of technical supports if physics teachers are faced with difficulties. These findings are in line with Barakabitze et al (2019) who underscored the importance of school characteristics, more so ICT infrastructure and school facilities as key in implementing STEM education programmes in Africa through ICT effectively

Majority 64.1% of the teachers agreed that there is computer lab in their school in which they can use to research physics learning contents and to watch physics educational videos which motivates students to perform better in exams. The standard deviation for the statement was 0.85 and this shows that the data was clustered around its mean. Moreover, the mean for the statement was 3.82. This meant that in most schools, there are computer labs for researching on physics learning contents and where physics educational videos are provided. This motivates students to perform better in exams. Patton (2010) posits that “many researchers suggested that variables associated with school climate such as social support, caring classroom, teacher commitment, and student-teacher relations not be only desirable but prerequisites for positive behavioral change”. Making the school environment inviting and conducive for learners is not a one’s man activity.

Finally, most 56.4% of the teachers were neutral that the school has well stated policy that guides students in subject selection. The standard deviation for the statement was 0.84 and this shows that the data was clustered around its mean. In addition, the mean for the statement was 3.67. This implies that in almost half of the targeted schools has a well stated policy to guide students in selecting students. Osher, *et al.*, (2018) note that, teachers as the facilitators have a great role in improving the STEM climate to be welcoming be it in classroom or outside classroom.

From the principal interviews on availability of learning adequacy and maintenance of teaching learning facilities, majority of the principals said that many of the learning resources were adequate and up to standard. Some STEM learning equipment was supplied by the ministry of education. The school takes initiative to add more equipment. With the adequacy of leaning resources, students are comfortable when learning; they are motivated to do hands –on-learning as they don’t scramble for the apparatus. This motivation has improved greatly their academic performance.

Further, P8 said,

The equipment’s are gender friendly; they are adequate and my students use them frequently with the guidance of teachers and technicians. Whenever they have a free lesson, teachers give them a project they organize with the laboratory technician and they go to the laboratory to try out the experiments. This lone has boosted their understanding of physics and definitely I have seen a great positive change in terms of attitude, enrollment and academic performance (10th August, 2021)

Moreover, from the principals’ interviews on how the students–teachers and students-management relationship affected academic performance, most of the principals responded that in their school, the relationship between students, teachers and school management was good and that teachers related very well with students. In support of this, one of the principals, P4 said,

My school has a culture in which teachers create a good rapport with the students, guiding them on subject selection and I haven’t experienced any problem with the students having negative attitude. They perform quite well with only few posting low grades either because of other factors like intelligent quotient and home related factors. (7th August, 2021).

From the interviews, the study found that in most targeted schools, there is good relationship between students, teachers and school management. This has given the teachers favorable environment to teach and the students to learn. The study also found that students and teachers relationships are significantly enhanced by a conducive school climate and this improves students’ performance in physics. This concurs with Clifford, Menon, Gangi and Condon (2012) who noted that school climate is intimately linked with positive teacher-student relationship, collaborative and cooperative learning, shared vision and mission, team work, high self-concept among other things.

Correlation analysis

“The study conducted correlation analysis to establish the influence of” school climate on student’s academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya. The findings are shown in Table 3.

Table 3 Correlations Results

		School climate	Students’ achievements
School climate	Pearson Correlation	1	.707**
	Sig. (2-tailed)		.002
Students’ achievements	Pearson Correlation	.707**	1
	Sig. (2-tailed)	.002	

Source: Evaluators 2021

The study sought to test the hypothesis that “there is no significant influence of school climate on student’s academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya. As per the results in Table 3, the $r=0.707$ and $p\text{-value}=0.002$. Since the $p\text{-value}$ was less than 0.05”, the study established that school climate positively and significantly influences students’ achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya. The findings agree with Sanchez (2019) findings “that school climate has a positive and significant influence on students’ achievements in physics subject”.

V. Conclusions

The study concluded that school climate characteristics influence student’s academic achievements in physics in STEM model schools in Nairobi Metropolitan region, Kenya. Having a positive student-school staff and management relationship motivates students to do better in physics. Also, friendly student-student relationships allow them to help each other in understanding physics concepts. In addition, having well maintained and are up to state standards physics facilities give students better conditions to post good grades in physics. Schools need to have technical supports for teachers, computer labs for physics research and a well stated policy to guide students in subject selection. Moreover, most schools need to procure overhead projectors, robotics kits, audiovisual materials, cathode ray oscilloscopes and digital cameras. This will facilitate effective physics teaching.

VI. Recommendations

The study recommends that ministry of education should formulate a policy of monitoring and evaluation of the progress of these STEM model schools and at various points should come up with solutions of motivating students’ interest in physics and interrogate the challenges that may inhibiting the performance.

The study recommends that school management should advocate for healthy relationships between the principals and teachers, teachers and students and students and students. This can be done by organizing students into families with each family having a teacher as the mentor and also organizing students into subject clubs and discussion groups in order to improve their level of interaction. These will create a good school climate which is essential for improved academic achievement.

The study recommends that school management should ensure that enough science and computer laboratories are constructed and equipped with the required teaching and learning material such as overhead projectors, robotics kits, audiovisual materials, cathode ray oscilloscopes and digital cameras. Computer labs will facilitate research in sciences hence making meaningful learning

The study recommends that school management should employ support staff like lab technicians. This will assist science “teachers to be in a position to teach effectively through practical and maximize the use of allocated” time since most of the work like preparation of apparatus and chemicals is done by the support staff

The study recommends that school management should formulate strategies to review school programs and time tables in order to ensure that more time is allocated to science subjects. This will make easy for science teachers to adopt various integrated STEM learning approaches “like problem based, project based and inquiry-based learning while teaching”.

The study recommends that teachers should strive to create a friendly classroom learning environment that is favorable for learning to take place. This will improve student-teacher relationship which improves students trust on teachers’ capabilities. Improving students’ relationships with teachers ensures that students are engaged fully in learning and this enhances their academic achievement in science subjects like physics.

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