

**ORIGINAL RESEARCH ARTICLE****Kenya Medical Training College laboratory student perception on adequacy of teaching and learning resources in the advent of COVID-19.****Benson Mbatii Kondo¹, Simon Kang'ethe¹, Anne Ngeno¹**¹Moi University, Department of Medical Education, Eldoret, KenyaCorresponding author email: bkmbati@yahoo.com**Abstract**

The emergence of COVID-19 presented a big challenge in medical education, especially with regard to the adequacy of teaching and learning resources. In addition, an increase in student intake and demand for Kenya Medical Training College courses could compromise these resources. This study investigated the perceptions of students towards the adequacy of teaching and learning resources at Kenya Medical Training College in the advent of COVID-19. The general objective was to determine the perceived adequacy of teaching and learning resources in the advent of COVID-19 by students in the department of Medical Laboratory Sciences at Kenya Medical Training College. A descriptive cross-sectional study design using mixed methods (triangulation) was used. Simple random sampling of the eight regions in the country was used to select one region (the Eastern Region). Census sampling was used to select all the four campuses in the region namely Machakos, Meru, Embu, and Kitui, which offer medical laboratory sciences. The study population was students in the department of medical laboratory sciences on these campuses, with 220 students participating. The data collection instrument was a self-administered closed- and open-ended questionnaires. Quantitative data collected was analysed using SPSS software, while qualitative data was analysed using themes. The response rate was 100% (220 students). The gender distribution among students showed a higher percentage in male (58%). Majority of the students were 21-23 years (35%). One-way ANOVA presented a statistically significance between and within groups ($P < 0.05$). Majority of students (51.8%) were not satisfied with adequacy of human resources. Majority of students perceived the state of physical facilities to be in poor state with a mean of 1.76, while the satisfaction level of majority of students' on teaching aids was below 3.40 representing very inadequate to neutral. Ordinal regression tests on satisfaction level on teaching aids in relation to gender, year of study and campus was significant (chi-square test $p < 0.000$) while the goodness of fit model was ($p = 1.000$) indicating it was a good model. R^2 value (Nagelkerke=99%) indicated that the study factors had great variations. The spearman's rank test showed that laboratory equipment and computer assisted aids, internet, learning systems have negative correlation but with very strong coefficient correlation of 1.0000. Satisfaction levels with teaching aids in relation to gender, year of study, and campus were significant with a chi-square test of $P < 0.000$. The study concluded that there were inadequate teaching and learning resources on the four KMTTC campuses before COVID-19.

Key words: Perception, adequacy, teaching/learning resources, students, advent, COVID-19



1.0 Introduction

Teaching and learning resources form the backbone for training healthcare professionals. They enhance the acquisition of relevant knowledge and skills, facilitate the delivery of information, and influence the development of attitudes. The adequacy of quality and relevant teaching materials is crucial for the training of all healthcare professionals as well as for continuing professional development. Without appropriate teaching and learning materials, healthcare professionals encounter many problems in training and practise. Even when the materials are available, there is a need for periodic review and production of new ones to cope with time and technology. Teaching and learning involve complex processes used in the active transfer of knowledge from an instructor to a learner. As outlined by Sequeira (2012), learning brings about a permanent change in behaviour through the acquisition of new skills. Teaching, also referred to as instruction, is the employment of different techniques to impact knowledge, skills, and attitudes in a learner. Of importance is that information can only be passed to the learner effectively if an instructor uses the right materials for the presentation of relevant content. Teaching and learning resources are therefore potent instructional facilities that must be envisaged by teachers in the administration of the content of the curriculum. This is evident from the curriculum development with regard to the ten steps as follows; Identification of Need/Problem, Identification of Professional Roles and Functions/Tasks/ Responsibilities, Performing Task Analysis, Developing Educational Objectives, Developing Content, Teaching Methods and Learning Activities, Developing Instructional resources, Evaluation and Assessment of Student Performance, Curriculum Implementation whereby one of the identified step is the development of teaching and learning resources, (Njeru et al., 2020).

The COVID-19 pandemic has had a significant impact on teaching and learning resources, which may have compromised the quality of education. With over 100,000 students spread across 71 campuses, Kenya Medical Training College (KMTC) is facing an increasing demand for teaching resources. In particular, the need for diagnostic courses like medical laboratory sciences has grown, but COVID-19 has presented unprecedented challenges such as a shortage of laboratory equipment, physical facilities, teaching aids, and human resources for teaching and learning. This has led to the sharing of limited resources, which compromises the quality of training. According to the OECD (2020), the pandemic affected public spending on education as funds were diverted into the health sector and the economy.

