

**EFFECTS OF CLASSROOM DESIGN ON STUDENT
LEARNING IN PUBLIC SECONDARY SCHOOLS IN
EMBU COUNTY, KENYA**

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**A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF
EDUCATION IN PARTIAL FULFILLMENT OF THE AWARD OF THE
DEGREE OF BACHELOR OF EDUCATION (ARTS) OF GREY
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DECLARATION

Student declaration

DECLARATION

Student declaration

This project is my original work and has never been submitted for any award of a degree or any similar purpose in any other institution.

Signature..... *JA*

Date..... *04/12/2024*

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Supervisor's approval

This project is submitted for an examination with our approval as the university supervisor.

Signature..... *Brian* Date..... *04/12/24*

WAWERU R BRIAN

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DEDICATION

I dedicate my research project to my parents, for your constant love, encouragement and support.

ACKNOWLEDGMENT

First, I would like to acknowledge and give my warmest thanks to the Almighty God for granting me all the wisdom throughout the journey.

Secondly, I salute Greta University for providing a conducive environment for my learning and providing me with all the needful resources.

I am grateful too to my supervisor (BRIAN. R WAWERU) who has made this work possible. His guidance, instructions and supervision have carried me through all the stages.

Finally, I would like to extend my sincere gratitude to my family for their continuous and endless support and committing their resources towards my education.

OPERATIONAL TERMS

CLASSROOM DESIGN

Incorporates a range of different physical elements, including classroom layout, seating arrangement, lighting, acoustics, furniture and color to ensure the best learning environment for the students.

CLASSROOM MANAGEMENT

Classroom management refers to actions that an instructor takes to create and maintain a learning environment that is conducive to successful instruction.

STUDENT LEARNING

Student learning is the measurable skills, attitude, and knowledge of the learner as a result of participation in an educational activity

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ABBREVIATIONS AND ACRONYMS

EFA - Education for All

GoK - Government of Kenya

MoE - Ministry of Education

RA - Research Advantage

ABSTRACT

The aim of the study was to find out the effects of classroom design on student learning in public secondary schools in Embu County, Kenya. Generally, literature seems to show that classroom design reflects the classroom management. Classroom design greatly affects students learning. The effects are both positive and negative. Our teachers need to research and get information immediately they know about the students they have. This is a RA and will be of great advantage to the teachers. This will help them decide on what will work best in the classrooms and what will improve and enhance student learning. Studies show that all things matter and are important and they should be put into considerations. Even those that a teacher views as small things they really matter. For instance, we can talk about the furniture. This can basically include the size of the desk. We can also look at the temperatures in the classroom, where items are placed in the classroom among others. All this affects student learning. The study had objectives which includes how; furniture, temperature, lighting, classroom layout and seating arrangement and color and aesthetic affects student learning in public secondary schools. The study adopted descriptive design method. The target population was 146 public secondary schools in Embu County. Data collection involved questionnaires where the students were issued some questionnaires to fill. Interviews were also used. Data was also collected by using simple random sampling techniques. Findings were represented in form of texts, pie charts, tables and graphs. The study showed that furniture, lighting and temperature ventilations highly affected student learning. The study recommended that the government and the stakeholders should come up with a way to address this issue so that student's performance can increase.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

In this chapter a number of elements were discussed which included; lighting, furniture, color and aesthetics and temperature and ventilation. These effects were deeply discussed based on how they affect student learning in public secondary schools in Embu County, Kenya.

1.1 Background of the study

Active learning has become an essential part of the current teaching and learning proceedings in schools all over the world. There is an increasing confirmation that classroom designs may accelerate and improve or diminish learning activities and encourage or discourage the involvement and contribution of the students. This includes student learning using a technique that requires them to do things and also think about the things they are doing (Baum, 2018, p.45). This has been supported by the many creations in the various sectors particularly in the field of technology.

In today's life it is common to find a classroom that is fully armed with modern computers and these computers have got a high access to high speed network.

This is a very different thing compared to the olden days. In the old days learning was only a teacher standing in front of the classroom with a book guiding and instructing the students on what they should do.

In today's current situation, information is all over web pages and virtual classrooms are on the way to replace conventional teaching environment (Bettinger et.al 2019, p.2859). The classroom-based learning models implemented by many countries consist of student engagement that give the theoretical framework for learning. A classroom is viewed as an environment for the commitment which is the process that is experienced on a continuum resulting in sharing of knowledge. We get to note that students spend most of their time in school spending time together and sharing a common environment which is the classroom. This environment which is now the classroom, therefore, ought to be one that promotes learning by ensuring the highest level of motivation and ease of access to learning materials.

Most of the learning institutions both the lower levels and the higher education facilities are engaging to channel their resources towards better classroom settings that have a favorable layout which promotes effective learning and student engagement. This environment that is been put forward is that which is conducive and fitting for both the teacher and the students. These institutions have set up policies that state the recommended requirements of their classroom design in agreement with the provisions that facilitate the most desirable sitting positions for student's the position and the arrangement of the teacher's desk and the position of the other remaining items in the classroom.

The University of Salfords school of the Built environment found that classroom design can highly affect student learning process and this leading to a positive or negative effect on the academic performance of the students by as much as 25%. They evaluated 153 classrooms across 27 schools in the UK and found out that classrooms with natural light, comfortable temperatures and good acoustics had a positive impact on academic performance.

1.2 Statement of the problem

The environment which is now basically the classroom, is a very critical factor in the educational experience, there is a gap in our understanding of how the classroom design that is the (natural lightning, color and aesthetics, furniture and classroom layout and seating arrangement) among others affects student learning in public secondary schools.

Generally, the research problem of this study was to investigate and get into understanding of how the classroom design affects the student learning in public secondary schools.

This study mainly majored to explore how various aspects of classroom design such as the seating arrangement, lighting and spatial layout how they influence student learning outcomes, motivation and well-being within the educational environment.

This research problem is underscored by the need to understand the extent to which classroom design impacts the cognitive and behavioral aspects of students ultimately impacting their academic success.

Additionally, educational institutions endeavor to provide optimal learning conditions, evidence-based insights into classroom designs can be instrumental in guiding school administrators, architects and the educators.

To address this research question exhaustively, this study investigated various classroom design to determine their potential effects on student`s performance, shedding light on the relationship between the physical learning environment and academic outcomes in public secondary schools.

