Classroom Climate as a Predictor of Academic Achievement in Biology among Form Three Students in Kiambu County, Kenya

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Abstract: **Kenya aims to become an industrialized nation by 2030, and achieving Vision 2030 can be supported by focusing fundamentally on science subjects, including Biology. However, academic achievement in Biology has been below average, raising numerous concerns. This study, therefore, aimed to establish how classroom climate predict achievement in Biology among Form Three students in Juja Sub-County of Kiambu County, Kenya. This research aimed to address the poor Biology achievement of secondary school students in Form Three in the Juja area of Kiambu County. The study adopted the interactive learning theory by Vygotsky (1978). Correlational research design was also adopted. The study targeted all 4,000 Form Three students in Kiambu County. A purposive, stratified sampling method, together with simple random procedures, were utilized to select an appropriate sample size of 399 students. The following research tools were employed to gather information: the Student Classroom Climate Inventory (SCCI), and end-of-term examination scores in Biology to measure academic achievement in Biology. In this study, a pilot test was carried out in two secondary schools within the neighbouring Juja Sub County to ascertain the reliability of the research tools. Additionally, Cronbach's alpha was utilised to determine internal consistency. Construct, face and content validity of the research scales were ascertained through the guidance of the supervisors and experts in the educational psychology department. SPSS version 30 was employed in the cleaning, coding and analysing data whereby descriptive and inferential statistics such as Pearson correlation coefficient and multiple regression were generated for data analysis. Findings from the study indicates a negative and significant relationship between classroom climate and Biology achievement r (396) =-.103, p <.05. Further, classroom climate significantly predicted the achievement of female students than male students. Additionally, academic achievement was greatly influenced by an interactive classroom climate. The research outcomes strongly suggest that parents and teachers should engage in activities that sustain an interactive classroom climate. Further research is recommended to explore ways to sustain interactive, supportive, and respectful classroom climates to ensure higher achievement among students.**

Keywords: **Biology academic achievement, classroom climate, public secondary schools.**

I. INTRODUCTION

Biology entails a detailed study of living organisms, including the examination of their structure, functioning, evolution, distribution, and interrelationships. Dutfield and Lim (2020) highlight that Biology is a branch of science that deals with living organisms and life processes. It is one of the oldest sciences in human history and is fundamental to understanding all aspects of life and the existence of living organisms, including humanity. It aids humans in understanding the living world and the ways in which species function, interact, and evolve. Advances in medicine, biotechnology, agriculture, and

many other areas of Biology have improved the quality of life. As a science, Biology therefore influences personal development and contributes to the wellbeing of a nation (Helmenstine, 2020; Ibimenji et al., 2021).

Classroom climate refers to the intellectual, social, physical, and emotional environments in which individuals learn. This includes, but is not limited to, teacher-student interaction, supportiveness, and respectfulness (Ambrose et al., 2010). Instances of disparity and uneven treatment towards a student or a group of students negatively impact the classroom climate. Additionally, even minor disparities can accumulate and adversely affect learning and teaching (Hirschy & Braxton, 2004; Hall, 1982). According to Qiu (2022), the benefits of positive social interactions in a supportive classroom climate include both students and teachers achieving a better understanding of each other and themselves.

Due to the poor grades announced annually when national assessment scores are released by the Examination Body in Kenya (KNEC, 2021). The prevalence of underachievement in Biology among high school students in Juja Sub-County has diminished the expectations of many students progressing to higher institutions of learning to pursue science-oriented careers. In effect this research focused on investigating whether classroom climate contribute to Biology academic achievement. Although examinations are used to assess performance, it has emerged that there are variations in the results made public each year. However, paucity of studies in Juja Sub-County relating to classroom climate and Biology academic achievement and prevalent low achievement in Biology is worrying and underscores the urgent need for a study to address this variables. Therefore, this study delved on these variables and this formed an interesting study theme that was explored to understand the achievement.

Vygotsky's (1978) interactive learning theory proposes that cognitive development is achieved through social interactions, making the learning process highly effective when students engage with socially knowledgeable peers or adults, including teachers and family members. The theory suggests that learning is fundamentally a social process, where the development of an individual's cognition occurs through social interactions. Vygotsky posits that students learn more effectively in a social environment. This is why applying the theory in the classroom can help students understand concepts more quickly. Social interaction, as identified in this theory, is a dimension of classroom climate. As a result, this theory was chosen to explore how classroom climate, including factors like social interaction, is related to students' achievement in Biology.