While KMTC has produced numerous graduates in medical laboratory sciences, it remains to be seen whether all campuses offering the medical laboratory science course had adequate resources with the advent of COVID-91, especially with an increasing demand for laboratory technicians. Kenya Medical Training College requires both academic and non-academic staff, physical facilities, teaching aids, crucial equipment, and reagents for teaching and learning. While KMLTTB (2002) recommends that the ratio of teacher to student should be 1:10, COVID-19 has strained teaching and learning resource provision in institutions of learning. Most medical schools and universities are understaffed and lack basic teaching equipment. Given the drastic effects of COVID-19 on the adequacy of teaching and learning resources, it is crucial to explore the perceptions of learners on the adequacy of teaching and learning in the advent of COVID-19 for better preparedness and a continued learning process (Curran, 2020). Murgatrot

(2020) reported that the education system was disrupted by the global COVID-19 pandemic due to a lack of accessibility, affordability, flexibility, learning pedagogy, and life-long learning. Inadequate teaching and learning resources affected the implementation of the curriculum. This, in turn, may cause inadequacies in knowledge, skills, and attitudes among learners.

According to Mohammad (2014), the availability of resources affects the quality of training in any medical service. Resources include instructional materials and media that a teacher may use to stimulate all the senses of the learner during learning. Materials include all those physical structures, such as classrooms, and objects, such as printed texts, charts, posters, LCD projectors, the internet, smart phones, computers, physical facilities, and human resources. Cross-sectional survey was conducted by Wynter et al. (2019) on educational resources used by medical students during learning. The research concluded that the majority of the students used traditional resources and not modern resources such as E-learning. According to Talukder (2011), medical colleges should have adequate trained manpower for medical education, audiovisual experts, computer operators, and support staff. In essence, the human resource establishment in medical colleges should focus on staff with technical skills in various fields, such as lecturers.

The status of physical facilities, especially in public schools, tertiary institutions like KMTTC, and universities today, appears to be of great concern to educators. Due to an increase in college enrollment and such pandemics as COVID-19, Ebola, and Influenza, the provision of facilities has dwindled. These problems and concerns necessitate finding out the perception of lecturers and students on the adequacy of the physical facilities, especially in line with the standards set by medical regulatory bodies including the Nursing Council of Kenya, the Clinical Officers Council, the Pharmacy and Poisons Board, and the Kenya Medical Laboratory Technicians and Technologies Board. The KMLTTB clearly stipulates the profile of each physical facility, including classrooms, demonstration rooms, libraries, ablution/toilets, and transportation, with regards to number in place, size, sitting capacity, fittings in regards to windows, doors, emergency exits, desks/fixed benches, water provision, necessary plumbing (sink and waste disposal), essential equipment, reagents, and availability of current books or journals as per the prescribed list.

A common phenomenon nowadays is the location of medical colleges on buildings or campuses meant for other purposes (Akram et al., 2016).

According to Orwenjo (2021), the outcome of teaching and learning is dependent on the perceptions of students towards lecturers and the resources used for teaching. Thus, the availability of appropriate media for teaching has an influence on the outcomes of teaching and learning and, subsequently, on the attitudes of students towards learning. Therefore, the general objective of the study was to find out the perception among Medical Laboratory Sciences students at Kenya Medical Training College on the adequacy of teaching and learning resources in the advent of COVID-19. The specific objectives were:

- i. To determine the perceived adequacy of human resources, and
- ii. To determine the perceived adequacy of physical facilities and projected or non-projected teaching aids.

The research questions were:

- i. What is the perceived adequacy of human resources?
- ii. What is the perceived adequacy of physical facilities and projected or non-projected teaching aids?

2.0 Materials and methods

The study employed a descriptive cross-sectional study design and mixed methods of both qualitative and quantitative data collection. According to Mugenda & Mugenda (2003), this design was adequate in collecting data that addressed the intended research questions for the study, which were: what is the perceived adequacy of human resources; what is the adequacy of physical facilities; and what is the adequacy of projected or non-projected teaching aids?.

2.1 Study population

Kenya has eight regions, one of which (the Eastern Region) was selected through random sampling. The four KMTC campuses in the region, namely Embu, Meru, Kitui, and Machakos, were purposefully sampled.

The study involved students in the department of medical laboratory sciences on the four KMTC campuses: Embu, Meru, Kitui, and Machakos.