1.3 Purpose of the study

The study investigated on the effects of classroom design on student learning in public secondary schools in Embu County, Kenya

1.4 Conceptual framework

Independent variables

Natural lighting

Classroom layout and seating arrangement

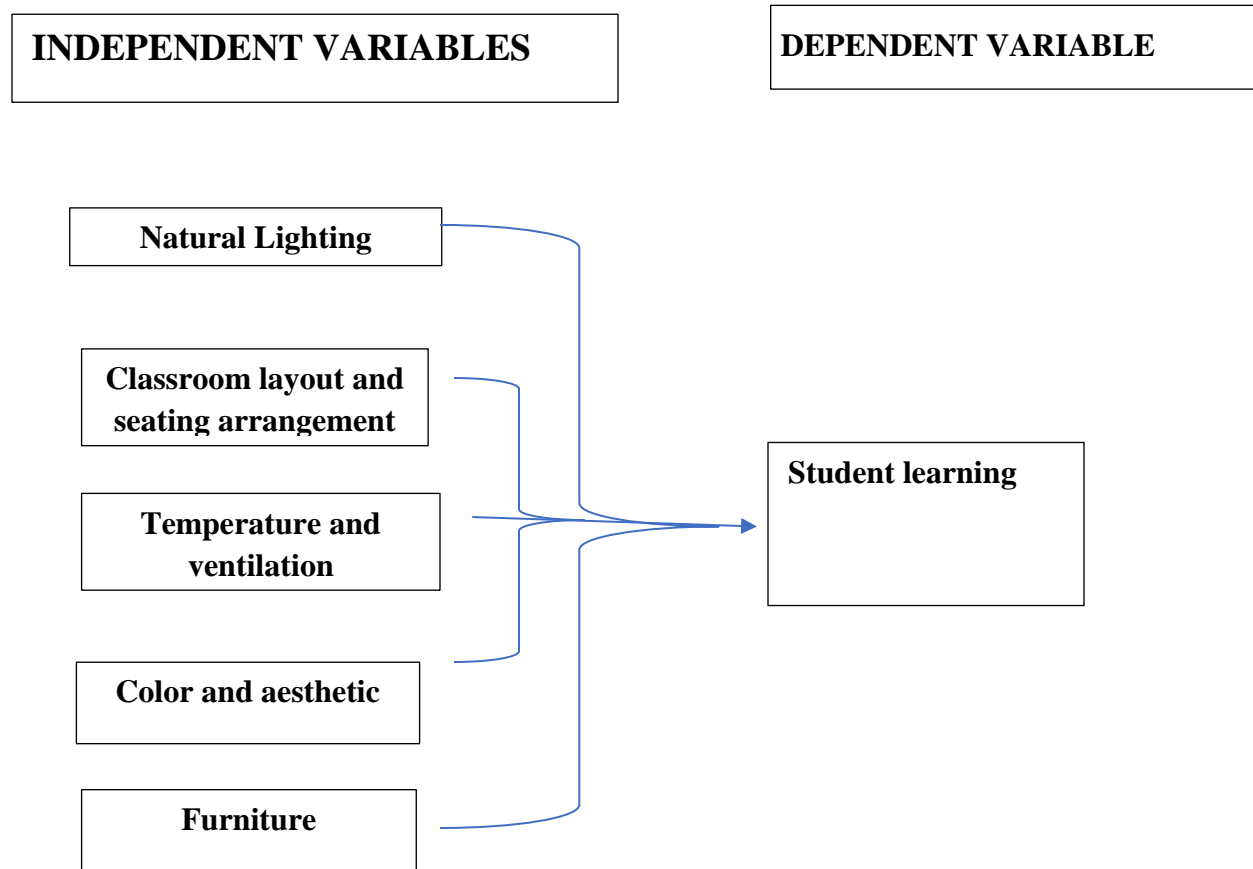
Temperature and ventilation

Color and aesthetic

Furniture

Dependent variable

Student learning



1.5 Objectives of the study

1.5.1 General objectives

To investigate the effects of classroom design on student learning in public secondary schools.

1.5.2 Specific objectives

1. To find out the effects of lighting on student learning in public secondary schools
2. To find out the effects of classroom layout and seating arrangement on students learning in public secondary schools
3. To find out the effects of temperature and ventilation on student learning in public secondary schools
4. To determine the effects of color and aesthetic on student learning in public secondary schools.
5. To investigate the effects of furniture on student learning in public secondary schools

1.6 Research questions

1. What are the effects of lighting on student learning in public secondary schools
2. How does classroom layout and seating arrangement affect student learning in public secondary schools
3. What are the effects of temperature and ventilation on student learning in public secondary schools
4. How does color and aesthetic affect student learning in public secondary schools
5. What are the effects of furniture on student learning in public secondary schools

1.7 Significance of the study

It was hoped that knowledge gained from the study will help the government and the stakeholders of education sector to understand that a classroom that is well designed can facilitate engagement, promote creativity and improve academic achievement.

This study is important to the public secondary schools in Embu County and also in other countries in Kenya as the school administrators can use the results from our study as a guide on the formulation and designing of the new and existing classrooms to the required ones.

1.8 The scope of the study

The study looked on what is meant by classroom design and also analyzed on how classroom design affects student learning in public secondary schools in Embu County Kenya.

1.9 Delimitations and limitations

1.9.1 Delimitations of the study

The study focused on the effects of classroom design on student learning in public secondary schools

1.9.2 Limitations of the study

- The study only focused on the public secondary schools in Embu County leaving behind the Private secondary schools.
- The study was only based on the primary data that they got from the respondents and at times this kind of data maybe biased.

CHAPTER TWO: LITERATURE REVIEW

2.1: Introduction

This chapter tried to explore a literature review on how classroom design can positively and negatively affect student learning in public secondary schools. First, classroom design incorporates a range of different physical elements and takes an important part in enhancing students learning outcomes. The comfort of students in the classroom is mostly influenced by several factors which include: lighting (natural and artificial lighting), classroom layout and sitting arrangement, temperature and ventilation, color and aesthetics and furniture. These factors are categorized in two groups: a) factors originating from the physical environment and b) factors from within it is occupants.

2.2: Review of related literature

Classroom design can include a number of things. We have the classroom design been the structure into the way the teachers organize their Classrooms. Can also be classroom design reflects the classroom management among others.

Classroom design includes the lighting, temperature, furniture, tables, desks chairs among others. Classroom management involves the class rules and regulations, behavior charts, behavior plans and positive behavior promotions. Classroom organization refers to how items have been arranged in the classroom. They should be arranged in a way that does not affect the classroom activities. Behavior shows how the students act and behave in the classroom.

In Embu County the effects of classroom design on student learning have become a challenge. There are so many negative effects of the classroom design that are affecting the students. This is mostly happening in those public secondary schools that are not yet well developed. These effects affect student learning thus leading to poor performance. It is not possible for a learner can learn in a classroom that is poorly ventilated, a classroom with fixed seating arrangement, uncomfortable furniture and expect him or her to be attentive and produce good results.

Lighting and Academic Achievement

Several studies highlight the importance of natural lighting in classrooms. Barrett et al. (2015) found that classrooms with ample natural light positively impacted students' reading and math scores. Similarly, Winterbottom and Wilkins (2009) emphasize that poor lighting can lead to eye strain and decreased concentration, particularly in secondary school students, where cognitive demands are higher. Artificial lighting, if improperly designed, can hinder focus and contribute to fatigue.

Acoustics and Student Engagement

Acoustic quality in classrooms plays a crucial role in student comprehension and participation. Shield and Dockrell (2003) demonstrated that high levels of background noise, often prevalent in poorly designed school buildings, negatively affect secondary students' ability to process verbal

instructions. This is particularly problematic in urban public schools, where external noise is more likely to intrude.