A proper classroom climate, characterised by dimensions of support, interaction, and respect, is predicted to result in better academic achievement in Biology among students. Conversely, an improper classroom climate, marked by a lack of support, interaction, and respect, is predicted to lead to poorer academic achievement in Biology (Wehril, 2019). Barnett (2019) applied the theory to assess students' academic performance and found that educators who attempt to teach at a level either below or above students' capability result in less motivated and unsupported students. This theory therefore also guided this study in predicting the relationship between classroom climate and achievement in Biology with those students experiencing appropriate classroom climate well hypothesized to do well and vice versa.

II. REVIEW OF RELATED LITERATURE

In the USA, Wehril (2019) studied a quantitative analysis of the California Healthy Kids Survey and the California Assessment of Student Performance and Progress to examine the effect of school climate on student achievement in California secondary schools. This study investigated the relationship between classroom climate and student academic performance. Data was collected from 1,340 students attending public middle and high schools. A quantitative ex-post facto research methodology was employed to examine the relationship between classroom climate and student academic performance. The findings indicated a highly significant variation between school climate and students' achievement. The reviewed research was based on an ex-post facto research design and general achievement, whereas this research employed a correlational study to predict the relationship between classroom climate and students' Biology achievement, a science subject.

In China, Yan and Wei (2022) conducted a study on the correlation between the prevailing classroom environment and the academic performance of teacher trainees in Guangxi. The research aimed to investigate the academic achievement of English major teacher trainees in relation to the prevailing classroom environment. A classroom climate questionnaire was used in the study. This study employed a correlational method, involving a total of 307 students—280 females and 27 males, aged 18 to 24 years—who were English major teacher trainees in Guangxi. The Alonso Learning Style Questionnaire and Strategy Inventory were used to collect data. The researchers found that the prevailing classroom

environment was positively related to students' academic achievement among English major teacher trainees. While this study focused on secondary school students at a developmental stage of adolescence, where the environment plays a significant role in academic achievement, the study by Yan and Wei concentrated on college English students at a higher developmental stage, who adapted more easily.

A study conducted in the Philippines by Matoy (2022) assessed the correlation between classroom climate and the achievement of undergraduate learners. The aim of this research was to explore the connection between classroom climate and academic achievement. The study involved fifty-five (55) third-year students pursuing Radiology Technology at Cebu Doctors University. A descriptive correlational design was employed to explore the correlation between classroom climate and academic achievement. The study found that both physical and emotional classroom climates positively impacted students' academic performance in nuclear medicine. The reviewed study focused on a small sample size of 55 students, which was susceptible to high classical errors, whereas this research was based on a larger sample of 399 respondents, allowing for generalisation to the wider population.

A study conducted in Nigeria by Ibimenji et al. (2021) explored the interrelationship between classroom environment and Biology academic performance among students in senior secondary schools. This study assessed how the learning environment influenced the academic performance of Biology students in Rivers State. A total of 345 senior secondary three students taking Biology were sampled using a random sampling technique from thirty-five senior secondary schools. The Biology Performance Test (BPT) and Classroom Environment Assessment Questionnaire were utilised to collect statistical information in this descriptive survey design. The outcomes of the research indicated a significant relationship between the classroom environment and students' Biology achievement. However, the study reviewed here was based on a descriptive survey design, which cannot establish causal relationships between variables, whereas this research focused on a correlational research method that assessed the correlation between the study variables.

In Kenya, Ogoti et al. (2018) conducted a study to investigate the relationship between classroom climate and students' performance in the KCSE exams in Kisii County. The aim of this study was to investigate the relationship between classroom climate and students' academic achievement in KNEC examinations. A mixed-methods approach, combining correlational descriptive survey and case study designs, was utilised in this study. Twenty secondary schools were selected using a stratified and simple random sampling method. Pearson's correlation analysis was used to examine the relationship between school climate and student academic performance. The results indicated a significant correlation between these two variables. The research found a significant correlation between school climate and students' academic performance. This study focused on a mixed methods research design for general academic achievement, whereas this research was specifically concerned with the correlation between classroom climate and Biology academic achievement.