2.2 Sample size determination

The total number of medical laboratory science students in years 1, 2, and 3 was 514 in the 4 campuses. This is less than 10,000; thus, Fischer et al.'s (1990) method of determining the sample size for a population less than 10,000 was used to determine the sample size of students. The standards for determining the sample size were as follows:

$$n = Z^2pq/d^2$$

Z = normal deviance at the level of the 95% confidence interval = 1.96

p: Proportion of population with desired characteristics

q: Proportion without desired characteristics

n: Desired sample size

d: Statistical error margin (5%)

Since there is no estimate available of the proportion, the target population was assumed to have the same characteristics (50%).

Therefore

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

Where $n = 385$

N which is 514 students is less than 10, 000 (the population of medical laboratory students).

Therefore, Yamane (1967) formula was used to determine the actual sample size.

$$nf = \frac{n}{1 + n/N}$$

nf = desired sample population less than 10,000

n = desired sample size = 385

N = total population = 514

$$nf = \frac{385}{1 + 385/514}$$

Therefore, the sample size was 220 students.

2.3 Sampling techniques

Further, the study employed proportionate sampling techniques to determine the exact number of students on each campus and per year. Proportionate sampling is a method in which a researcher divides a population into subgroups and then applies random sampling methods to the subgroups to develop the required sample size. In this way, strata were created for first-year, second-year, and third-year students to form the sample size of 220. Further, simple random sampling was carried out in each stratum to set the actual size accordingly, as stated. Machakos – First Year (30 students) – 13, Second Year (45 students) – 19, Third Year (50 students) – 21, Meru- First Year (30 students) – 13, Second Year (49 students) – 21, Third Year (50 students) – 21, Kitui- First Year (30 students) – 12, Second Year (50 students) – 22, Third Year (50 students) – 22, Embu- First Year (30 students) – 12, Second Year (50 students) – 22, Third Year (50 students) – 22, Total= 220.

2.4 Data collection

A descriptive cross-sectional study design and mixed methods of both quantitative and qualitative data collection techniques were employed. The rationale for the mixed methods design was to obtain a more comprehensive view and more data that addressed the intended research questions for the study, as recommended by Mugenda (2003). Data was collected through the use of structured questionnaires comprising both open-ended and closed-ended questions. To ensure validity, the research instruments underwent scrutiny from a panel of peer reviewers. Further, to ensure reliability, pretesting of the data collection instruments was conducted at the Department of Medical Laboratory Sciences, KMTC Nakuru campus, which is not one of the campuses chosen for this study.

2.5 Data analysis

The data was edited, cleaned, sorted, coded, and classified as either quantitative or qualitative for easier presentation (Mugenda & Mugenda, 2003). Analysis was conducted using Statistical Package for Social Sciences (SPSS) Version 28. Thereafter, qualitative data was presented through the use of themes, while quantitative data was presented through frequency distribution tables, pie charts, bar graphs, and histograms.

3.0 Results

The response rate among students showing the percentage of respondents who completed the questionnaires was 100% (=220).

3.1 Perceived adequacy of human resources

The perceived adequacy of male lecturers showed a higher mean score relative to that of female lecturers (mean = 1.4709, mean = 1.0045), respectively; see Table 1. All the lecturer staff were perceived by students to be very inadequate, that is, falling in the category of from 1 to 1.80 (Very inadequate). Particularly, students perceived being up to just a neutral (mean = 3.2048).

Table 1: Perceived adequacy of male and female lecturers.

		Perceived adequacy of number of male lecturers in MLS department	Perceived adequacy of number of female lecturers in MLS department	Satisfaction level with staffing
N	Valid	220	220	220
	Missing	0	0	0
Mean		1.4709	1.0045	3.2048
Std. Deviation		.50027	.06696	1.38616

This is further demonstrated by Table 2, which shows that about 51.8% were not satisfied with the lecturers' staffing.

Table 2: Student satisfaction with staffing of lecturers

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely Dissatisfied	40	12.9	18
	Dissatisfied	34	10.2	13.9
	Neutral	45	15.1	20.5
	Satisfied	55	20.0	27.1
	Extremely Satisfied	46	15.6	21.1
Total	220	73.8	100.0	100.0
Missing	System	0		

In order to determine the availability and adequacy of staff, including male and female (support staff and lecturers), the aggregate perception by students was interpreted based on mean scores and standard deviations of the responses to the selected open-ended items rated on a four-point Likert scale, and since the mean scores required proper interpretation, it was important to give the scale for interpretation based on a five-scale interpretation as follows:

Mean score level interpretation

- a) From 1 to 1.80 represents (Very Inadequate) / very poor /Very Dissatisfied.
- b) From 1.81 until 2.60 represents (Inadequate) / Poor / Dissatisfied
- c) From 2.61 until 3.40 represents (Neutral) / Average / Neutral
- d) From 3:41 until 4:20 represents (adequate) / Good / Satisfied
- e) From 4:21 until 5:00 represents (Very adequate) / Very good / Very Satisfied

A mean satisfaction level of 1.0538 towards the male support staff falls into the very inadequate, very poor, or very a mean satisfaction level of 1.0538 towards the male support staff falls into the "very inadequate," "very poor," or "very dissatisfied" categories. On the other hand, the mean satisfaction level of 1.0045 towards the female support staff also falls in the (Very Inadequate/Very Poor/Very Dissatisfied) category. In general, the satisfaction levels of students towards both male and female support staffing were low, with a mean satisfaction level (3.2048) below the "Neutral" category.

Table 3: Satisfaction level with staffing on support staff

Statistics		Number of male support staff	Number of female support staff	Satisfaction level
N	Valid	220	220	220
	Missing	0	0	0
Mean		1.0538	1.0045	3.2048
Std. Deviation		.67569	.06696	1.38616

3.2 Perceived adequacy of physical facilities

Satisfaction level on adequacy of physical facilities (rooms available as offices, classrooms, demo laboratories, skills laboratories, and computer laboratories) by students in the Medical Laboratory Sciences department using the measures of central tendency to interpret the five-level Likert scale on satisfaction level in regards to number of rooms occupied and using the five-point mean interpretation (see below), there was no adequate number of rooms in all the five clusters, with only demonstration laboratories showing the highest mean (3.1698). All the other rooms were below the adequacy scale (2.61 to 3.40 represents neutral, average, or Neutral), see Table 4.

Mean-level interpretation scale

- a) From 1 to 1.80 represents (Very Inadequate) / very poor /Very Dissatisfied.
- b) From 1.81 until 2.60 represents (Inadequate) / Poor / Dissatisfied
- c) From 2.61 until 3.40 represents (Neutral) / Average / Neutral
- d) From 3:41 until 4:20 represents (adequate) / Good / Satisfied
- e) From 4:21 until 5:00 represents (Very adequate) / Very good / Very Satisfied

Satisfaction level on rooms occupied by	N	Minimum	Maximum	Mean	Std. Deviation
Offices	220	1.00	5.00	2.8261	1.38252
Classrooms	220	1.00	5.00	2.2595	1.31783
Demo laboratories	220	1.00	5.00	3.1698	1.37666
Skills laboratories	220	1.00	5.00	3.1041	3.68819
Computer laboratories	220	1.00	5.00	2.5818	1.36747
Valid N (listwise)	220				

3.3 Perceived adequacy of teaching aids (projected and non-projected)

The adequacy of teaching and learning aids was assessed by asking the students to rate the satisfaction level on a five-point Likert scale (1= extremely dissatisfied to indicate a lack of enough aids, 2 = dissatisfied, 3= neutral, 4= satisfied, and 5= very satisfied to indicate satisfactory levels of the teaching aids).

The students were asked to rate fourteen (14) different factors associated with the state of teaching and learning aids at their MLS departments. The factors used to rate the state of the resources provided included level of satisfaction with whiteboards, flipcharts, overhead projectors, posters, handouts, chalkboards, boards, textbooks, DVD players, tape recorders, episopes, computer-assisted aids, and internet connectivity.

Response based on a Likert scale of 5 showed that only whiteboards and overhead projectors attracted above-good satisfaction levels (from 3:41 until 4:20 represents adequate/good/satisfied), while the rest demonstrated below-neutral satisfaction levels, as indicated in Table 5.

Mean-level interpretation

- From 1 to 1.80 represents (Very Inadequate) / very poor /Very Dissatisfied.
- From 1.81 until 2.60 represents (Inadequate) / Poor / Dissatisfied
- From 2.61 until 3.40 represents (Neutral) / Average / Neutral
- From 3:41 until 4:20 represents (adequate) / Good / Satisfied
- From 4:21 until 5:00 represents (Very adequate) / Very good / Very Satisfied

Table 5: Satisfaction level on teaching aids (projected and non-projected aids)

Satisfaction with:	N	Minimum	Maximum	Mean	Std. Deviation
Whiteboards	217	1.00	5.00	3.6452	1.52096
Flipcharts	203	1.00	5.00	3.0345	1.33639
Overhead Projectors	213	1.00	5.00	3.7042	1.18633
Posters	201	1.00	5.00	3.2139	1.28024
Handouts	200	1.00	5.00	3.3050	1.32694
Chalkboards	194	1.00	5.00	2.7577	1.44612
Magnetic boards	185	1.00	5.00	2.2919	1.32746
Textbooks	212	1.00	5.00	3.5613	1.35989
DVD players	201	1.00	5.00	2.6468	1.47296
Tape recorders	198	1.00	33.00	2.7222	2.57252
Episcope	187	1.00	5.00	2.5615	1.39130
Computer assisted aids	207	1.00	5.00	3.0386	1.33600
Internet Connectivity	213	1.00	5.00	2.7042	1.40479
Learning systems	213	1.00	5.00	2.9718	1.47596
Valid N (listwise)	134				

4.0 Discussion

4.1 Perceived adequacy of human resources

According to Choudhury (2014), the unequal distribution and inadequacy of both teaching and non-teaching staffs in medical colleges have had an indirect impact on medical training and access by populations. In this study, the majority of the students perceived the staff to be inadequate in MLS departments. Further, Jain, Mathew, and Bedi (2012) state that the maintenance of employees at different levels assists an organisation in setting and achieving its goals. Indeed, there exists a strong positive relationship between human resource establishment and learning outcomes. In medical education, the importance of human resources, skilled and unskilled, has increasingly been emphasised.

4.2 Perceived adequacy of physical facilities

In the study, the majority of the students felt that the number of rooms available as offices, classrooms, demo laboratories, skills laboratories, and computer laboratories was not adequate. Recent studies have emphasised the importance of the availability of physical facilities. Ajayi and Ayodele (2001) emphasised that the availability of these resources is quite critical for effectiveness in instructional delivery and supervision in the institution system.

KMLTTB (2002) outlines requirements for offices and rooms in terms of the number, size, and capacity for the lectures. Classrooms, laboratories, demonstration laboratories, and libraries should be planned in terms of number of rooms, size, and fittings (windows, doors, emergency exit, ground, desks, fixed benches, water provision, plumbing, fire extinguishers, safety cabinets, and essential apparatus or equipment).

4.3 Perceived adequacy of projected and non-projected teaching aids

The satisfaction level with the perceived adequacy of teaching and learning aids among students showed an unacceptable level. According to a study by Subedi (2021) on the perceptions of students' towards teaching and learning resources in medical school in Nepal, the usage of the internet was very low. In the study, projected media that required the use of the internet were very ineffective, and this affected teaching and learning.

5.0 Conclusion and recommendations

There was evidence that the students generally perceived that human resources were not adequate with the advent of COVID-19. There was evidence that students perceived that the physical facilities were inadequate with the advent of COVID-19. There was evidence that students perceived that the teaching aids were not adequate with the advent of COVID-19.

Based on the findings of this research, the following recommendations are made to improve the adequacy of resources in medical training colleges by the Government of Kenya, the Ministry of Health, which is the mother ministry of Kenya Medical Training College, and The Board of Directors of Kenya Medical Training College:

- i. Increase the human resources in the Medical Laboratory Sciences department of Kenya Medical Training College to ensure adequacy. This can be achieved by recruiting more lecturers, laboratory technicians, and non-teaching staff.
- ii. Improve the physical facilities of the department, including offices, classrooms, demo laboratories, skills laboratories, and computer laboratories. This can be achieved by renovating existing facilities, constructing new ones, and ensuring that they are properly equipped.
- iii. Provide more teaching aids to the department to include whiteboards, flipcharts, overhead projectors, posters, handouts, chalkboards, magnetic boards, textbooks, dvd players, tape recorders, episcope, computer-assisted aids, and internet connectivity. This can be achieved by purchasing new teaching aids, upgrading existing ones, and ensuring that they are readily available for use.
- iv. Further study should be done to cover all other departments, that is, Nursing, Clinical Medicine, Physiotherapy, Medical Imaging Sciences, Health Records, Pharmacy, Occupational Therapy, Orthopaedic Technology, Dental Technology, Optometry, Community Oral Health, Community Health Assistant, Public Health, Health Promotion, Medical Education, Orthopaedic and Trauma Medicine, Medical Social Work, and Health Counselling at KMTC on all campuses. Similarly, it should cover other private institutions, faith-based institutions, and institutions of higher learning such as universities.

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6.1 General acknowledgement

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6.2 Funding

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6.3 Conflict of interest

None.

5.4 Ethical consideration

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