Classroom arrangement

The spatial arrangement of desks and furniture has been shown to influence interaction and collaboration among students. Dorman (2018)

Temperature and Air Quality

Acoustic quality in classrooms plays a crucial role in student comprehension and participation. Shield and Dockrell (2003) demonstrated that high levels of background noise, often prevalent in poorly designed school buildings, negatively affect secondary students' ability to process verbal instructions. This is particularly problematic in urban public schools, where external noise is more likely to intrude.

2.3: Effects of lighting on students learning in public secondary schools

Lighting can be classified into two, we have the natural and artificial lighting.

2.3.1 Natural lighting

It is well understood that a classroom with sufficient natural lighting enhance student`s attitude, attention and from this the performance of the students is affected. Natural light also improves mood and the levels of energy and from this their focus and engagement is increased. When the light (Natural lighting) is suitable and appropriate can lead to reduction of eye straining and constitute a learning environment that is convenient. When we look on the negative side of the natural light we need to understand and consider the building orientation and sun path geometry so as to provide the best environmental conditions for students during the day.

For instance, we find out that there are classrooms that have been built in a design that when the sun shines the rays of the sun penetrate through the classroom windows. This will negatively affect the learning of the students who are getting affected by the sun rays. Due to this student learning will be interfered leading to poor performance. To avoid this there should be provision of controllers which includes the curtains. There should be also larger windows from orientations with no glare, skylights that allow natural light to enter the space and translucent roofs.

2.3.2 Artificial lighting

We shall focus on both the positive and negative impacts of artificial lighting on students learning. A student brain based on the ability to focus is highly related to the way in which the lights have been lit in the classrooms. It is highly believed that students who learn in a classroom that is well lit (that is brightly lit) tend to have an environment that is conducive compared to those students who learn in classrooms that are dimly lit. Class rooms that have poor quality lighting can have some negative effects to the learners. The negative impacts may include headaches and impairs visual performance.

2.4 The effects of classroom layout and seating arrangements on student learning in publicsecondary schools

Classroom layout is the physical set up of chairs, tables and materials in the classroom. This generally means how the chairs, tables and materials have been arranged in a given classroom. The class room layout significantly affects the student learning and it plays a major role on how students interact and collaborate. In real sense, a classroom that is well designed should be flexible, should be spacious and adaptable to various activities related to learning in the classroom. The classroom should have furniture`s that are flexible in order to favor the collaborative learning that takes place. This furniture (chairs and tables) should be easy to rearrange in order to facilitate discussions. We get to understand that there are desks that are suitable to use when you want the students to hold discussions in the classrooms. This kind of desks are the one that should be used. So as to ensure that the discussion goes on well in the class room, the desks should be arranged in a semi-circle. This will make the communication among the group members effective. The seating arrangement will also enhance the student engagement because the design they have sat will enable every student to clearly hear and contribute freely to the discussion without any strain.

When it comes to individual work the seats should be arranged in the required way so as to minimize peer interaction.

That`s why it is recommended to have flexible furniture in the classrooms.

2.5 Effects of temperature and ventilation on student learning in public secondary schools

A class room that has been well designed, that is, with proper ventilations and suitable hygiene have got a great impact on student learning. It is essential to maintain comfortable room temperature in a classroom and ensure that there is proper ventilation. Temperatures that are extreme (too high or too cold) and poor air quality negatively affect the learning process.

These negative effects include; coughing, sneezing, headaches, losing interest and attention, irritations among other discomforts.

Since these effects are affecting the student learning there will be poor performance.

2.6 Effects of color and aesthetic on student learning in public secondary schools

The colors that are used in the class rooms can influence emotional states and that change in emotional state may have an impact on student learning. The colors can also motivate the students in the classroom also influence the student`s behavior and cognitive processes. Colors are crucial part of classroom designs for they affect the student`s mood and help them focus. This will highly depend on the color that has been used to furnish the class room. The color that is painted on the wall is determined by the age of the students and the education level and it should be intentional and purposeful. Each and every color symbolizes different meanings.

Colors that were discussed were blue, green, black and red.

2.6.1 Blue color

Blue color is a soothing color and it seems a relaxing and calming color. Blue color emboldens a sense of well-being, and this leads to an ideal situation for learning. These situations can be continuously challenging and cognitive taxing. But by the help of the blue color, the student will be able to handle all the challenging questions in the classroom.

2.6.2 Green color

Green color improves reading ability. This will provide a conducive environment for learning.

Calmness is also associated with green color. We also get to understand that green color increases memory for positive words

2.6.3 Black color

Black color is associated with sadness and indicates fear and worry. When this kind of color is used to furnish the classrooms then the students will be greatly affected and thus leading to discomfort resulting to poor performance.

2.6.4 Red color

Red color is normally linked with stimulation and excitement. Red color also helps with memory retention. In specific red color generally increases memory for negative words.

2.7 Effects of furniture on the performance of students in public secondary schools

Furniture improves the student's engagement, the health of the students, the focus as well as the interaction and collaboration. The furniture that is comfortable and ergonomics improve posture leading to reduction of discomfort. This will enable the students to focus better on their studies. When the furniture's are designed thoughtfully, this will lead to improved student's engagement. We all know that students interact more with furniture than all the other design elements in the classroom. They lean on it, relax, socialize and think on it since they spend most of the time in schools. So, when they are designed in the best way, students learning will be smooth.

2.8 Theoretical Framework

2.8.1 Cognitive Learning Theory

Cognitive learning theory was proposed by psychologists like Lev Vygotsky and Jean Piaget. It mainly focuses on how individuals acquire, process and store information. Cognitive learning theory aligns closely with the effects of classroom design on student learning.

This theory emphasizes on the importance of optimizing the learning environment to manage the cognitive load placed on the students. A classroom that is effectively designed can help reduce extraneous cognitive load allowing students to focus on learning materials and tasks. This will enhance their understanding and retention of information. This theory emphasizes on how the physical environment can influence cognitive process which includes; memory, attention and the

act of problem solving. Factors like the arrangement of learning spaces, accessibility to resources and are accessibility to collaboration as well.

Generally, applying this theory to classroom design includes creating environments that stimulates active thinking, provide opportunities for social interaction (which includes classroom design) and encourage the act of problem solving. This positively affects the student learning process.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter presents a detailed description of the selected research design, study area, target population, sampling techniques, sample size, measurement of variables, validity measurements, data collection techniques, data analyses and ethical considerations.

3.1 Research Design

Based on the research gathered on the study on effects of classroom design on students learning in Embu County, Kenya, a descriptive cross sectional survey research design method was used. Descriptive cross sectional survey research design aimed to collect information from respondents on their opinions and idea in relation to classroom designing in their schools. This research design method was effective because it covered a large population over a short period of time and it was affordable. It was easy to collect, record, analyze, interpret and present information gathered from the respondents.

3.2 Area of Study

The study was carried out in Embu County, Kenya. The study focused on both the girls' and boys' schools and also the mixed public secondary schools. Embu county was ready for the study topic because the teachers and parents discovered that classroom design had a great impact on students learning hence affecting the student's performance.