III. METHODOLOGY

Target Population

A population of all 4,000 respondents consisting of Form Three learners from all 36 public secondary institutions in Juja Sub-County were targeted. Form Three students were chosen because of their advanced experience in secondary school, as they had already selected their career paths by choosing their subjects (Bhandari, 2022).

Sample Size and Sampling Techniques

Sample Size

A simplified formula by Yamane (1967) was utilised to determine sample size. This was expressed as $n = N \div (1+N(e)^2)$. Where n represents the sample size and N is the population size while E denotes is the desired level of precision. Therefore,

$4000 \div (1+4000(.05)^2) = 363$

In the study, in order to take care of those participants who opted to leave the study or non-responders, an attrition bias of 10% was added (Singh et al., 2020). Therefore, from the total sample of 363, 10% of the participants was added. Hence, n=363+36= 399 participants consisting 200 boys and 199 girls as indicated in Table 3.1.

Table 3.1: Sampling Distribution and Sample Size Frame

Type of schools	The Population			schools	No of students in 12 schools		Sampled	Students
	Schools	Students						
		Boys	Girls		Boys	Girls	Boys	Girls
Boys' boarding	6	1300	-	2	297	-	116	
Girls boarding	5	-	1000	2		221	-	87
Co-educational	25	800	900	8	214	258	84	112
Sub-total		2100	1900	12	511	479	200	199
		52.5%	47. 5%					
Total	36 100%	4000 (100%)		12(33%)	990(33%)		Sample of 399 (13%)	

Source: Researcher 2023

Note. The total number of boys and girls in sampled schools were proportionately sampled.

No - means number

The Sampling Techniques

Given the researcher's familiarity with Juja Sub-County, it was purposively chosen for the study. Stratified sampling procedure was applied to segment the 36 public secondary institutions in the area (McCombes, 2022). Within these sub-groups, 12 institutions were sampled using simple random procedure and included in the research. According to Dell et al. (2002), 12 schools exceed the minimum requirement of 10 schools. Finally, numbers were allocated and drawn randomly from a basket to give an identical possibility of selection for each school category (Kothari, 2004).

Classroom climate Scale

A scale created by Hadiyanto et al. (2019) on classroom climate was adapted. The scale, called the Student Classroom Climate Inventory (SCCI), comprised 49 questions. It used a five-point Likert scale to measure classroom climate, with answer options as follows: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. SPSS version 30 was employed to analyse the data and predict the correlation between classroom climate and Biology achievement. The questionnaire included both positively and negatively framed items to measure Interactive, Supportive, and Respectful classroom climates. For negative statements, a score of one indicated the best classroom climate, while for positive statements, a score of five indicated the best classroom climate.

IV. RESULTS

To determine the relationship between classroom climate and Biology academic achievement, the sampled respondents were provided with a questionnaire whereby the items were indicators of classroom such as interactive, supportive and respective classroom climates in Biology achievement. The items in the scale were in a 5 point likert format rating from 1 (strongly disagree), 2 (disagree), 3 (undecided), 4 (agree) and 5 (strongly agree). The summary of the ratings of participants in classroom climates were presented in table 4.1.

Table 4.1: Summary of Students' Responses to Statements on Classroom Climate

Item	SA	A	U	Response D	SD	Mean	Std Dev
The teacher is considerate of students' emotions	158 (39.9)	125 (31.6)	33 (8.3)	37 (9.3)	43 (10.9)	3.80	1.341
The teacher prioritise talking over listening.	46 (11.6)	72 (18.2)	39 (9.8)	125 (31.6)	114 (28.8)	2.52	1.375
The classroom is composed of students who are unfamiliar with each other.	47 (11.9)	44 (11.1)	26 (6.6)	95 (24.0)	184 (46.5)	2.18	1.420
The students look forward to coming to classes.	124 (31.3)	134 (33.8)	56 (14.1)	39 (9.8)	43 (10.9)	3.65	1.306
Students have knowledge of what has to be carried in our class.	183 (46.2)	132 (33.3)	38 (9.6)	27 (6.8)	16 (4.0)	4.11	1.089