3.3 Target Population

In statistics target population is the specific population about which information is described. According to (Kothari, 2014) A population is well defined as the set of people, services, elements, events, group of things or households that are being investigated. In Embu County, there were 146 public secondary schools. The public schools are spread across different sub-counties. The target population of the study of Embu County was all the 146 public secondary schools.

3.4 Sampling Technique

In this study the researcher used simple sampling technique. The researcher also included the use of questionnaires and interviews. Simple sampling technique was an appropriate technique since the chosen sample would present the entire target population. This chosen samples gave final data of the study. Questionnaires were provided to the respondents to get information over a wide range of study. Interviews were also conducted from a few teachers and students to get information concerning the effects of classroom design.

3.5 Sample Size

Sample size is influenced by the characteristic of the target population.

So as to get the sample size, Cochran's (1977) simplified formula was used. The formula was;

$$n = \frac{N}{1+N(e)^2}$$

n – Sample size

N – Population size

e – level of precision required

Confidence level of 90%

Precision level of 0.1

To get the sample we used the formula above as follows;

$$n = 146 / (1+146(0.1)^2)$$

$$n = 146 / (1+146(0.01))$$

$$n = 146 / 1+1.46$$

$$n = 146 / 2.46$$

$$n = 59$$

Therefore, the sample size for the study was 59 public secondary schools.

3.6 Research Instruments

The main instrument that the researcher used to collect data in the field was questionnaires. The students were given the questionnaires to fill. Closed and open questions were used in order to allow the respondents to give more and useful information that will help the researcher to carry out the study. Gay, (2010) noted that questionnaires have considerable advantages in administration as they present an even stimulus potentiality to many. This method was suitable in Embu County since it provided accurate information to the researchers and firsthand information was be obtained.

3.7 Validity of Measurements

Kerlinger and Lee (2000) describe validity as the extent to which a test accurately measures the specific concept it claims to measure.

In order to find the effectiveness of the study, measurements were applied to the respondents.

3.8 Reliability of Measurements

In order to identify and address any potential problems or difficulties, pilot testing was conducted before the actual data collection. The retest method used to analyze if the first information is similar to the same test that was carried out three times after two weeks. This helped in honing measurements techniques and making any necessary modification before gathering data.

3.9 Data collection techniques

Data collected from the schools was by the use of questionnaires since it is relatively effective to the researcher to obtain the information. Both closed and open questionnaires were issued to the respondent.

3.10 Data Analysis and Presentations

According to Kombo and Tromp (2011), data analysis was the process of packaging the collected information putting it in order and structuring its main components in a way that the findings can easily be communicated. Data was analyzed using descriptive analysis techniques. After the analysis, the data was presented in form of tables, texts, charts and graphs. The analysis was carried out using SPSS version.

3.11 Logical and Ethical Considerations

When I was conducting the study, ethical considerations included confidentiality of the participants who were involved in the study. In addition, privacy was also considered in the questionnaires. Respect to all the respondents was also considered.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study on the effects of classroom design on student learning in public secondary schools in Embu County, Kenya. The findings are organized according to the research questions outlined in the first chapter of our study (chapter one).

This chapter starts with demographic information of the respondents, then detailed analysis of the classroom design elements, presentations, interpretation and discussions of research findings based on the respondents and it finally concludes with a discussion of the impacts of these elements on various aspects of student learning. Pie charts, graphs and tables will be included to present the findings.

4.2 Results

Students from different public secondary schools in Embu County, Kenya participated fully in answering the questionnaires. They filled out and returned the questionnaires which was a 100% return rate.

A summary of the questionnaires return rate is shown in the table 4.1.

Table 4.1: Questionnaire completion rate

Respondents	Expected responses	Actual responses	Percent
Students	2500	2500	100.0
Total	2500	2500	100.0

From the 59 schools that we collected our data from, 2500 students participated just as it was expected. From each school we got at least 40 students.

4.3 Demographic Information of the Respondents

The demographic information of the students was based on the gender, the age of the respondents and the level of the students based on class/form.

4.3.1 Students gender

The students were asked about their gender and what they indicated was as follows.

The data of the gender is shown in table 4.2.

Table 4.2: The gender of the students.

Demographic	Category	Percentage
Gender	Male	41%
	Female	59%

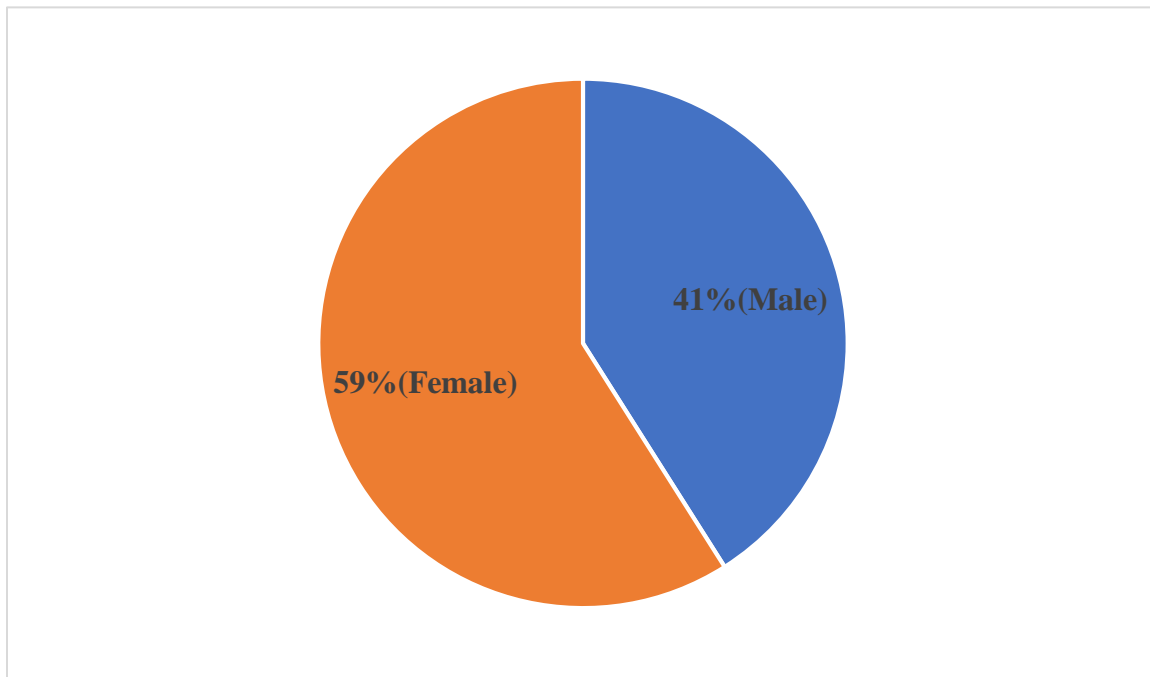


Figure 4.1 Gender of the respondents

From the table and the figure above the results shows that 41% were the male while 59% were the female. This shows that the gender was well distributed and this would help the researcher gather all the information that he needed to.

The study also aimed at determining the age of the respondents.

The findings of the age are shown in the table below.

4.3.2: The age of the respondents

The students were asked to indicate their age. The data is presented on Table 4.3

Table 4.3: the age of the respondents

Demographic	Category	Percentage
Age	14-15 years	20%

	16-17 years	75%
	18 years and above	5%

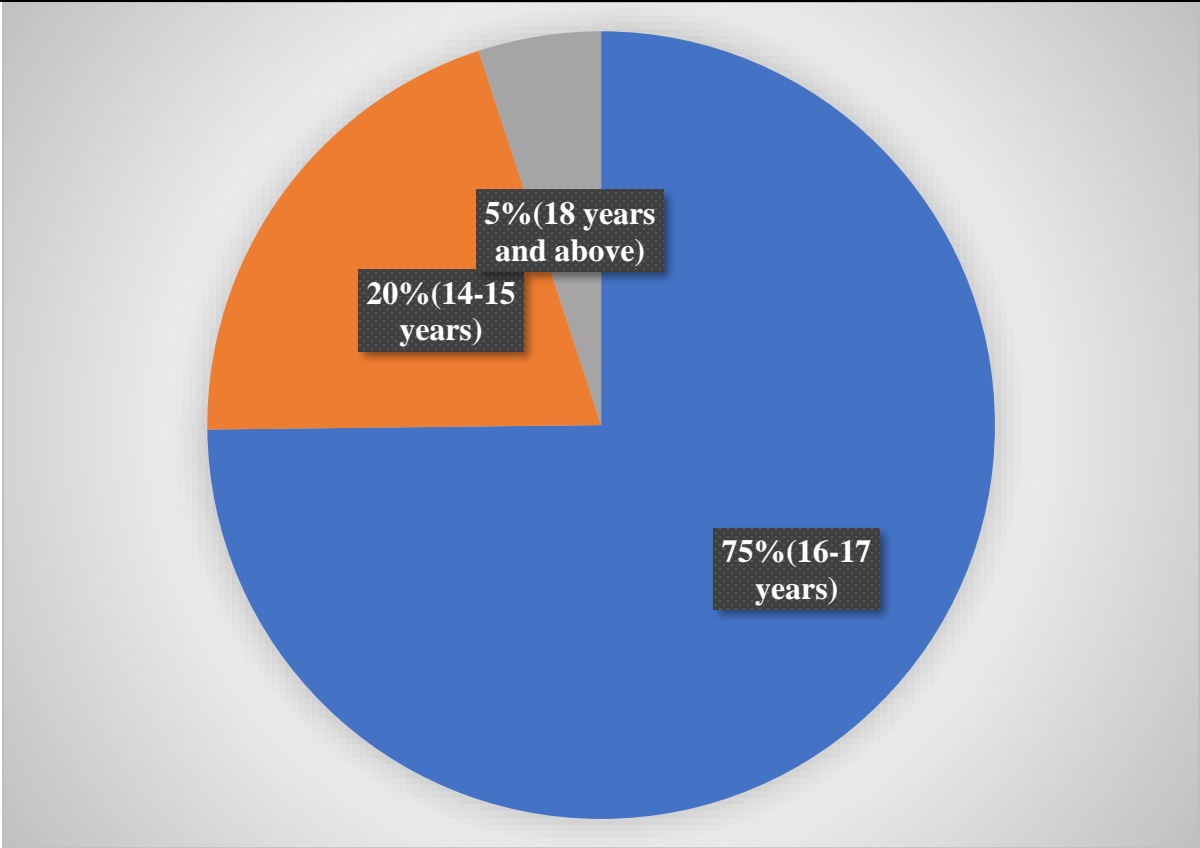


Figure 4.2 the age of the respondents

From the above table and figure, the results show that respondents between 16-17 years were the highest in number which is 75%; respondents who were 18 years and above hold the least percentage which was 5%. From our study, it was found out that they were students in the bracket of 18 years and above who aged 20 years plus. This could have been caused by maybe repeating of the classes, dropping out of school and then joining back later after some years and also starting to school late than recommended; while respondents between 14-15 years were 20%.

4.3.3: Students level

The study also assessed the level of the respondents based on their class/form.

The data of the level of the respondents is shown in the table below.

Table 4.4: The level of the respondents

Demographic	Category	Percentage
Class/ level	Form one	20%
	Form two	15%
	Form three	30%
	Form four	35%

The results in table 4.4 shows the majority of the respondents were students in form four which holds a percentage of 35%; 30% of the respondents were students in form 3; 20% of the respondents were in form one; while 15% of the respondents were in form two. The study targeted students from all forms since they all interact with their classrooms at a high level.

4.3.4: The number of streams in schools

The study also assessed the number of streams in the schools. The students were asked to indicate the number of streams of their schools.

The data is as shown in table 4.5

Table 4.5: The number of streams

Streams	Percentage
2 streams	17%
3 streams	22%
Above 3 streams	61%

The table above indicated that 17% had 2 streams; 22% had 3 streams;61% had 3 streams and above. Since the population in Embu County is growing at a very first rate you find out that most of the schools are those with streams and above so as to favor all learners.

4.3.5: The average number of students per class

The students were asked to put down the average number of students in their class rooms.

The table below shows the results.

Table 4.6: The average number of students per class

Average number of students	Percentage
45- 55	49%
55 and above	51%

The results in table 4.6 show that majority of the schools have 55 students and above which is 51%. It is recommended that a class should hold 35-40 students. But then in our case it is so different since the results from Embu County clearly show that classes there are overpopulated with 55 students and above. This is a recommendation from MoE. From our study, none of the chosen schools met the recommendation. All schools had 45 students per class.

4.4 Classroom design elements

In chapter one of the study, a number of elements of classroom design were highlighted on the objectives. In this chapter we are going to examine these elements of classroom design and they were as follows;

- Lighting
- Classroom layout and seating arrangement
- Temperature and ventilation
- Color and aesthetic
- Furniture

4.4.1 Lightning

Based on lighting as a classroom design element, students were asked to indicate whether the lights that reach their classrooms during the day were usually enough.

The results were as follows:

Table 4.7: Students responses about lighting.

CHOICES	PERCENT
YES	93%
NO	7%

The results show that in most of the classrooms in the schools visited, there is enough light that supports their learning. This was clearly shown by the 93% which indicated that light reaching

their classroom was enough and the 7% which shown that they did not assess enough light in their classroom.