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Statement						Mean	SD
New ideas are rarely tested out in our classroom	65 (16.4)	102 (25.8)	71 (17.9)	87 (22.0)	71 (17.9)	3.01	1.362
All learners in the class are believed to do the same task using the same methods and within the same timeframe.	133 (33.6)	89 (22.5)	35 (8.8)	78 (19.7)	61 (15.4)	3.39	1.495
The teacher talks individually with students.	94 (23.7)	124 (31.3)	42 (10.6)	65 (16.4)	71 (17.9)	3.27	1.442
Learners are diligent in their classwork.	191 (48.2)	114 (28.8)	46 (11.6)	29 (7.3)	16 (4.0)	4.10	1.117
All learners know their classmates by their first names.	175 (44.2)	99 (25.0)	31 (7.8)	59 (14.9)	31 (7.8)	3.83	1.342
Learners are displeased with the classroom activities.	48 (12.1)	72 (18.2)	74 (18.7)	93 (23.5)	109 (27.5)	2.64	1.370
Completing a specific workload is important in this class.	149 (37.6)	161 (40.7)	47 (11.9)	24 (6.1)	15 (3.8)	4.02	1.039
Novel and variant means of teaching are rarely tried in our classroom.	105 (26.5)	127 (32.1)	37 (9.3)	73 (18.4)	54 (13.6)	3.39	1.400
Students are often permitted to work at their own paces.	83 (21.0)	112 (28.3)	44 (11.1)	76 (19.2)	81 (20.5)	3.10	1.458
The instructor goes out of his/her way to assist learners.	181 (45.7)	134 (33.8)	33 (8.3)	25 (6.3)	23 (5.8)	4.07	1.146
Learners 'clock watch' in the class.	70 (17.7)	73 (18.4)	44 (11.1)	71 (17.9)	138 (34.8)	2.66	1.535
Students' Friendships is practiced in our classroom.	198 (50.0)	142 (35.9)	24 (6.1)	15 (3.8)	17 (4.3)	4.23	1.023
Learners have a sense of fulfilment after the class session.	92 (23.2)	137 (34.6)	92 (23.2)	48 (12.1)	27 (6.8)	3.55	1.169
The group frequently loses focus and deviates from the main point.	42 (10.6)	75 (18.9)	111 (28.0)	114 (28.8)	54 (13.6)	2.84	1.194
The instructor devises creative activities for students carried out.	121 (30.6)	131 (33.1)	63 (15.9)	37 (9.3)	44 (11.1)	3.63	1.305
Students decides how class time is utilised.	85 (21.5)	119 (30.1)	64 (16.2)	59 (14.9)	69 (17.4)	3.23	1.399
The instructor assists every learner who is having difficulty with the work.	192 (48.5)	142 (35.9)	18 (4.5)	24 (6.1)	20 (5.1)	4.17	1.097
Class pays attention to what other students are communicating.	139 (35.1)	110 (27.9)	37 (9.3)	62 (15.7)	48 (12.1)	3.58	1.411
The class does not have much time to get to know each other.	44 (11.1)	45 (11.4)	46 (11.6)	128 (32.3)	133 (33.6)	2.34	1.340
Students have a view that classes are a waste of time.	22 (5.6)	6 (1.5)	24 (6.1)	91 (23.0)	253 (63.9)	1.62	1.057
The class is disorganised.	31 (7.8)	18 (4.5)	26 (6.6)	107 (27.0)	214 (54.0)	1.85	1.214
Approaches applied in teaching are variant, innovation and creative.	76 (19.2)	129 (32.6)	125 (31.6)	38 (9.6)	28 (7.1)	3.47	1.119
The class is permitted to select class activities and how to work them.	82 (20.7)	122 (30.8)	47 (11.9)	64 (16.2)	80 (20.2)	3.16	1.446
The instructor seldom walk around the classroom to interact with learners.	99 (25.0)	95 (24.0)	25 (6.3)	93 (23.5)	84 (21.2)	3.08	1.524

The class rarely present their assignments to the whole class.	65 (16.4)	84 (21.2)	53 (13.4)	103 (26.0)	91 (23.0)	2.82	1.422
Knowing everybody by his/her first name in this classroom takes long time.	34 (8.6)	42 (10.6)	45 (11.4)	122 (30.8)	153 (38.6)	2.20	1.289
Classes are boring.	27 (6.8)	19 (4.8)	36 (9.1)	104 (26.3)	210 (53.0)	1.86	1.188
Students' practice exercises are often clear, so that everyone understands how to work them.	144 (36.4)	138 (34.8)	41 (10.4)	43 (10.6)	30 (7.6)	3.82	1.246
Classroom seating arrangements is the same way every week.	179 (45.2)	92 (23.2)	23 (5.8)	36 (9.1)	66 (16.7)	3.71	1.515
Teaching methodologies allow the learners to work at their own pace.	68 (17.2)	124 (31.3)	79 (19.9)	50 (12.6)	75 (18.9)	3.15	1.366
The teachers are not interested in students' predicaments.	50 (12.6)	35 (8.8)	43 (10.9)	117 (29.5)	151 (38.1)	2.28	1.380
The class is presented with an opportunity to convey opinions in this class.	190 (48.0)	129 (32.6)	23 (5.8)	25 (6.3)	29 (7.3)	4.08	1.203
The class members get to acquit to each in class.	145 (36.6)	143 (36.1)	51 (12.9)	27 (6.8)	30 (7.6)	3.87	1.199
All students love coming to the classroom.	163 (41.2)	130 (32.8)	47 (11.9)	28 (7.1)	28 (7.1)	3.94	1.204
The class rarely starts in time.	102 (25.8)	95 (24.0)	35 (8.8)	92 (23.2)	71 (17.9)	3.26	2.451
Unusual class activities are often thought by the teacher.	31 (7.8)	57 (14.4)	115 (29.0)	107 (27.0)	86 (21.7)	2.60	1.198
There is little opportunity for the class to pursue their specific interest during class time.	52 (13.1)	68 (17.2)	59 (14.9)	101 (25.5)	115 (29.0)	2.72	2.806
The instructor is unapproachable and lack consideration toward learners.	33 (8.3)	46 (11.6)	33 (8.3)	96 (24.2)	188 (47.5)	2.09	1.330
The instructor leads most of the class discussions.	88 (22.2)	110 (27.9)	55 (13.9)	88 (22.2)	55 (13.9)	3.22	1.378
Learners in this class show little interest in getting to know their peers.	43 (10.9)	55 (13.9)	57 (14.4)	129 (32.6)	112 (28.3)	2.46	1.322
Classes are interesting.	184 (46.5)	126 (31.8)	39 (9.8)	27 (6.8)	20 (5.1)	4.08	1.135
Classroom activities are precisely and keenly orchestrated.	164 (41.4)	124 (31.3)	39 (9.8)	49 (12.4)	20 (5.1)	3.92	1.208
The class seems to participate in similar activities every class session.	50 (12.6)	68 (17.2)	60 (15.2)	123 (31.1)	95 (24.0)	2.63	1.348
What to be performed in our class is decide by the teacher.	126 (31.8)	121 (30.6)	41 (10.4)	64 (16.2)	44 (11.1)	3.56	1.370

Note. Percentages are indicated by the figures in brackets.

Table 4.2 shows the descriptive statistics of classroom climate scores.

Table 4.2: Descriptive Statistics of Classroom Climate Scores

	N	Min	Max	Range	Mean	*SD*	*Sk*	*Kur*
Classroom Climate	396	47	91	47	63.99	5.928	.129	.803

From Table 4.2 it is revealed that the highest classroom climate score and the lowest classroom climate score are 91 and 47 respectively meaning, the difference (range) between them is 47. Classroom climate mean score of 63.99 and standard deviation 5.928. The skewness and kurtosis coefficients were .129 and .803 respectively indicating a near normal distribution of the scores.

In addition, classroom climate scores were examined as per the different genders of student' as illustrated in Table 4.3 below.

Table 4.3: Classroom Climate Descriptive Statistics by Gender

Gender of Students	N	Mean	Std. Deviation	Min.	Max.	Range	Skewness	Kurtosis
Male	197	64.35	6.225	47	82	35	-.084	.138
Female	199	63.63	5.611	48	91	43	.374	1.903
Total	396	63.99	5.928	47	91	44	.129	.803

Outcomes in Table 4.3 show that the lowest score among the male participants was 47, and the highest was 82. The mean score was 64.35, with a standard deviation of 6.225. For female students, the lowest score for classroom climate was 48 while the highest score was 91. The classroom climate average score and standard deviation pertaining to female students were (M = 63.63, SD = 5.611). This implies that despite the fact that females recorded the highest classroom climate they collectively had a lower classroom climate compared to the boys.

The descriptive statistics of Classroom Climate scores by the school category are showed in Table 4.4.

Table 4.4: Classroom Climate Descriptive Statistics by School Category

Type of school	Mean	N	Std. Dev.	Kurtosis	Skewness	Min.	Max.	Range
Boys Boarding Schools	63.43	112	6.473	.242	.139	47	82	35
Girls Boarding Schools	63.09	88	5.935	4.857	1.049	48	91	43
Co-Educational Institutions	64.71	196	5.527	-.317	-.279	49	79	31
Total	63.99	396	5.928	.803	.129	47	91	44

The research outcomes in Table 4.4 indicate that boys' boarding institutions had a mean score of 63.43, with a standard deviation of 6.473; the mean score for girls' institutions was 63.09 (SD = 5.935), while that of co-educational institutions was 64.71 (SD = 5.527). Maximum classroom climate score for male boarding schools and female boarding schools was 82 and 91 respectively and that of co-educational institutions was 79. Minimum classroom climate score was 47 for male boarding, 48 female boarding schools and 49 for co-educational institutions. These statistics show that classroom climate was relatively relatable to the school types, with girls' boarding schools having the highest classroom climate score and co-educational institutions having the lowest classroom climate score. However, generally co-educational institutions seemed to have a better classroom climate on average than boys and girls boarding schools. The researcher further categorised class climates according to levels displayed in Table 4.5.

Table 4.5: Classroom Climate Levels

stage	N	Percentage
Supportive	222	56.1
Interactive	94	23.7
Respectful	80	20.2
Total	396	100

Table 4.5 revealed that a supportive classroom climate attracted 222 participants, representing 56.1%. This was followed by an interactive classroom climate, which was moderately prevalent with 94 participants supporting it, amounting to 23.7%. The least dominant classroom climate was respect, which attracted 80 participants and accounted for 20.2%. This implies that most respondents identified support as the main contributor to a positive classroom climate.

The hypothesis was evaluated using the Pearson's correlation and results are as shown in Table 4.6.

In determining if the relationship between classroom climate and Biology achievement was significant. The hypothesis that follows was examined.

H_{01} There is no statistical significant relationship between classroom climate and Biology achievement. The Pearson correlation coefficient was used to test the hypothesis, and the results are displayed in Table 4.6

Table 4.6: Relationship between Classroom Climate levels and Biology Academic Achievement

		Biology Achievement
	Pearson Correlation	-.103[*]
Classroom Climate	Sig. (2-tailed)	.41
	N	396

* This relationship is significant at the 0.05 level (two-tailed).

The researcher hypothesised, there was no significant relationship between classroom climate and Biology achievement. However, the Pearson correlation analysis indicated a negative and significant relationship between classroom climate and Biology achievement, with r (396) = -0.103, p < 0.41, leading to the null hypothesis being rejected. This implies that the relationship between classroom climate and the Biology achievement was generally an inverse relationship. Therefore those students achieving highly in Biology may not experience better classroom climate than those who are performing poorly in Biology.

Table 4.7: Levels of Classroom Climate and Biology Mean Scores

Level of Classroom Climate	N	Biology Mean	*SD*
Supportive	222	65.54	8.303
Interactive	94	65.95	7.934
Respectful	80	61.34	9.400

From the results given in Table 4.7, a supportive classroom climate was associated with a Biology mean score of 65.54 and a standard deviation of 8.303 among students, while an interactive classroom climate had a mean score of 65.95 and a standard deviation of 7.934. In comparison, a respectful classroom climate was associated with an average score of 61.34 and a standard deviation of 9.400, pointing that the interactive classroom climate resulted in higher Biology achievement among students

This study identified a significant relationship between classroom climate and Biology academic achievement. This suggests that a classroom climate characterised by respect, support, and interactions is likely to influence scores in Biology. The findings support those of other researchers in past studies conducted in this area. Ma and Wei (2022) pointed out that academic achievement was significantly affected by the classroom environment. Their study involved teacher trainees pursuing English as a major in Guangxi, China. Data from the students were collected via questionnaires and then analysed. The outcomes from the research indicated that classroom climate was positively correlated with the academic achievement of teacher trainees, implying that the higher the perceived classroom climate, the higher the academic achievement. The study further identifies classroom climate as a strong predictor of students' achievements.

Furthermore, Kalkan and Dağlı (2021) found results similar to the current study's findings. The study investigated the correlation between classroom climates, school belonging, and academic performance in Turkey. Data collected using questionnaires were analysed, and the Pearson's correlation was r (667) = .367, p < .05. The results showed that secondary school learners' understanding of classroom climate and school belonging is at a high level. Also, the study's results showed a significant relationship between classroom climate and academic achievement, implying that both classroom climate and school belonging are important predictors of academic success. In addition to the physical characteristics of the class, the quality of the class environment was found to be determined by the quality of the relations between the individuals in the class, that is, an interactive classroom climate within the class.

Contrary findings to this study were arrived at by Randjelovic and Dimić (2020). In examining the correlation between academic achievement and components of classroom climate of teacher-student interactions, emotional climate, social climate, and fear of failure in Malaysia. The results revealed that the relationship between the dimensions of classroom climate and academic achievement is not significant. Moreover, consistent with the current study, it was found that students of a younger age had better scores pertaining to the teacher-student interaction dimension than those older in age.

Consistent findings have also been reported in the African context. Ekpo et al. (2019) asserted that there is correlation between classroom climate and students' academic achievement in Social Studies, across three Educational Zones within the State Secondary Education Board of Cross River State, Nigeria. The researcher examined various sub-variables of classroom climate in this study, including the physical layout of the classroom, teachers' instructional behaviours, and the

use of instructional materials. The study established that the classroom climate variables mentioned jointly contributed to the variance in students' academic achievement in Social Studies.

A survey in Kenya by Rutto (2017) reported similar findings on the relationship between classroom environment and learners' academic scores in Chemistry. The Pearson product-moment correlation analysis showed a significant relationship between students' perceptions of the classroom psychosocial environment and their academic performance in Chemistry. In addition, learners understanding of the psychosocial environment in the Chemistry classroom were linked to their academic performance. The classroom environment is recognised as a crucial factor in student learning and should be managed by both teachers and students to ensure high academic achievement. It was also noted that students from Kirinyaga County performed better than students from Murang'a County. Moreover, the study established that adjusting elements of the classroom environment can enhance student learning. This can be achieved by encouraging cohesive, cooperative, and task-focused classroom settings.

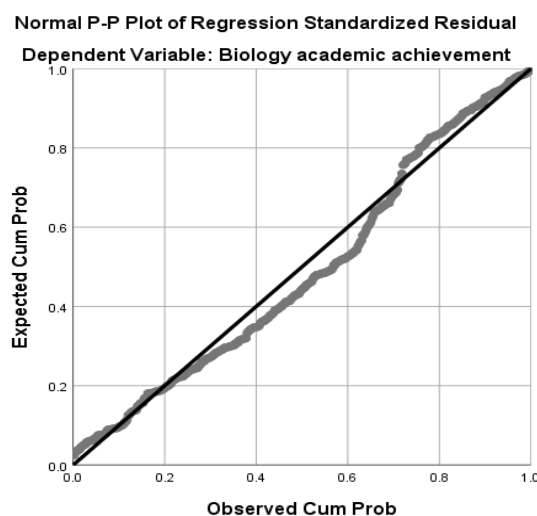**Figure 4.1: Scatter Plot for Observed Cumulative Probabilities and Expected Cumulative Probabilities**

Figure 4.1 indicates that the scatter plot formed a definite pattern, implying that the data from the study was equally distributed. In addition, the error were spread out consistently between the predictor variables, indicating the heteroscedastic assumption of equal variance of outcome variables.

Also, normal distribution error was tested, a histogram was used to test the assumption as displayed in Figure 4.2.

Figure 4.2: Scatter Plot for testing normality distribution
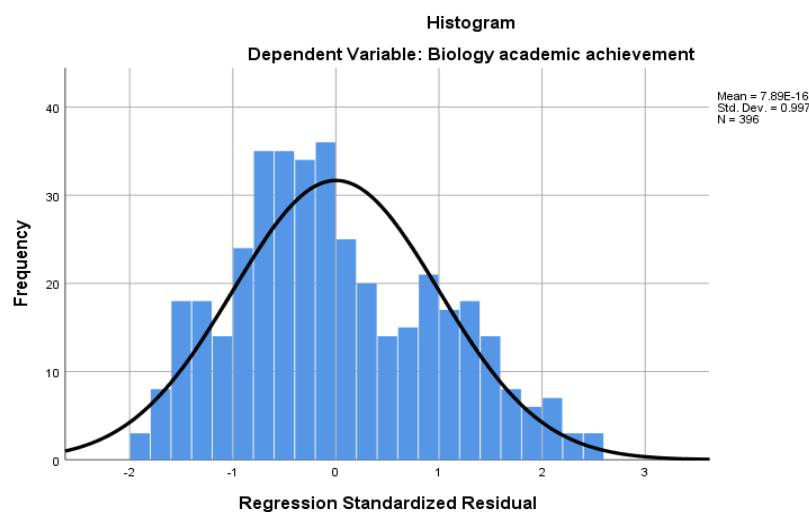

Figure 4.2 shows the normality test results. This points that classroom climate and academic buoyancy were approximately normally distributed.

Table 4.8 indicates the assumptions regarding multi-collinearity and singularity

Table 4.8: Assumptions regarding Multi-Collinearity and Singularity

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Support	Interaction	Respect
1	1	4.941	1.000	.00	.00	.00	.00
	2	.033	12.152	.00	.02	.01	.06
	3	.012	20.079	.04	.00	.31	.69
	4	.007	26.028	.01	.94	.25	.21
	5	.006	29.695	.95	.04	.44	.03

a. Dependent Variable: T-score: Biology achievement

Findings in Table 4.8 indicate that values that are $p<.05$ significantly predicted academic scores in Biology, while those that did not meet this criterion did not significantly predict Biology academic achievement.

In establishing the presence of any predictive weight between classroom climate and Biology achievement, the following hypothesis was formulated.

H_{02} There were no predictive weight between classroom climate and academic buoyancy on Biology academic achievement.

Regression analysis was applied in testing the hypothesis.

Table 4.9 presents model summary for predicting Biology achievement.

Table 4.9: Summary of the Model for Predicting Biology Achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.157[a]	.025	.015	9.92566	.806

a. Predictors: (Constant), Classroom climate (Respectful, interactive and supportive).

b. Dependent Variable: T-score: Biology academic achievement.

Table 4.9 above indicates that the Durbin-Watson value was .814. This suggests that the data did not meet assumption of the independence of observations. According to Tabachnick & Fidell (2019), assumption for independent errors should range from 1.5-2.5. Thereby, our data violated the assumption for independent errors.

Table 4.10 indicates the regression coefficients

Table 4.10: Regression Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	57.339	5.796		9.893	.000
	Supportive Classroom Climate	-.016	.007	-.135	-2.277	.023
	Interactive Classroom Climate	.002	.007	.016	.298	.766
	Respectful Classroom Climate	-.002	.006	-.020	-.358	.720

S- Supportive Classroom Climate, I- Interactive Classroom Climate, R- Respectful Classroom Climate and ŷ- Biology Achievement

Based on Table 4.10, the equation predicting Biology achievement from classroom climate is;

ŷ =0.002I -0.016S-0.002R+57.339

The results reveal that interactive classroom climate had the highest predictive index for Biology achievement followed by respectful and supportive classroom climates. Interactive classroom climate as a variable displayed positive variation in Biology achievement while respectful and supportive classroom climates displayed negative variations in Biology

achievement and, therefore, rejection of the null hypothesis was sustained. Further, it can be seen that classroom climate predicts Biology achievement from the multiple regression expression. However, the equation indicates among classroom climate levels, interactive classroom climate had the highest predictive index on Biology performance.

V. SUMMARY AND CONCLUSION

The research aimed to establish the relationship between classroom climate and students' Biology achievement. In Regards the relationship between classroom climate and Biology achievement, this research established a negative and significant relationship. Male students had the highest classroom climate scores, influenced by respect, support, and interaction, and their Biology achievement was better than that of female students. Co-educational institutions generally had a better classroom climate on average compared to boys' and girls' boarding schools. Analysis of classroom climate levels showed that supportive classroom climate was preferred most, followed by interactive and respectful climates. However, interactive classroom climate was the most significant predictor of achievement in Biology, followed by supportive and respectful climates. Pearson's correlation revealed $p<.05$, implying a significant relationship between classroom climate and Biology achievement.

From the findings, it can be concluded that interactive classroom climate was the best predictor of Biology achievement among the various levels of classroom climate. In addition, having established that Biology achievement is predicted to a large extent by classroom climate, teachers should ensure and uphold high classroom climate through creating an interactive environment.

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