The respondents also stated that they preferred natural lighting over artificial lighting

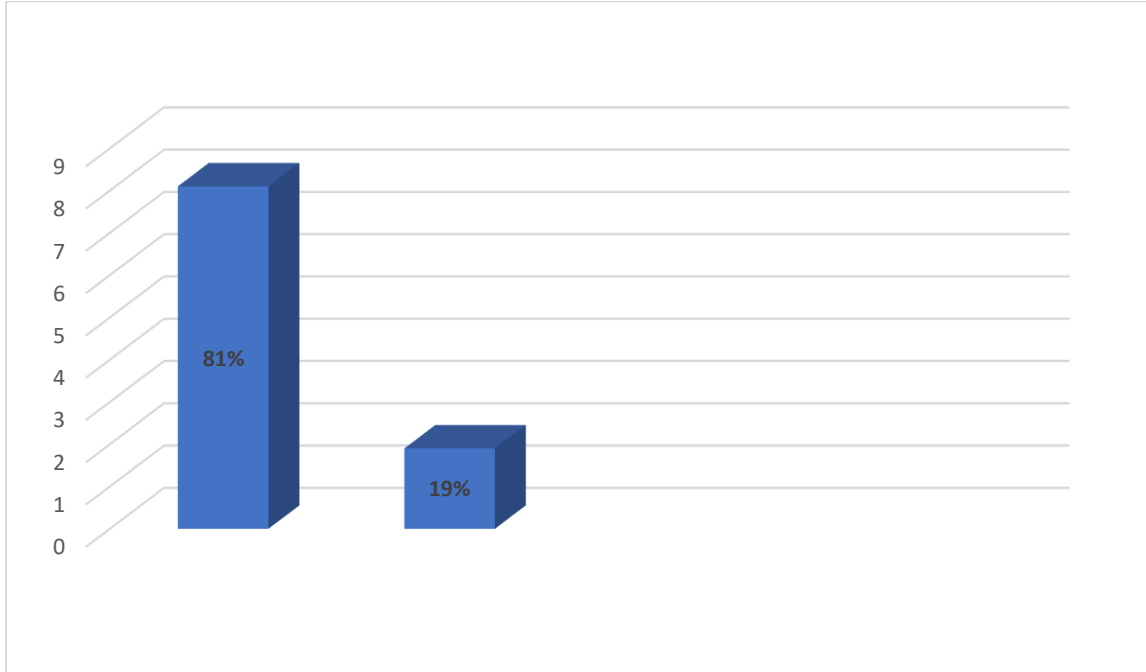


Figure 4.3 Natural lighting over artificial lighting

The above graph clearly shows that the students chose 81% natural lighting over the 19% artificial lighting. Artificial lighting which includes electric bulbs, the torches, oil lamp and candles did not favor the students as compared to the natural lighting which includes the stars, sun, fire flies among others.

4.4.2 Classroom layout and seating arrangement

On classroom layout and seating arrangement, a number of issues were looked at. The table below shows the results on classroom layout and seating arrangement

Table 4.8: Students responses on classroom layout and seating arrangement

Element	Preferred option	Percentage
Classroom layout and seating arrangement	Flexible	89%
	Fixed	11%

From the table, the results showed that 89% of the students preferred flexible seating arrangement over fixed seating arrangement which was 11%. A flexible arrangement includes a spacious classroom, proper arrangement of the chairs and desks and adjustable chairs and desks. Flexible arrangement also made it easy when it came to discussion time since it is easy to move with the flexible chairs and desks.

4.4.3 Temperature and ventilation

From the findings, it was clearly shown that 78% of the respondents stipulated that proper ventilation, suitable hygiene favor their learning and increases their ability to stay focused while in the classroom. A classroom with extreme temperature and one which is poorly ventilated negativity affects their learning process. The effects that are brought about by a poorly ventilated classroom include; sneezing, headache, losing interest among others.

The student`s responses included that; high temperature always affects them when they are in the classrooms and also indicated that, during the day when temperatures are extremely high the teachers usually take them outside to learn from there.

Table 4.9: Students responses on temperature and ventilation

Element	Preferred option	Percentage
Temperature and ventilation	Well ventilated	78%
	Poorly ventilated	22%

This table clearly shows that students preferred a well-ventilated classroom that will be free from high temperatures which was 78%. This will highly support their participation in class and also boost their academic performance. 22% were those who choose a classroom that is not well-ventilated. This might have been caused by the students not clearly understanding the question and mistakenly feeling the left space with less concentration.

4.4.4 Color and aesthetic

75% of the students indicated that brilliant colors, cosy colors impact them positively. The students emotional state, student`s moods by the brilliant colors. The cosy colors also help students stay focused, they also get motivated to learn and increases their concentration.

Table 4.10: Students responses on color and aesthetic

The table below shows the respondents of the students about; a blue color painted on the wall, it emboldens a sense of well-being and this promotes an ideal environment for their learning.

Element	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Percentage	32%	28%	22%	16%	2%

The table above shows that the students are attracted by brilliant colors since they stimulate their attention.

Element	Preferred option	Percentage
Color and aesthetic	Brilliant colors	75%
	Neutral colors	25%

The table clearly shows that students prefer brilliant/warm colors over cool colors.

4.4.5 Furniture

From the finding, it was clearly shown that 85% of the students believes that furniture improves their engagement, their health, their focus and collaboration. Comfortable furniture leads to reduction of discomfort and highly supports their attention while in class.

Table 4.11: Students responses on furniture.

Element	Preferred option	Percentage
Furniture	Comfortable	85%
	Uncomfortable	15%

Below is a summary of the responses that were got from the students based on classroom design elements

ELEMENTS	PREFERRED OPTION	PERCENTAGE
Lighting	Natural lighting	81%
	Artificial lighting	19%
Classroom layout and seating arrangement	Flexible	89%

	Flexible	11%
Temperature and ventilation	Well ventilated	78%
	Poorly ventilated	22%
Color and aesthetic	Brilliant\warm	75%
	Neutral\warm color	25%
Furniture	Comfortable furniture	85%
	Uncomfortable furniture	15%

The pie chart below shows the responses of the students on the preferences for color and aesthetic, and temperature and ventilation

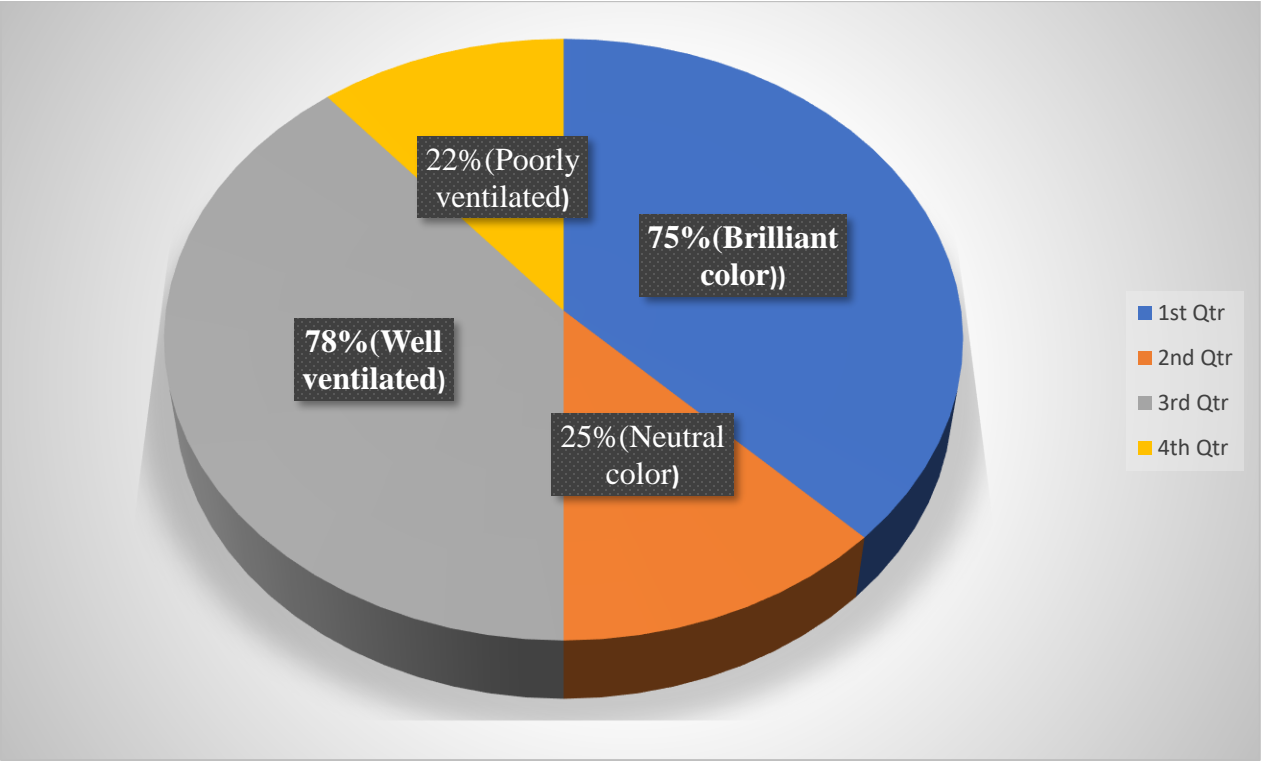


Figure 4.4 shows pie chart preferences for color and aesthetic, and temperature and ventilation

The figure above shows the preferences for color and aesthetic, temperature and ventilation. It is clear that 78% out of a 100% preferred a well-ventilated classroom. This would help in proper circulation of air therefore ensuring that the temperatures are not extreme. This will highly support their participation in class and also boost their academic performance.

On the other hand, 75% out of a 100% chose brilliant\warm colors over dull colors. It is visible that students in Embu County have an understanding that brilliant colors have got a positive effect to their learning as compared to the dull colors which includes black.

4.5 Impacts on student involvement and learning end results.

During the study, the student`s involvement and learning end results were measured.

This was done through surveys and academic performance benchmark.

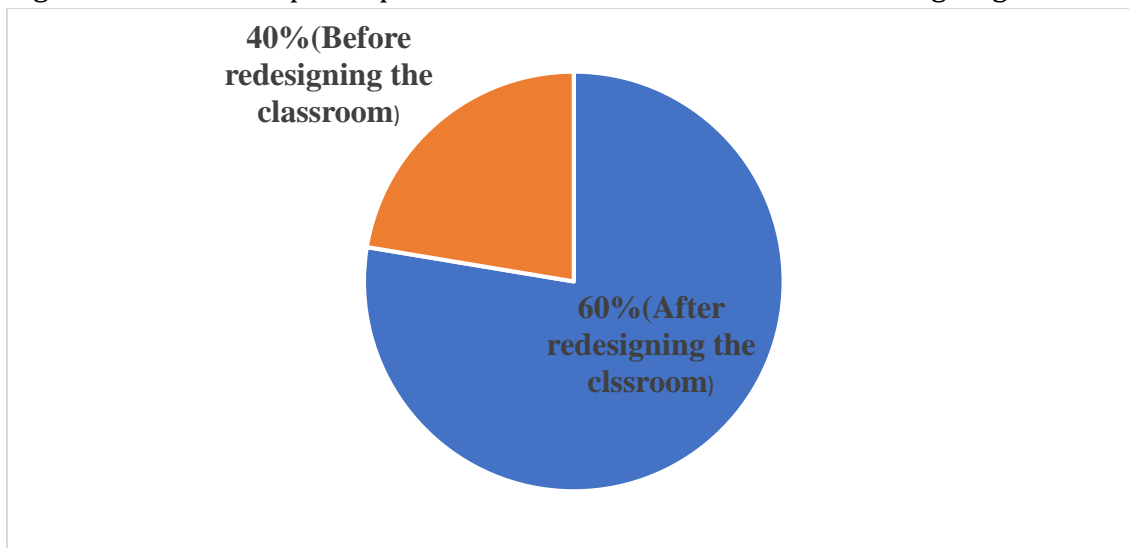
4.5.1 Involvement

A classroom that is well designed, that is one that has natural lighting, flexible furniture, well ventilated, warm colors painted on the classroom walls and comfortable furniture have got positive effects to the students and thus indicated a very high involvement of the learner`s. 84% highlighted that they were do much focused, emotionally considered and attentive in well-designed classrooms.

4.5.2 Academic performance

Based on classroom design, implementations were made. And afterwards, normal learning took place and some texts were given to the students. There were two tests given; one was given before implantations and the other was given after the implementations. This was done so as to determine if really classroom design had any impacts on their performance.

Figure 4.5 - learners participated in the tests before and after redesigning



The figure below (figure 4.5) shows how the learners participated in the tests before and after redesigning

Before redesigning the classrooms, there is a test that was issued. Then after the redesigning of the classrooms another test was issued. From our study, it is clear that there was an improvement. The scores of the tests after redesigning were pleasing as compared to those issued before redesigning. Before redesigning it was 40% then after redesigning it was at 60%.

4.6 Qualitative feedback from students

During the study, the students provided feedback using the following ways;

Focus group discussions

Open ended questions

From the feedback obtained a lot was gathered. Some of the key impacts that were looked at included:

Lighting

Comfort

Color and aesthetic

4.6.1 Lighting

The students came into conclusion by quoting that a classroom with enough light and natural lighting favor their learning. The light provides a positive and conducive area for learning and stimulates them while in the classroom. They also highlighted due to the enough light received in the classroom, chances of straining, severe headache among other challenges are minimized

4.6.2 Comfort

The students appreciated classrooms with comfortable seating and enough space. Comfortable seating may include: flexible chairs and desks and proper arrangement. It was noted that proper arrangement favored them while learning. They also stated that the flexible desks were do much reliable when it came to discussion time.

4.6.3 Color and aesthetic

Bright and warm colors painted on the classroom walls, affected the learners positively. This was proven by the students when they stated that bright colors motivate them to learn more, increases their attention and concentration, and helps then stay focused while in their classrooms.

4.7 Discussion

The study established that a classroom with natural lighting, flexible arrangement, well-ventilated space, warm/brilliant colors and comfortable furniture supports student learning positively in public secondary schools in Embu County, Kenya. These elements enhance the student's involvement and affects their academic performance outcome. From the study, it was found out that schools should consider lighting as an element and ensure that they enough light in all the classrooms in the schools. It will favor the learners by helping them stay focused and also boost their academic performance. The study also show that schools should consider having classrooms with flexible seating arrangement which will facilitate the group work and active learning. Well-ventilated classroom is another element that schools should put into consideration. In a classroom where they is proper circulation of air the students concentration will be considered. The study established that color and aesthetic, and comfortable furniture should also be considered. The study examined that improved classroom design led to very high student involvement and boosts the student's academic performance.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1: Introduction

The chapter presents the summary of research findings, conclusion of the study, recommendations for policy or practices and recommendations for further research.

5.2: Summary of research findings

The study investigated the effects of classroom design on student learning in public secondary schools in Embu County, Kenya. The research objectives were; To find out the effects of lighting on student learning in public secondary schools, To find out the effects of classroom layout and seating arrangement on students learning in public secondary schools, To find out the effects of temperature and ventilation on student learning in public secondary schools, To determine the effects of color and aesthetic on student learning in public secondary schools. The study used descriptive research design. The target population included only the students; form one to form four. The sample size consisted of 146 public secondary schools in Embu County. The data was gathered through questionnaires and focus group discussions. The questionnaires were only one set which were directed to the student.

The study found out that there is a relation between a well-designed classroom and good performance. Meaning, for learners to well perform classroom design must be considered. The students preferred natural lighting over artificial lighting, flexible arrangement over fixed seating arrangement, brilliant/warm colors to help them stay focused and concentrate over dull colors, well-ventilated spaces for free circulation of air over poorly ventilated classroom and comfortable furniture to improve their interaction and engagement over uncomfortable furniture. The findings revealed that well-designed classrooms improved student learning.

The study clearly shown that a classroom that is well designed increases student`s participation, engagement and their focus while in the classrooms. It was proven that well designed classroom not only boosts the learner`s participation but also affects their academic performance. In our study, a difference was noted between two tests that were done before and after classroom renovations. The results indicated that a classroom that has got the elements stated above leads to student`s success but a classroom that does not have the elements redesigned leads to poor results.

5.3 Conclusion

From the study, it is clear that a well-designed classroom increase student`s attention, participation, involvement and improves their academic performance. The study concludes that classroom design plays a big role in enhancing student learning in public secondary schools in Embu County, Kenya. The findings have shown that a classroom that is well designed can lead to improved academic performance, high level of participation, engagement and the student`s attentiveness.

The study concludes that schools should consider elements like; natural lighting, flexible furniture, well-ventilated spaces, bright/ warm colors and comfortable furniture. When this is followed in

schools there will be conducive environments for their learning and this will also inspire students in school.

The study also concludes that a classroom that is poorly designed got negative effects to the students. The effects may include;

Eye strain caused by lack of enough light in the classrooms

Emotions affected negativity caused by black color painted on the classroom walls.

Severe headaches, coughing, sneezing losing interest and attention caused by poor ventilated classrooms

Discomfort leading to health issues caused by uncomfortable furniture. Since it's EFA all students should be considered by ensuring that their learning environment is conducive and equality should be observed at all time.

5.4 Recommendations

Based on the findings, analysis and conclusions of the study, the following recommendations were made;

5.4.1 Recommendations for policy

On the recommendations for policy a number of issues can be looked at and they are as follows;

- Funding and resources
- Guidelines and standards
- Professional development
- On funding and resources, policy makers and the GoK should allocate funds to cater for redesigning and also building other new classrooms. In the public secondary schools. They should prioritize a conducive environment that will favor learners in their learning process. The funds should be specifically allocated for redesigning the classrooms and building new classrooms. Resources should also be allocated in order to cater for the learners in schools. The resources may include; material resources, human resources and technological resources among others. By following this, the environment for the learners will be conducive and suitable for their learning.
- On guidelines and standards, motivational programs should be put in place for school managers, teachers and students so as to encourage them, guide and maintain their focus on their roles and contribution towards effective and efficient classroom design.
- On professional development, the school administrators and teachers need to be trained on the benefits of a well-designed classroom and how to use the different design elements in order to intensify student learning.

5.4.2 Recommendations for further research

The researcher suggests that; the study was conducted in Embu County, a similar study should be done in other counties to establish status of classroom design in those schools. A study can be conducted in other areas to further our understanding of how to optimize classroom environments to support the student`s education journey.

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APPENDICES

APPENDIX; ONE: QUESTIONNAIRES INTRODUCTION.

My name is Mwende Joy Davine a degree student from Grets University. I am conducting a research on the effects of classroom design on student learning in public secondary schools in Embu County, Kenya. I request you to fill the following questionnaires.

PRIVACY DECLARATION

I would like to inform you that all information generated from this questionnaire is to be used for research purposes only and shall not be disclosed to third parties. Privacy and confidentiality is highly considered by the researchers and will be maintained at all cost.

SECTION A: PERSONAL DATA

Tick an appropriate option.

Tick only one.

1) Select your gender

Male [] Female []

2) How old are you?

- 14 years []
- 15 years []
- 16 years []
- 17 years []
- Above 18 years []

3) In which form are you?

Form 1 [] Form 2 [] Form 3 [] Form 4 []

4) How many streams do you have in your school

- 2 streams
- 3 streams
- Above 3 streams

5) What is the average number of students In you class

- 45-55
- Above 55

SECTION B: TECHNICAL QUESTIONS

1)Among the following factors which one supports your attention when the teacher is teaching.

- Black color painted on the classroom wall
- Too high temperatures
- Comfortable furniture
- A classroom with minimal lighting

2)What motivates you to learn more?.....
.....

3)How do you rate how your classroom has been designed?

- Excellent
- Good
- Fair
- Poor

4)Do you focus while in class?

Yes []

No []

5)If NO state down what takes away your attention.....
.....

6)According to you, do you think that the school provides a good and conducive environment that favors your learning activities?

- Yes []
- No []

7)If NO write down what the school should put into consideration in order to support your learning activities.....
.....

8)Do high temperatures affect you when you are in the classroom?

- YES []

- No []

9)How often do high temperatures in the afternoon affect your learning?

- Always []
- Sometimes []
- Rarely

10)In the afternoon when the temperatures are high and unsustainable, do your teachers decide to take you out and learn from outside so as to curb the extreme temperatures in the classroom?

- Yes []
- NO []

11)When you talk to the administration about the negative effects that you come across from the quantity of sun heat that the classroom receives, do they take any action on solving the issue?

- Yes []
- No []

12)Please share your agreement with this statement:

Our principal promised to purchase new furniture that provides the required comfort while in class, furniture that will influence collaborative activities and individual learning preferences.

- Strongly agree []
- Agree []
- Neutral []
- Disagree []
- Strongly disagree []

13)Is the light that reaches your classroom during the day enough?

- Yes []
- No []

14)If NO state the problems that you pass through while learning with minimal lighting.....
.....

15)Does the organization and layout of the classroom affect the ease of movement and access to learning materials?

- Yes []
- No []

16)If YES state

how.....
.....
.....

17)Please share your agreement with this statement:

18)All the classrooms in our school have been painted a blue color on the wall. This been a relaxing and calming color, it emboldens a sense of well-being and this promotes an ideal environment for my learning.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree