ATTITUDES, PREFERENCES AND BARRIERS TO E-LEARNING AMONG OPEN, DISTANCE AND e-LEARNING (ODeL) ORTHOPAEDIC MEDICINE STUDENTS AT THE KENYA MEDICAL TRAINING COLLEGE

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A THESIS SUBMITTED TO THE DEPARTMENT OF FAMILY MEDICINE, COMMUNITY HEALTH & MEDICAL EDUCATION, SCHOOL OF MEDICINE, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN MEDICAL EDUCATION, MOI UNIVERSITY

DECLARATION

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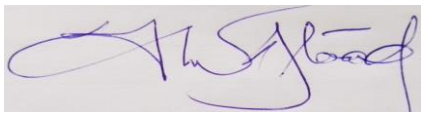
Signature:  Date: 17/06/2025

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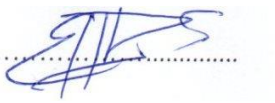
   Signature …… 

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DEDICATION

To Lydia, Allan, Erik, Maria, and our late Angel, Akisa.

I’m sorry I was not always home with you. This work is part of the reason.

ABSTRACT

Background: Medical education is undergoing a global shift toward technology-enhanced learning. In KMTC, the Orthopaedics and Trauma Medicine program incorporates the Open, Distance, and e-Learning model. Understanding students' attitudes, preferences, and barriers to e-learning is critical for optimizing digital strategies and sustaining quality training in resource-limited settings.

Objective: This study aimed to assess the attitudes, learning preferences, and barriers to e-learning among ODeL othopaedic students at the Kenya Medical Training College.

Methods: A mixed-methods cross-sectional design was used. Quantitative data was used to determine the relationship between variables, while qualitative data contextualized the research problem in a detailed context. The sample consisted of 156 participants drawn through stratified random sampling for the quantitative arm, and 8 FGD participants purposively sampled for the qualitative arm. Quantitative data were collected using a 5-point Likert scale questionnaire, and qualitative data using an interview guide. Data were analyzed using descriptive and inferential statistics for quantitative elements, complemented by thematic analysis for qualitative data.

Results: The findings reveal a predominantly positive student attitude towards e-learning (68%), with a significant majority (70%) expressing a clear preference for a blended learning model. Prior e-learning exposure exhibited a statistically significant association with e-learning participation (OR = 3.845, p=0.001), underscoring the importance of early exposure. Critical barriers identified included internet access limitations (60%), insufficient training on e-learning platforms (45%), and the prohibitive cost of internet data bundles (35%).

Conclusion: While ODeL orthopaedic students have a positive attitude towards e-learning, they prefer a balanced blended instructional approach.

Recommendations: To augment ODeL orthopaedic student attitude and participation in e-learning, early exposure to e-learning should be adopted in a blended learning context. Campus internet strength and coverage should be enhanced as a key enabler for e-learning.

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ABBREVIATIONS AND ACRONYMS

KMTC	Kenya Medical Training College
PBL	Problem-based learning
SDL	Student-directed learning
BL	Blended Learning
EBM	Evidence-Based Medicine
CAI	Computer-assisted instruction
CAL	Computer-aided learning
CAT	Continuous Assessment Test
CBI	Computer-based instruction
CBL	Computer-based eLearning
CBT	Computer-based training
ICT	Information and communications technology
IP	Internet protocol
LCMS	Learning content management systems
LMS	Learning management systems
ODeL	Open, distance and e-learning
OTM	Orthopaedics and Trauma Medicine
SAGA	Semi-autonomous government agency
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Asynchronous delivery: Delivery of eLearning activities where participants are not required to be online at the same time.

Blended learning: Mixed mode of delivery combining traditional classroom learning with eLearning techniques. It is a mix of the traditional and fully online methodologies, where some of the learning is undertaken in the traditional classroom environment, but the use of eLearning technologies and techniques is also applied.

Barriers: Refer to the hindrances/challenges/obstacles faced by students during online learning

Distance learning: The delivery of education where the student and tutor are not co-located and may be in different time zones. eLearning technology is used to deliver predefined structured curricula fully, using eLearning technology or in a combination of eLearning and face-to-face learning.

eLearning: An approach to teaching and learning that is based on the use of electronic media and devices as tools for improving access to training, communication and interaction, and that facilitates the adoption of new ways of understanding and developing learning.

Flipped the classroom Where students use eLearning technology to view lectures and read course material outside the classroom

	and classroom time is dedicated to interactive problem-solving exercises.
Enablers:	Refer to conditions that facilitate e-learning
Flexible learning:	Facilitates a range of options for the learner relating to several aspects of their learning experience, including time, content, instructional approach and delivery. A key difference between distance and flexible learning is that it is the learner who can define the dimensions of learning.
m-Learning:	Any activity that allows individuals to be more productive when consuming, interacting with or creating information, mediated through a compact digital portable device that the individual carries on a regular basis, has reliable connectivity, and fits in a pocket or purse.
ODeL:	Open, distance and e-learning. Learning that combines online digital media with traditional classroom methods, enabling students who occupy multiple roles and those affected by barriers of distance, cost, and time an opportunity to pursue their studies.
Online Learning:	A method of education that takes place over the internet, involving the delivery of educational content, interaction between learners and instructors, and assessment through digital platforms and tools

Outcome-based education: A performance-based educational approach where the focus is on the outcomes expected of educational interventions. Outcome-based education clearly defines the knowledge, skills, attitudes and behaviors expected and can be used to inform curriculum design and evaluation.

Synchronous delivery: Delivery of eLearning activities where participants are required to be online and taking part in real time.

Traditional learning: Any learning activity undertaken in the traditional classroom environment where there's face-to-face instruction and practical work.

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This thesis would not have been possible without the invaluable support and continuous guidance from my esteemed supervisors, Dr. Anne Ngeno and Dr. Franklin Boibanda. Their expertise and dedication were instrumental throughout this research journey, and I am profoundly grateful for their mentorship. I extend my sincere appreciation to the entire Department of Medical Education. Both the academic and non-academic staff played a crucial role by offering unwavering support and fostering an environment conducive to my blended learning experience. Their collective efforts significantly contributed to the successful completion of this thesis. My gratitude also extends to the leadership of Moi University, including the Dean of the School of Medicine, as well as the broader university management, led by the Chancellor.

Furthermore, I wish to acknowledge the Chief Executive Officer of the Kenya Medical Training College. I am grateful for his approval of my request to enroll in this program, which allowed me to pursue this academic endeavor while managing my professional responsibilities.

Finally, I am indebted to the study participants, students, and staff of the Kenya Medical Training College – Embu and Kangundo Campuses, with whom I worked during this study. Their understanding and flexibility in accommodating the increased demands on my time, necessitated by my pursuit of this program, were truly invaluable and for which I remain enormously grateful.

CHAPTER ONE

1.0 INTRODUCTION TO THE STUDY

1.1 Overview

This chapter covers the background of the study topic, the problem statement, the purpose of the study, research questions, the significance of the study, study justification, study limitations, and the conceptual framework

1.2 Background

Medical education has undergone a profound transformation in recent years, largely driven by rapid advancements in digital technology and the evolving needs of medical students. The shift towards technology-enhanced instruction has gained considerable momentum globally, with institutions increasingly incorporating online and distance learning into mainstream curricula. This transition was notably accelerated by the COVID-19 pandemic, which disrupted traditional classroom instruction and necessitated the adoption of remote teaching methods across all levels of education (Niroumand et al., 2022).

In Kenya, the Kenya Medical Training College (KMTC) responded to this challenge by reinforcing digital learning initiatives through revitalizing its LMS, the KMTC e-learning portal, guided in part by policy directives aimed at minimizing educational disruptions during periods of limited face-to-face student-lecturer interactions (Kaloki et al., 2023). KMTC, a semi-autonomous government agency and the largest middle-level medical training institution in the country, has integrated digital learning into various academic programs. One such initiative is the upgrading course in Orthopaedics and Trauma Medicine, designed to transition students from certificate to diploma level through a structured Open, Distance, and e-Learning (ODeL) model.

E-learning, often used interchangeably with terms such as online learning, web-based instruction, and digital education, refers to the use of electronic and communication technologies to facilitate teaching and learning. This approach is commonly categorized into three formats: synchronous learning, which involves real-time interaction between instructors and learners; asynchronous learning, which allows flexible, self-paced access to pre-recorded content; and hybrid or blended learning, which combines elements of both (Kamal et al., 2020). At KMTC, synchronous instruction is delivered via platforms such as Zoom, Google Meet, and the Kenya Education Network (KENET), while asynchronous learning utilizes Moodle-based platforms, multimedia presentations, email, WhatsApp, and YouTube videos.

Understanding how students engage with these platforms, including their perceptions, attitudes, and the challenges they encounter, is critical to the effective implementation of e-learning (Limenie, 2022). In medical education, where the training of health professionals demands both theoretical grounding and practical competence, the stakes are particularly high. Digital learning tools offer potential solutions to the persistent problem of limited teaching staff and inadequate infrastructure, especially in low and middle-income countries (LMICs). As Fatani (2020) observes, the future of medical education is likely to be anchored in blended learning models, with digital tools playing an increasingly central role in instruction and assessment.

This transition aligns with broader pedagogical trends that favour active student engagement and autonomy. Traditional lecture-based delivery is gradually giving way to instructional models that position learners as active participants in their own development. In medical schools, this shift is often guided by the SPICES model, which promotes student-centered, problem-based, and integrated approaches to learning (Sarkal, Sharma, & Raheja, 2021). E-learning supports these goals by offering

flexibility, accessibility, and a wide range of resources that empower students to learn independently and at their own pace.

For medical disciplines such as Orthopaedics and Trauma Medicine (OTM), the integration of e-learning components into practical training has shown significant benefits. Digital content can be used to reinforce foundational knowledge, while clinical rotations and in-person demonstrations provide essential hands-on experience to plug the skills gap. This approach complements KMTC's competency-based curriculum and supports the development of clinical reasoning and professional judgment that are key in clinical practice. According to Dost et al. (2020), students tend to find blended learning effective for both understanding theoretical material and applying it in practice.

However, the integration of e-learning in medical education has not been without challenges. While faculty satisfaction with digital platforms is generally high, the same cannot always be said for students. Learners may be hesitant to embrace e-learning due to digital literacy challenges, technological limitations, or uncertainty about pedagogical effectiveness. This is further compounded by limited research into the specific barriers faced by medical students in low-resource settings. Despite these obstacles, digital education continues to gain traction, with more institutions incorporating virtual repositories, simulation tools, and interactive media into their teaching strategies (Suryawanshi, & Venugopal, 2020).

Moreover, while students generally appreciate the flexibility and convenience of e-learning, many do not view it as a complete replacement for conventional instruction. Rather, they regard it as a valuable supplement to face-to-face learning. This is especially relevant in practice-oriented fields such as orthopaedics, where clinical

exposure is indispensable. As Verma (2020) points out, students in low- and middle-income countries often face difficulties such as unstable internet access, high data costs, and inadequate digital infrastructure. These barriers, though significant, do not negate the value of e-learning but instead highlight the need for supportive measures to ensure expanded and equitable access.

In response to these realities, innovative models such as flipped learning have gained attention. These models involve delivering core content online, with classroom time reserved for discussion, clarification, and application. Students have expressed support for such approaches, as they allow more control over the learning process while maintaining essential interactive elements. The COVID-19 pandemic further legitimized these models, demonstrating that remote learning could be effective when properly implemented (Monaghan, 2020).

Yet, some concerns remain, particularly with regard to the diminished interpersonal interaction in online learning. Clinical education, by its nature, thrives on mentorship, observation, and direct feedback. Reducing contact hours without a clear strategy to preserve these elements can hinder the learning experience. Hybrid models that alternate between online and in-person sessions have proven useful in addressing this concern, gaining a lot of traction with students. This is because the blended approaches preserve the flexibility of e-learning while maintaining opportunities for hands-on practice, peer collaboration and enhanced feedback (Makhbool et al., 2013).

Ultimately, the responsibility for navigating these new learning environments falls in part on students. As digital instruction becomes more common, learners are expected to take a more proactive role in championing and managing their education. This shift calls for not only technological competence but also self-discipline, time management,

and critical thinking. As Miles et al. (2017) argue, these skills are essential for success in the evolving educational landscape, particularly in programs that require clinical proficiency.

The incorporation of e-learning into KMTC's Orthopaedics and Trauma Medicine program reflects broader shifts in the medical education landscape. The rise of digital platforms, while accelerated by the COVID-19 pandemic, is rooted in a wider movement towards learner-centered, flexible, and competency-based instruction. While challenges related to infrastructure, training, and pedagogy persist, the benefits of e-learning, particularly when integrated into blended models, are well acknowledged. For KMTC and similar institutions, the task ahead lies in improving and refining the digital strategies to ensure improved user satisfaction, and that they complement, rather than compromise, the quality of medical education

1.3 Statement of the Problem

Despite the integration of Open, Distance, and e-Learning (ODeL) into orthopaedic and trauma medicine training, student participation in e-learning remains poor\\\\. A study by Kaloki et al (2023) in KMTC found that up to 11.8% of learners failed to attend scheduled virtual sessions. Online class attendance and e-learning portal usage reports reveal that nearly 40% of orthopaedic ODeL students do not log in consistently, some only joining online classes for a short duration. This is detrimental for students whose learning relies primarily on online delivery, as such irregular class attendance is associated with poor overall performance (Hulke et al, 2022). Niroumand et al. (2020) stress that students' attitudes, preferences, and perceived obstacles significantly determine the effectiveness of e-learning initiatives.

In Kenya, the introduction of online classes has been with several challenges. Many students lack reliable internet connectivity, access to personal devices, or the financial capacity to sustain online learning costs. Furthermore, limited ICT support and skills among campus staff have undermined their ability to maintain student engagement (Golga, Kassaw & Midakso, 2020). Given that ODeL students depend heavily on virtual platforms to access content, such barriers threaten both participation and academic outcomes.

Past studies suggest that e-learning benefits continuing or upgrading students by strengthening clinical knowledge and practical competencies (Gregory & Trapani, 2012). However, no formal investigation has been conducted at KMTC to evaluate the perspectives of orthopaedic ODeL students on their attitudes, preferences, and perceived barriers to e-learning. These areas are key to the success of any ODeL program, and an in-depth evaluation is crucial for enhancing its effectiveness and successful mainstream adoption.

1.4 Study Justification

For any e-learning initiative to succeed, it must be rooted in a clear understanding of its users, particularly their attitudes, learning preferences, and the barriers they experience when using e-learning strategies. Among orthopaedic students enrolled in the Open, Distance, and e-Learning (ODeL) program at the Kenya Medical Training College (KMTC), low and intermittent participation in virtual instruction has raised legitimate concerns regarding the effectiveness and sustainability of digital delivery. Yet, despite the expansion of e-learning across health education, there’s a paucity of data on ODeL students' attitudes, preferences, and perceived barriers to e-learning. This study directly addresses this gap.

Prior research has pointed to several systemic issues that hinder the uptake of e-learning in clinical disciplines. Niroumand et al. (2022) note that technology-enabled education holds significant potential for increasing access and flexibility, particularly for learners in dispersed or underserved regions. Within medical education, e-learning has been linked to reduced learner stress and greater self-confidence, especially when integrated appropriately alongside clinical training (Manikan et al., 2013). It also offers cost-effective scalability, allowing institutions to extend their reach and scope without incurring the expenses of additional physical infrastructure (Suryawanshi & Venugopal, 2020).

Nonetheless, orthopaedic and trauma education in Kenya remains largely anchored in traditional, face-to-face instruction. The shift toward digital platforms within this field is still in its early stages and lacks contextual evidence to guide its development. Without a clear understanding of student engagement patterns, technological barriers, or preferred modes of content delivery, efforts to enhance and expand ODeL risk remaining superficial or misaligned.

This study is therefore timely and necessary. Its findings provide a grounded basis for improving online pedagogical approaches, strengthening learner support systems, and informing national strategies for blended and remote medical training. By capturing the lived realities of orthopaedic ODeL students through qualitative and quantitative analyses, it contributes to the development of more responsive, inclusive, and effective e-learning models for health education in Kenya.

1.5 Objectives

1.5.1 Broad Objective

The study sought to scrutinize orthopaedic students' attitudes, preferences, and perceived barriers to e-learning. It also assessed their use of e-learning in relation to their attitudes, gender, computer skills, and prior experience with e-learning.

1.5.2 Specific Objectives

1. To determine the attitudes of ODeL orthopaedic students towards e-learning at the Kenya Medical Training College
2. To determine the content delivery preferences of ODeL orthopaedic students at the Kenya Medical Training College
3. To analyze the barriers to e-learning as perceived by ODeL orthopaedic students at the Kenya Medical Training College

1.6 Research Questions

To this end, the following research questions were addressed in this study;

1. What are the attitudes of ODeL orthopaedic students towards e-learning at the Kenya Medical Training College?
2. What are the content delivery preferences of ODeL orthopaedics students at the Kenya Medical Training College?
3. What are the barriers to e-learning as perceived by ODeL orthopaedic students at the Kenya Medical Training College?

1.7 Hypotheses

1. **$H_0$1:** There's no significant relationship between ODeL orthopaedic students' demographic factors and their attitudes towards e-learning.

H_11: There's a significant relationship between ODeL orthopaedic students' demographic factors and their attitudes towards e-learning.

2. **H_02:** There's no significant difference in learning preferences among ODeL orthopaedic students for face-to-face learning, e learning, and blended learning.

   H_12: There's a significant difference in ODeL orthopaedic students' preference for face-to-face learning, e-learning, and blended learning.

3. **H_03** There's no significant correlation between ODeL orthopaedic students' prior e-learning experience and their participation in current e-learning

   H_13: There's a significant correlation between ODeL orthopaedic students' prior e-learning experience and their participation in current e-learning.

1.8 Significance of the Study

1.8.1 Practical Implications

This study provides a grounded understanding of the dynamics shaping e-learning in the ODeL orthopaedic and trauma medicine program at the Kenya Medical Training College. By examining student attitudes, learning preferences, and experienced barriers, it offers a framework for addressing the specific needs of both learners and program implementers within a digital environment. The results carry practical value for departmental planning, particularly in guiding the provision of student support, digital infrastructure, instructional support, and staff development in online teaching methods.

Importantly, the findings are expected to contribute to more effective policy formulation within the Department of Orthopaedic and Trauma Medicine (OTM) at the Kenya Medical Training College. By identifying areas where student support is lacking or where instructional delivery requires reinforcement, the study creates an evidence base for reforming e-learning practices. This, in turn, may lead to more consistent

student participation, improved learning outcomes, and a more resilient model of medical education better suited to the evolving demands of distance and blended learning in Kenya.

1.8.2 Social Implications

This study holds important social significance, particularly in the context of evolving pedagogical models within health education. By examining the attitudes of ODeL orthopaedic students, their preferences and the obstacles they encounter in digital learning, the research contributes to a broader understanding of how learners construct meaning and engage in knowledge sharing in virtual environments. In doing so, it supports the application of social constructivist principles, where learning is viewed as an interactive, collaborative process shaped by individual and collective experiences in a shared context.

Through its focus on student perceptions and lived experiences, the study encourages a shift in how online medical education is understood and implemented within Kenya's public institutions. The findings not only add to the growing body of knowledge on e-learning in low-resource settings but also reveal how social and technological barriers influence educational equity and participation. These insights are particularly relevant for institutions like KMTC, which serve a wide demographic across the country and are expected to provide inclusive, accessible training for future healthcare professionals.

By identifying the structural and behavioural factors that affect engagement with e-learning, the study offers practical implications for fostering a more supportive academic culture within ODeL frameworks. In this way, it promotes not only academic performance but also social cohesion among learners who may otherwise feel isolated in remote learning settings. Ultimately, the research contributes to strengthening KMTC's role as a national leader in middle-level medical training and as an institution

responsive to the changing social landscape of higher education. It also serves as a reference point for other institutions in the region seeking to align digital learning strategies with the needs and realities of their student populations.

1.8.3 Originality and Value

The study offers a timely and original contribution to the discourse on e-learning in medical education, focusing on the underexplored context of orthopaedic training within a developing country setting. By concentrating on the Kenya Medical Training College's ODeL program, the research addresses a specific yet broadly relevant challenge: how to sustain an effective, student-centred digital learning in environments with limited infrastructure and diverse learner needs. The study captures a transitional moment in medical education, emerging from the disruptions of the COVID-19 pandemic into a new era where blended and distance learning are becoming more permanent fixtures in medical education.

What sets this work apart is its practical orientation. Rather than relying solely on theoretical assumptions, the study draws on empirical data to paint a realistic picture of the students' attitudes toward e-learning, how students interact with e-learning platforms, what hinders their participation, and how prior exposure influences future engagement. It highlights the urgent need for targeted digital literacy training for ODeL students, particularly in the early stages of their academic journey, where foundational skills often determine future success in online environments.

Moreover, the research challenges the notion that e-learning is too complex or unsuitable for hands-on medical fields such as orthopaedics. It reveals that, when thoughtfully implemented, digital platforms can complement traditional face-to-face methods, enhance access, and cater to the clear preference among students for blended models of instruction. In this way, the study not only adds depth to existing literature

but also reframes e-learning as an adaptable and inclusive approach rather than a rigid or elite alternative.

By demystifying the concept of e-learning education in clinical disciplines, the study advances academic and institutional understanding of how digital strategies can be effectively integrated into healthcare training. It provides a foundation for future planning of ODeL orthopaedic programs, and a guide for program developers seeking to build robust, learner-responsive e-learning systems in resource-constrained environments.

1.9 Limitations of the Study

1. Being a cross-sectional study, the participants' perceptions may change over time. Therefore, a further longitudinal study may be required in the future to enhance the understanding of determinants that are critical to students' attitudes, preferences, and perceived barriers to e-learning
2. There was a lack of comparable studies at the national level to draw meaningful comparisons with.

1.10 Delimitations

1. Geographically, the study was delimited to KMTC campuses offering ODeL upgrading diploma program in Orthopaedics and Trauma medicine.
2. Conceptually, it was delimited to assess attitudes, preferences, and barriers to e-learning among ODeL orthopaedic students of the Kenya Medical Training College

1.11 Philosophical Underpinnings

The philosophical foundation of any research study shapes not only its methodological choices but also its interpretation of knowledge and reality. As Creswell (2009)

explains, a philosophical worldview or underpinning refers to a core set of guiding beliefs that inform the researcher's approach to inquiry. Broadly, four dominant paradigms frame most contemporary research: post-positivism, constructivism, transformative inquiry, and pragmatism (Cherryholmes, 1992). This study is primarily anchored in the constructivist tradition and draws more specifically on the theory of connectivism, which builds upon and extends constructivist thinking into the realm of digital learning.

Connectivism, introduced by George Siemens and Stephen Downes in 2004, offers a paradigm especially suited to the demands of learning in the digital era. Unlike traditional constructivism, which focuses on the internal cognitive processes of learners as they make meaning from experience, connectivism emphasizes the value of networks; technological, social, and informational, in shaping how knowledge is acquired and applied. Kropf (2013) notes that connectivism acknowledges the accelerated pace at which information is generated and shared, arguing that learners must develop the ability to locate, interpret, and connect knowledge within the ever-evolving digital environments.

Siemens (2008) further articulates this by suggesting that contemporary learning occurs less through static content and more through fluid exchanges across digital platforms. Individuals form learning networks by engaging with others who offer diverse perspectives, expertise, and insights. As Dost et al. (2020) observed, these networks not only facilitate access to information but also enable dynamic participation in collaborative knowledge construction, which is central to effective e-learning.

Guided by this philosophical lens, the present study adopted a mixed-methods approach to explore the attitudes, preferences, and barriers to e-learning among ODeL

orthopaedic students at the Kenya Medical Training College. The study does not rely on a single mode of inquiry but instead integrates both quantitative and qualitative tools to capture the complexity of learners' experiences. This pluralistic stance aligns with the epistemological flexibility inherent in connectivism, allowing the researcher to examine statistical trends while also giving voice to individual narratives and perceptions.

The decision to combine methodological approaches was influenced also by the real-world challenges facing KMTC students in the digital learning environment. To address these challenges meaningfully, the research sought to explore not just patterns of usage, but also the underlying attitudes, preferences, and barriers that influence engagement with online platforms. In doing so, it aimed to offer a nuanced, context-sensitive understanding of the current state of e-learning in orthopaedic and trauma medicine. The findings are intended to inform practical strategies that promote e-learning in the context of ODeL orthopaedic training, thereby aligning institutional practices with the dynamic, networked nature of knowledge in the 21st century.

1.12 Conceptual Framework

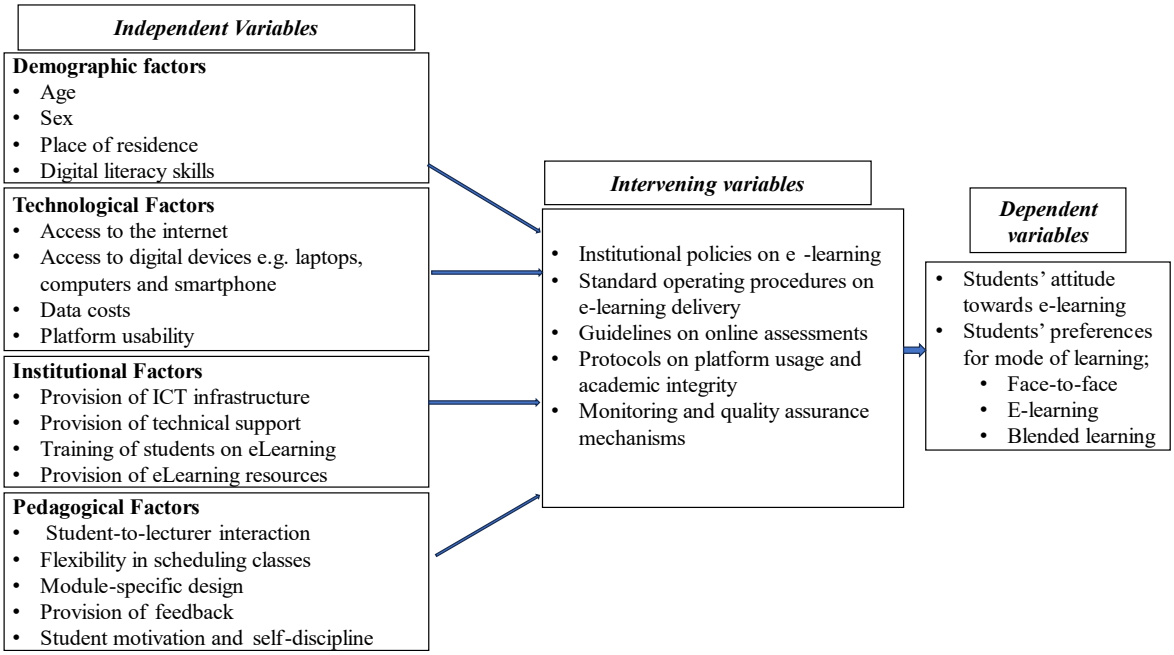

Figure 1: Conceptual Framework

1.13 Variables

1.13.1 Dependent Variable

Students' attitudes, preferences, and level of participation in e-learning are the dependent variables

1.13.2 Independent Variables

The independent variables included;

1. Student demographics - age, gender, computer skills, time management, prior experience in e-learning
2. Technological factors – access to the internet, access to digital devices, and e-learning platform usability
3. Institutional factors – provision of ICT infrastructure, provision of technical support, training on e-learning, and provision of e-learning resources

4. Pedagogical factors – flexibility on scheduling of online classes, module-specific requirements, lecturer-to-student and student-to-student interaction and communication, student motivation and self-discipline, and provision of feedback.

1.13.3 Intervening Variables

Intervening variables for this study were as follows;

1. Institutional policies on e-learning
2. Standard operating procedures on e-learning delivery
3. Guidelines on online assessments
4. Protocols on platform usage and academic integrity
5. Monitoring and quality assurance mechanisms

1.13.4 Relationship in Variables

The conceptual framework illustrates how selected independent variables influence students' attitudes and preferences in e-learning among ODeL orthopaedic students at the Kenya Medical Training College. The framework further recognizes the institutional regulatory and operational framework as an intervening variable that conditions the strength and direction of these relationships.

Independent Variables

The independent variables were organized into four domains: demographic, technological, institutional support, and pedagogical factors. These variables are conceptualized as determinants that directly or indirectly shape students' experiences with e-learning.

Demographic factors such as age, sex, year of study, place of residence, and digital literacy skills may influence students' readiness to adopt digital platforms and their confidence in navigating online systems. For example, students with higher digital

literacy skills are more likely to demonstrate positive attitudes toward e-learning and reduced perceptions of technological barriers.

Technological factors, including access to the internet, reliability of connectivity, access to digital devices, data affordability, and platform usability, are central structural enablers of e-learning participation. Limited connectivity or high data costs may increase perceived barriers and negatively influence attitudes, while reliable access and user-friendly platforms may foster favourable perceptions and preference for online or blended modes of learning.

Institutional support factors encompass the availability of ICT infrastructure, technical support services, training on e-learning systems, and access to digital learning resources. These elements determine the institutional capacity to sustain online delivery. Adequate institutional support is expected to reduce operational frustrations, strengthen student confidence, and positively influence both attitudes and participation preferences.

Pedagogical factors relate to the instructional design and learning process, including lecturer–student interaction, student–student interaction, flexibility of scheduling, quality of module design, and feedback mechanisms. These variables influence the perceived effectiveness and engagement of e-learning. High-quality interaction and timely feedback are likely to enhance student satisfaction and preference for blended or fully online learning. Further, learner-related factors, such as student motivation, self-discipline, prior online learning experience, home learning environment, and individual learning style preferences, represent personal attributes that shape engagement with digital learning. Students who demonstrate high levels of intrinsic motivation and self-

regulation are more likely to adapt successfully to online environments and to report fewer barriers.

Intervening Variables

The institutional regulatory and operational framework functions as an intervening variable. It includes institutional policies on digital learning, standard operating procedures for e-learning delivery, guidelines on online assessment, protocols governing platform usage and academic integrity, and monitoring and quality assurance mechanisms.

This framework does not act as a primary determinant but rather modifies how independent variables translate into outcomes. For instance, even where technological access is adequate, the absence of clear policies or assessment guidelines may generate uncertainty and weaken students' confidence in the system. Conversely, well-defined procedures and quality assurance mechanisms may strengthen the positive impact of institutional support and pedagogical quality on student attitudes and participation.

Thus, the intervening variable conditions the operational environment within which demographic, technological, institutional, pedagogical, and learner-related factors function.

Dependent Variables

The dependent variables represent the core outcomes of the study. These include students' attitudes toward e-learning and their preferences for the various modes of learning, whether face-to-face, e-learning, or blended learning

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter provides a critical review of existing literature related to e-learning within the context of medical education, particularly as it applies to open, distance, and e-learning (ODeL) students. The structure follows the study's objectives, examining the following thematic areas;

- The concept of e-learning in medical education
- Students' attitudes toward e-learning
- Students' learning preferences
- Barriers to effective implementation of e-learning

This review sought to establish a theoretical foundation for the study and to identify both global and contextual insights that shape e-learning among ODeL orthopaedic students in low-resource settings.

2.2 The Concept of E-learning in Medical Education

The integration of e-learning into medical education has become an increasingly prominent feature of modern pedagogical practice. E-learning refers to the use of electronic devices and digital technologies, primarily internet-based platforms, to deliver instructional content, facilitate interaction, and support learners' engagement beyond the boundaries of the traditional classroom (Ruiz, Mintzer, & Leipzig, 2006). While the practice is not entirely novel, its sophistication and scope have expanded considerably, particularly with the emergence of blended learning models that seek to combine the best elements of both digital and face-to-face instruction.

The advent of e-learning has popularized blended learning, defined as the purposeful integration of in-person teaching with online learning activities, has become a dominant mode of delivery in health professions education. Hege, Tolks, Adler, and Hartl (2020) argue that this approach is not simply a logistical compromise but a pedagogical strategy intended to maximize learning outcomes through multimodal delivery. In their definition, blended learning involves intentional design where physical and digital components are interconnected to form a cohesive instructional unit. Though various models exist, most share key characteristics: learners are afforded a degree of control over time, place, and pace; learning is personalized through digital scaffolds; and both online and classroom-based components are systematically aligned (Garrison & Vaughan, 2008).

Harris et al. (2009) provide a definition particularly suited to the present study, describing blended learning as an environment that merges co-located interactions with technologically mediated exchanges between learners, instructors, and content. This definition captures the hybrid nature of instruction experienced by students enrolled in Open, Distance and e-Learning (ODeL) orthopaedic program program at the Kenya Medical Training College (KMTC), where spatial separation is bridged by digital connectivity and pedagogical intention. The logic of e-learning learning lies not in replacing traditional methods but in enhancing them with the convenience of modern technology.

The transition of medical education toward e-learning has been neither abrupt nor uniform. The gradual adoption of digital tools in anatomy labs, simulation centres, and clinical skills training points to an evolutionary process driven by shifting student expectations, institutional reforms, and technological advancement. As early as the 2000s, Ruiz et al. (2006) identified e-learning as a transformative force capable of

improving access to medical education, standardizing content delivery, and supporting active learning strategies.

The COVID-19 pandemic accelerated this transformation dramatically. Educational institutions around the globe were compelled to pivot almost overnight from traditional classroom teaching to virtual environments (Sir Daniel, 2020). This global disruption catalyzed a re-evaluation of pedagogical norms and revealed the resilience and flexibility of e-learning and blended learning models. In developing countries such as India, initiatives like Bharat Padhe Online were launched to promote the development of open digital content and asynchronous instructional resources, underscoring the long-term strategic value of online learning platforms (Bordoloi, 2021).

In the context of sub-Saharan Africa, including Kenya, the pandemic similarly underscored the urgency of investing in digital infrastructure and pedagogical innovation. Though gaps in connectivity and digital literacy remain significant, institutions such as the Kenya Medical Training College (KMTC) have increasingly turned to e-learning modalities to reach a geographically dispersed student population. According to Mutisya and Makokha (2016), Kenyan universities and colleges have seen incremental but meaningful integration of e-learning platforms, facilitated by policy shifts and donor-funded technology initiatives.

One of the core strengths of e-learning lies in its capacity to individualize instruction. Digital learning environments permit the design of adaptive content that adjusts to learners' prior knowledge, pace of engagement, and preferred modalities (Fresen, 2018). Multimedia presentations, interactive quizzes, real-time feedback, and virtual patient scenarios can be tailored to reinforce clinical reasoning, procedural knowledge, and ethical decision-making. Furthermore, asynchronous formats such as recorded

lectures and online discussion boards afford students the flexibility to review materials multiple times, thus deepening retention and conceptual understanding (Means et al., 2014).

The flipped classroom model exemplifies this shift in pedagogical strategy. In this strategy, foundational concepts are introduced online through pre-recorded videos or reading assignments, allowing face-to-face sessions to be dedicated to application, analysis, and synthesis. Hege et al. (2020) list three primary ways in which online content can support blended learning. First, as preparatory material before in-person instruction; second, as reinforcement following classroom sessions; and third, as embedded tools within the classroom itself, such as simulations and interactive digital labs. This strategic sequencing aligns with Bloom's taxonomy, enabling instructors to address lower-order cognitive skills asynchronously and reserve face-to-face time for higher-order learning tasks.

E-learning has proven advantageous in supporting collaborative learning. Online platforms facilitate peer-to-peer interaction through forums, shared documents, and group projects, often extending the scope of classroom discussions. Social learning platforms such as Moodle, Blackboard, and Google Classroom enable not only the dissemination of content but also structured interaction between students and educators (Hasan, 2020). This capacity for real-time and asynchronous communication enhances learner engagement and creates a community of inquiry conducive to deeper learning (Garrison, Anderson, & Archer, 2000).

E-learning also addresses logistical challenges faced by medical institutions, particularly those offering ODeL programs. The geographical dispersion of students, limited availability of teaching staff, and variability in clinical placement opportunities

necessitate delivery modes that are scalable and flexible (WHO, 2015). E-learning platforms facilitate the distribution of learning materials across broad regions, synchronizing educational delivery while reducing dependence on physical infrastructure.

This model aligns well with contemporary calls for decentralized medical education, particularly in low and middle-income countries where health worker shortages persist. The World Health Organization (2015) stressed that medical training must become more accessible, responsive, and adaptable to local needs. Digital platforms offer a means of achieving these goals by reducing the burden of travel, allowing for continuous assessment, and enabling real-time updates to curricula. Moreover, digital resources can be rapidly modified to reflect new evidence or public health emergencies, a feature that proved essential during the COVID-19 pandemic (Loda et al., 2020).

The successful incorporation of e-learning into medical curricula depends upon thoughtful instructional design. This includes needs assessments, alignment with learning outcomes, and careful sequencing of content delivery (Fresen, 2018). Equally important is faculty readiness. Instructors must be trained not only in the use of digital tools but also in online pedagogy. Transitioning from content expert to learning facilitator requires a conceptual shift, one that demands both institutional support and personal commitment (Goh & Sandars, 2020).

Instructional designers play a pivotal role in this process. Working collaboratively with subject matter experts, they ensure that online and in-person activities are pedagogically aligned and technically feasible. Course design must incorporate mechanisms for student feedback, self-assessment, formative evaluation, and opportunities for revision. Furthermore, effective e-learning environments attend to learners' cognitive load,

cultural context, and technological constraints (Kay et al., 2019). These principles are particularly relevant in resource-limited settings, where assumptions about device ownership, internet access, and digital fluency may not hold.

Students themselves must also adjust to the demands of blended learning. Self-regulation, time management, and digital literacy are essential competencies in online environments. Some learners may struggle with the autonomy required in asynchronous formats, while others thrive in the self-paced structure. Research by Miles et al. (2017) highlights the diversity of learning preferences among health profession students, suggesting the need for orientation programs, digital mentoring, and structured support systems to foster effective engagement.

Despite its advantages, e-learning is not without its limitations. Technical barriers such as inadequate internet connectivity, power outages, and in some cases the lack of devices, pose persistent challenges in many contexts. Faculty resistance also remains a barrier, especially among instructors accustomed to traditional didactic methods (Makhbool et al., 2013). In some cases, e-learning is perceived as a threat to traditionally established academic standards, or a technological discourse requiring additional time and effort without adequate compensation or institutional backing.

Students, too, may resist the transition, particularly if platforms are poorly designed or if expectations are unclear. Engagement can suffer in the absence of timely feedback or if learning activities are perceived as irrelevant. The novelty of the digital format does not guarantee pedagogical value. As such, continuous evaluation of blended programs is essential. Hege et al. (2020) advocate for the use of structured assessments, learning analytics, and student feedback mechanisms to refine delivery and ensure alignment with educational objectives.

E-learning should not be seen as a one-size-fits-all solution. The ideal balance between digital and face-to-face instruction must consider contextual variables such as the medical discipline, curriculum requirements, and student demographics. In procedural or hands-on subjects such as surgery, physiotherapy, or orthopaedics, the online component must be carefully calibrated to avoid undermining skill acquisition. Simulations, virtual reality, and part-task trainers offer promising alternatives, but they cannot fully replace supervised clinical experience (Sarkal et al., 2021).

E-learning, and by extension blended learning, has become an indispensable feature of modern medical education. Its capacity to individualize instruction, extend access, promote active learning, and foster collaboration positions it well for 21st-century pedagogical demands. While implementation challenges persist, particularly in low-resource settings, the potential for scalable, flexible, and learner-centered education is undeniable. For institutions like KMTC and similar ODeL programs, the strategic adoption of blended learning models offers a promising avenue for enhancing the quality, reach, and relevance of health professions such as the ODeL orthopaedic medicine training. The success of such models depends on more than technology. Pedagogical considerations, faculty commitment, institutional support, and learner preparedness are all critical determinants. As the global education community moves beyond the emergency pivots of the pandemic era, the task ahead lies in consolidating and refining blended learning frameworks grounded in sound educational theory and evidence-based practice.

2.3 Students' Attitudes Toward E-learning in Medical Education

The effectiveness of e-learning programs is largely shaped by students' attitudes, perceptions, and willingness to embrace technological innovations. Kanwal and Rehman (2017) emphasize that learners' attitudes significantly influence the success or

failure of online learning initiatives. For medical education in particular, understanding and addressing these attitudinal factors is essential to ensure students are motivated to engage in and benefit from e-learning opportunities.

E-learning is now firmly established as an integral part of teaching strategies in medical schools. According to Dhawan (2020), factors such as accessibility, affordability, flexibility, continuous learning, and supportive policies are critical to the adoption of online learning. She further notes that the integration of digital tools with traditional classroom instruction creates models such as blended learning and flipped classrooms, which provide students with greater flexibility and enhance their ability to learn independently while still benefiting from structured teaching.

Research shows that electronic learning can be as effective as traditional approaches in delivering knowledge to health profession students. Liu et al. (2016) observed that blending online and in-person instruction helps overcome the limitations inherent in each method. While online formats may lack the personal interaction of face-to-face settings, classroom sessions help fill that gap. Similarly, online platforms enable self-paced learning, which is often missing in traditional teaching. In medical training, e-learning has the added advantage of strengthening practical skills such as clinical reasoning and documentation (Hege et al., 2020).

The World Health Organization (2015) reviewed evidence comparing conventional, online, and blended learning methods across disciplines such as medicine, dentistry, and pharmacy. The findings indicated that blended learning not only improved knowledge and skill acquisition but, in some cases, performed better than traditional approaches. Network-based learning was shown to be scalable, cost-efficient, and

adaptable to diverse learning environments, making it a valuable tool for health workforce training worldwide.

Another advantage of e-learning education is portability, which allows students to maintain curricular consistency when placed at satellite hospitals and clinics (Spikard et al., 2002). The WHO (2015) highlighted that e-learning models can combine self-directed study with practical skill-building, reduce educational delivery costs, and bridge geographic and time-related barriers. Digital platforms also enable learners to access expert knowledge and tailored curricula while creating immersive experiences through tools such as augmented reality, 3D simulations, mobile learning, and cloud-based resources.

Flexibility is one of the most frequently cited benefits of e-learning, as students can choose when and where to study. This mode of learning also reduces the financial burden of traditional delivery methods, improves access to specialists, and supports large-scale expansion of educational programs. The WHO (2015) suggested that as e-learning becomes more embedded in higher education, distinguishing it from traditional teaching may eventually be unnecessary.

Digital content, such as e-books and online modules, enhances portability and eliminates the need for heavy textbooks. Moreover, online platforms foster interaction between students and instructors beyond scheduled class hours, reducing isolation and creating a stronger sense of community. Online discussion forums, for example, provide spaces for peer-to-peer collaboration and staff engagement, which can improve student satisfaction (Romanov & Nevgi, 2006).

Students who struggle to keep pace with conventional lectures often find e-learning beneficial. As Palmer and Devitt (2008) argue, digital learning environments free up

faculty time to support struggling learners and allow individuals to progress at their own pace. This personalization ensures students with varying abilities still access the same comprehensive content. Furthermore, e-learning emphasizes a shift from teacher-centered to learner-centered education (Gerdprasert et al., 2011), aligning with universities' goals of promoting self-directed learning. Interactivity, instant feedback, and the opportunity to control the learning pace are key factors contributing to stronger performance and deeper understanding (Davies et al., 2008). Bordoloi et al. (2021) observed that online and blended platforms empower both educators and learners by fostering independence and enhancing ICT skills. Dhawan (2020) further notes that effective communication—through messaging, video calls, or collaborative applications, is critical in online education, enabling students to practice and refine their skills.

Learners commonly identify benefits such as accessibility, portability, flexibility, enhanced interaction with faculty, and peer collaboration. On the other hand, challenges include the perception that online study can be time-intensive, reduced face-to-face tutor interaction, feelings of isolation, limited opportunities for clarification, and fewer in-depth group discussions.

2.4 Students' Learning Preferences

Students' learning preferences are often shaped by their prior experiences, technological exposure, and perceptions of efficacy. In ODeL contexts, learners tend to favour formats that are flexible, device-friendly, and bandwidth-sensitive. Asynchronous learning such as pre-recorded lectures, downloadable materials, and message boards, emerges as a preferred mode for many students who lack stable internet access. A study by Mtebe and Raisamo (2014) among Tanzanian medical students reported a strong preference for asynchronous modules due to their

compatibility with intermittent connectivity. However, when infrastructure is available, students report appreciating the interactivity and immediacy of synchronous tools such as Zoom, Microsoft Teams, and Google Meet (Bordoloi, Das P., & Das K., 2021).

Medical education in Kenya and other developing countries continues to be shaped by both global technological trends and regional socioeconomic realities. Open, Distance, and e-Learning (ODeL) students, particularly in Sub-Saharan Africa, increasingly engage with blended education models that aim to bridge gaps in access to professional training. As international institutions such as the World Health Organization (WHO, 2015) and the United Nations continue to endorse e-learning as a strategic tool for expanding healthcare education, especially in resource-constrained settings, understanding the learning preferences of students becomes vital for effective pedagogical planning and implementation.

A global view of internet usage reveals significant disparities. While developed countries enjoy a 77% internet penetration rate, only 31% of people in developing nations have regular access, with approximately 90% of the 1.1 billion unconnected households residing in these regions (WHO, 2020). These figures have direct implications for the practical delivery of online instruction. Reliable internet connectivity and access to functional devices such as smartphones, tablets, or laptops remain essential prerequisites for meaningful student engagement in digital learning environments. In Kenya, a study by Mwendwa (2021) found that medical students in public institutions often depended on mobile data, citing unreliable campus Wi-Fi and a lack of institutional ICT support as consistent impediments.

Faculty readiness directly influences how effectively these modalities are implemented. Hege et al. (2020) argue that lecturers must be trained not only in technical proficiency

but also in pedagogical strategies specific to e-learning. Faculty development programs should mirror the e-learning experiences expected of students, incorporating the same platforms and technologies in a hands-on, iterative manner. This approach allows educators to gain familiarity with instructional tools and anticipate user challenges, thereby aligning their teaching strategies with learners' preferences and constraints.

Moreover, engaging students in the co-design of digital learning environments fosters deeper participation and cultural relevance. Hege and colleagues (2020) advocate for participatory design methods where students contribute to content development, platform testing, and feedback loops. In a similar vein, a South African study by Uys et al. (2023) demonstrated that student involvement in developing case-based multimedia modules led to higher engagement rates and greater academic satisfaction. The process of allowing learners to co-create educational materials whether through short videos, discussion prompts, or peer review forums, not only increases the applicability of the content but also supports the development of transferable skills in communication and critical thinking.

ODeL students tend to favour learning environments that provide autonomy, choice, and clear structure. Flexibility in pacing, timing, and assessment windows is especially valued in programs targeting working professionals, as is common in distance medical education (Kebritchi, Lipschuetz, & Santiague, 2017). However, flexibility must be balanced with structure. Students often cite well-organized course layouts, timely instructor feedback, and regular communication as key to their continued participation. In an e-learning needs assessment conducted among Kenyan nursing students, Ndung'u et al. (2022) found that learners preferred weekly content releases over open-ended modules, noting that predictable timelines supported better time management and reduced academic stress.

Student support services further shape learning preferences by reducing barriers to engagement. Technical assistance, timely troubleshooting, and responsive communication channels are essential in e-learning ecosystems. Banda et al. (2021) and Ndung'u et al. (2022) both underline the importance of having accessible learning technologists and IT departments that understand the specific needs of medical students. Institutions must also invest in expanding the capacities of their support teams, especially during transitions from face-to-face to blended or fully online delivery. In Kenya, Muriithi and Mukhongo (2023) reported that institutional delays in providing login credentials, insufficient LMS training, and the absence of student help desks were among the top contributors to e-learning dissatisfaction.

While technology underpins e-learning infrastructure, human interaction remains a critical preference in digital medical education. Students repeatedly affirm the value of being able to reach out to instructors for academic support and mentorship. Raupach et al. (2010) note that the educational efficacy of web-based interventions increases when supplemented by continuous interaction with faculty. Similarly, Uys et al. (2023) emphasize the need for the availability of both synchronous and asynchronous delivery to foster a sense of presence and accountability. The perception of instructor accessibility has been linked to higher levels of student satisfaction and course completion in blended learning environments.

In terms of instructional design, multimedia-rich content appeals to many students, particularly when it incorporates clinical scenarios, procedural demonstrations, or interactive simulations. However, such resources must be optimized for low-bandwidth environments if they are to be adopted successfully in ODeL contexts. Platforms that allow content to be downloaded for offline access are particularly popular. In Malawi, Banda et al. (2021) observed that students were more likely to engage with clinical

content in audio or compressed video formats than in high-resolution streaming modules.

Institutional readiness also plays a defining role in determining how student preferences are met. Flowers et al. (2010) highlight that curricular reforms increasingly incorporate computer literacy as a core competence in medical education. This recognition supports investments not only in technology but in curriculum design that is responsive to evolving digital cultures. Integrating technology is no longer an optional enhancement but a pedagogical imperative that reflects broader transformations in medical training. When institutions proactively align their offerings with students' technological realities and learning preferences, the transition to digital models becomes less disruptive and more pedagogically sound.

Social and generational trends further influence the orientation of student preferences. Today's learners, particularly in urban areas, are digital natives accustomed to mobile technology, social media, and on-demand content. This expectation shapes their attitudes toward traditional instruction. Muriithi & Mukhongo (2023) suggest that educational models must evolve to align with these shifting norms, favouring dynamic, learner-driven approaches over rigid, instructor-centric ones. However, it is essential to avoid overgeneralizing generational traits. In rural or under-resourced settings, students may have limited prior exposure to e-learning platforms, and their preferences will reflect a blend of aspiration and limitation.

It is important to appreciate that learning preferences in medical education are influenced by a matrix of factors including technological access, faculty readiness, instructional design, institutional infrastructure, and socio-cultural context. In ODeL programs, especially in Sub-Saharan Africa, preferences tend to be influenced by

flexibility, clarity, technical support, and meaningful human interaction (Banda et al, 2021). Designing effective e-learning initiatives in such environments demands the understanding of these preferences, supported by adaptive strategies that integrate both local realities and global best practices.

2.5 Barriers to E-learning

Despite the accelerating global adoption of e-learning in health professions training, its implementation remains patchy, particularly in low- and middle-income countries (LMICs). Numerous challenges have been observed across educational systems, often undermining the potential of digital learning tools to improve access, quality, and efficiency in medical education. Limenie (2022) provides a useful typology of these challenges, categorizing barriers into four broad domains: personal, institutional, curricular, and technological. This classification reflects the complex and interdependent nature of the obstacles faced, particularly in contexts where educational innovation must contend with resource constraints, infrastructural deficits, and systemic inertia. In African medical education, these barriers are further amplified by longstanding inequalities in digital access, weak policy implementation, and variability in institutional capacity (Kigotho, 2020).

Digital Literacy

A key barrier to e-learning is the lack of digital literacy among students and some educators. Instructors often lack formal training in the use of educational technologies, and students, especially those entering from underserved backgrounds, frequently begin their studies with minimal exposure to digital tools (Bordoloi, Das, & Das, 2021). This digital divide manifests not only in technological proficiency but also in confidence and motivation to engage meaningfully in online learning environments.

Ghawail, Yahia, and Alrshah (n.d.) report from a study conducted in Libyan universities that digital illiteracy among students and academic staff significantly hampered the integration of e-learning. Most faculty members relied on personal, often outdated, equipment and were unfamiliar with the pedagogical principles underlying digital content delivery. In a parallel finding, Mtebe and Raisamo (2014) observed that Tanzanian medical students lacked basic digital skills, rendering them dependent on printed materials and in-person lectures even within supposedly blended curricula. Without systematic training and continuous support, both instructors and learners struggle to navigate learning management systems (LMS), conduct online assessments, or participate in digital discussions.

To mitigate this challenge, there is a need for structured digital literacy programs within health training institutions, tailored to local contexts and aligned with the evolving demands of medical education. Training should go beyond tool usage to include information literacy, data security awareness, and pedagogical strategies for online learning (Harris et al., 2009).

Technological Infrastructure

Reliable technological infrastructure is essential for the effective delivery of e-learning. This includes access to functioning computers, mobile devices, stable internet connections, and consistent electricity supply, all of which remain unevenly distributed across many African medical training institutions (Kaliisa & Picard, 2017). Hege et al. (2020) highlight the necessity of dependable digital platforms that allow synchronous and asynchronous engagement, content distribution, and assessment. Yet in many sub-Saharan African contexts, both students and faculty often depend on personal mobile

phones and prepaid data bundles to access online content, creating inequities in participation and academic performance.

Juliani, Corrente, and Dell'Acqua (2011) point out that limited bandwidth and intermittent connectivity directly influence the quality and consistency of e-learning delivery. Such infrastructural deficiencies hinder the use of video conferencing tools, delay the submission of assignments, and reduce the interactivity of digital courses. In Kenya, for instance, students at rural campuses of medical training colleges face recurring connectivity problems, forcing institutions to rely on low-bandwidth alternatives such as WhatsApp or email (Ochola & Mumo, 2021).

Technological support within institutions is often insufficient. Information, Communications and Technology (ICT) departments are often understaffed, underfunded, or not integrated with teaching functions. This disconnect limits the institution's ability to maintain digital infrastructure or respond to emerging challenges during course delivery. As a result, even when software platforms are acquired or introduced, they often remain underutilized or poorly configured, ultimately reducing their pedagogical value.

Skills Training and Pedagogical Adaptation

Effective e-learning requires targeted skill development. The shift to online learning introduces new demands on students for self-regulation, time management, and navigation of complex digital environments. These skills are not innate and must be cultivated deliberately. However, for many institutions in Africa, the introduction of e-learning has been reactive rather than strategic. During the COVID-19 pandemic, for instance, training programs were hastily rolled out without adequate pedagogical guidance or follow-up support (Bordoloi et al., 2021). Consequently, many faculty

members defaulted to uploading lecture notes or PowerPoint slides without meaningful integration of interactive elements, such as discussion boards or formative quizzes. This passive use of digital tools risks replicating traditional didactic models in a virtual format, undermining the core advantage of e-learning, namely, learner-centred, adaptive instruction.

There's need for a systematic approach to capacity building. Such an approach should include formal induction for new staff, continuing professional development in instructional design, and mentoring programs that pair digitally experienced educators with those new to e-learning. Institutions may also consider dedicating specific time for curriculum development, acknowledging the additional labour that digital pedagogy often entails (Sharpe, Benfield, & Francis, 2006).

Institutional Barriers

Institutional support is perhaps the single most important determinant of successful e-learning implementation. Ghawail et al. (n.d.) underscore that faculty enthusiasm and student engagement increase markedly when institutional leadership visibly supports e-learning through policy, resource allocation, and symbolic recognition. Without such support, e-learning remains a marginal activity, easily overshadowed by conventional priorities. Atun (2012) advocates for systems thinking in educational innovation, arguing that the success of digital transformation depends not merely on technological components but on how well they are integrated into institutional structures and governance frameworks. This involves aligning digital learning strategies with institutional missions, providing clear guidelines for faculty performance in e-learning environments, and embedding digital literacy in student support services.

In many African universities and training colleges, however, policy gaps remain. While strategic plans may mention e-learning, actual implementation is sporadic and underfunded (Kigotho, 2020). This results in ambiguity for departments, insufficient budget lines for digital initiatives, and the lack of formal incentives for staff to participate in online education. In such contexts, creating sustainable e-learning ecosystems requires not just technology procurement but organizational change involving redefining roles, revising workload formulas, and investing in long-term infrastructure and training.

The Role of e-Learning Champions and Technologists

Promoting e-learning often requires designated individuals to serve as advocates within institutions. These "e-learning champions" play a vital role in localizing strategies, mentoring colleagues, and mediating between administrative directives and academic practice (Sharpe et al., 2006). As Cummings et al. (2005) suggest, champions can emerge through top-down initiatives, grassroots enthusiasm, or middle-management advocacy. Regardless of origin, their sustained influence depends on institutional recognition and empowerment. Alongside pedagogical champions, the presence of dedicated e-learning technologists is essential. These individuals provide technical assistance, troubleshoot digital systems, and collaborate with faculty to develop course materials. Technologists should not be confined to IT departments but embedded within academic units to ensure responsiveness to disciplinary needs. Cross-functional collaboration, such as joint workshops or interdisciplinary learning design teams, has been shown to increase faculty confidence and innovation in digital teaching (Kaliisa & Picard, 2017).

In Africa, this model remains underdeveloped. Most institutions have limited numbers of instructional designers or technologists, and their roles are often poorly defined. This gap leaves faculty isolated and overburdened, especially during periods of rapid digital transition, as witnessed during the pandemic and the subsequent period.

The potential for the scalability of e-learning in medical education is undeniable. However, its realization depends on the resolution of multifaceted barriers. Digital literacy, infrastructure, skills training, institutional support, and strategic leadership all play essential roles in determining the viability of e-learning systems. For African medical education institutions such as KMTC and similar colleges, there is an urgent need for contextually sensitive solutions that recognize the interplay of technical, pedagogical, and organizational variables.

Addressing these barriers must begin with contextualizing them from the perspective of the students who experience them. As digital tools become more deeply integrated into health professions education, the goal must shift from basic access to meaningful engagement. This requires long-term investment in people, systems, and pedagogy, not simply the deployment of devices or platforms. E-learning provides the opportunity through which institutions can restructure their teaching and learning strategies, refine and reinforce their support structures, and redesign their Learning Management Systems (LMS) to provide quality and accessible medical education.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter discusses the methodology employed in the study. It includes the research design, the target population, and the sampling techniques employed. The chapter also discusses the sample and sampling techniques, data collection methods, study instruments, and data analysis methods used.

3.2 Study Site

The study was conducted at the Kenya Medical Training College (KMTC), in campuses offering upgrading diploma course in orthopaedic and trauma medicine through ODeL. As of 2024, KMTC operated 83 Campuses across Kenya, with a student population of about 50,000 (www.kmtc.ac.ke). With over 76 different medical courses on offer, KMTC contributes immensely to the Kenyan health sector and is currently producing more than 12,000 graduates every year for both the Kenyan public and private health sectors, accounting for more than 85 percent of the hospitals' workforce (KMTC, 2024).

There were four (4) campuses of the College offering Upgrading Diploma level training in orthopaedic and trauma medicine through ODeL in 2023. These four campuses were the study sites for this study. These campuses are Kangundo, Nakuru, Makindu and Port Reitz.

3.3 Study Design

This was a mixed-methods cross-sectional study. Both quantitative and qualitative approaches to data collection were deployed. Quantitative data helped test the hypotheses and helped determine relationships between variables.

The qualitative method was incorporated to understand the e-learning barriers from the perspective of the ODeL orthopaedic students themselves, which cannot be expressed in quantitative terms (Myers and Avison 2002). The qualitative method is the best approach to explore more thoroughly the participants' experiences, attitudes and beliefs, as it does not regard facts as objective, but as a subjective reality related to differences in each individual (Creswell 2014). It helped provide a deeper understanding of the perceived barriers affecting e-learning among ODeL orthopaedic students of the Kenya Medical Training College and further yielded sufficient information to answer the research questions.

3.4 Target Population

The target population refers to the entire group of individuals or objects to which the researcher is interested in generalizing the conclusions. It usually has varying characteristics, and it is also known as the theoretical population (Crotty, 1998; Creswell, 2009).

This study targeted four (4) campuses of the Kenya Medical Training College offering the Upgrading course (Certificate to Diploma) in Orthopaedic and Trauma Medicine through the Open, Distance and e-Learning (ODeL) system. Specifically, the target cohorts were those students who had completed the first semester through ODeL and were at the time in the second semester of year one, i.e. 1.2. This selection was based on the fact that this cohort had already had a semester's experience using e-learning strategies as opposed to the fresh intake (i.e., the 1.1). The class populations from the four campuses fitting this description were as follows: Kangundo 71, Makindu 70, Port Reitz 69, and Nakuru 70. This makes the total target population for this study to **280** ODeL orthopaedic students.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

ODeL orthopaedic students undertaking an upgrading course in orthopaedic and trauma medicine in year 1, semester 2 (Y1S2).

3.5.2 Exclusion Criteria

- Direct entry certificate and basic diploma students of orthopaedic and trauma medicine were not be included in this study
- ODeL students who had deferred studies or been discontinued for some reason.
- OTM upgrading students in their first semester were excluded because of their limited e-learning exposure, including limited exposure to online exams and assessments.

3.6 Sample Size Determination

According to Gay (2002), stating the sample size and sampling procedure enables the establishment of a representative sample for generalization. Sampling is a procedure of selecting a part of a population on which a research or study can be conducted. The sample is to be selected in such a way that conclusions or inferences drawn from the study can be generalized for the entire population.

The four KMTC campuses surveyed had a total of 280 ODeL orthopaedic students that constituted the population of the study. From the population, a sample size of **168** was obtained using the Yamane equation (Yamane et al, 1967) as follows;

$$\mathbf{n = N/1+Ne^2}$$

Where;

n = sample size

N = Population size

e = margin of error (at 95% confidence interval = 0.05)

After substituting for the parameters;

n = 280/1+(280 x 0.05^2) = **164.7**, **adjusted to 168** to evenly distribute to the 4 campuses (42 students per campus) included in the study.

3.7 Sampling Procedure

The respondents were sampled through stratified random sampling to ensure adequate gender representation in each sampled class. The campus and gender of the students formed the basis of stratification. From a target sample of 168 students for the quantitative arm, 156 responded to the questionnaire, constituting the actual number sampled.

For the qualitative arm, two students were purposively selected from each of the four campuses to participate in the FGD. Class representatives were intentionally selected for the FGD in order to benefit the study with the information under their purview by virtue of their position in handling and channeling class concerns to the department. The total number of student FGD participants were eight (8), being four (4) male and four (4) female class representatives from the four selected campuses. Thematic analysis was used to analyze the data, and after transcription and coding, the researcher segregated emerging themes and triangulated them with the results from the quantitative arm.

Table 1: Proportionate Sampling Matrix

Sample Type	**Campus**	**Class Population**	**Gender**		**Representative Sample**	**Actual No. sampled**
Quantitative	Kangundo	71	M	26	15	14
			F	45	27	23
	Makindu	70	M	19	11	11
			F	51	31	28
	Nakuru	70	M	30	18	16
			F	40	24	24
	Port Reitz	69	M	23	14	14

			F	46	28	26
Total				**286**	**168**	**156**
Qualitative	Kangundo	71	M	26	1	1
			F	45	1	1
	Makindu	70	M	19	1	1
			F	51	1	1
	Nakuru	70	M	22	1	1
			F	48	1	1
	Port Reitz	69	M	23	1	1
			F	46	1	1
Total				**286**	**8**	**8**

3.8 Data Collection Procedures

The Heads of Department in Orthopaedic Trauma Medicine in the four campuses were requested to provide class lists and contacts (email and phone contacts) of ODeL orthopaedic students in year 1 semester 2 of training. These lists constituted the sampling frame.

As this is a mixed-methods study, the researcher employed a sequential approach for data collection. There were two distinct phases; the first phase of data collection, where quantitative data was collected using a structured questionnaire, and the second phase, where qualitative data was collected using an interview guide (attached as an appendix in the thesis document). The sequential technique was preferred for this study for ease of integrating the quantitative and qualitative results.

A structured questionnaire was designed in Google Forms to assess the attitudes, preferences, and perceived barriers to e-learning among the ODeL orthopaedic students. Additionally, a virtual focused group discussion with a select group of the students was conducted to obtain deeper insights into the barriers to e-learning. Quantitative data were entered and analyzed using Stata/SE version 16. Descriptive and inferential statistics were computed with statistical significance set at $p<0.05$. Qualitative data was organized into key thematic areas using the NVivo 12 software.

The questionnaire consisted of three (3) sections. The first section aimed to collect data about the study participants' socio-demographic characteristics. The second part collected data on learning preferences, while the third and final part was data about attitudes and perceived barriers to e-learning.

Additionally, an online focused group discussion was conducted with a purposively selected cohort of class representatives in order to gather more views on their experiences with e-learning. An interview guide was used for this phase of data collection. Before data collection, the questionnaire was pre-tested among ten (10) second year ODeL orthopaedic students from the North Coast Medical Training College.

The Likert-scale type electronic questionnaire, adopted from a validated tool developed by Kisanga & Ireson (2016) was used for collecting quantitative data. Prior to the analysis, all responses were coded as 1= Strongly disagree, 2 =Disagree, 3 = Agree and 4 = Strongly agree for positive worded items. Subsequently, responses were reverse-coded as 1= Strongly agree, 2 = Agree, 3 = Disagree, and 4 = Strongly Disagree for all negatively worded items.

3.9 Administration of the Instrument

The electronic questionnaire was sent to the respondents via WhatsApp as a link. Subsequently, a FGD was conducted to obtain qualitative data using an FGD interview guide. The researcher explained the purpose of the study and took time sure to establish a good rapport with group to facilitate a free and open discussion.

3.8 Validity and Reliability of the Research Instruments

3.8.1 Validity

Validity refers to the extent by which an instrument measures what it is supposed to measure (Wiersma, 2000; Mugenda & Mugenda, 1999). It entails establishing whether an instrument measures the characteristic trait or construct for which it was intended. There are three types of validity; content related validity, criterion related validity and construct related validity. Construct validity is overarching and encompasses other validity. Content validation on the other hand is a logical analysis of the items to determine their representativeness. It refers to the extent to which a measure represents all facets of a given social construct.

The data collection tool to determine attitudes was adopted from the validated instrument developed by Kisanga & Ireson (2016) on the *Test of e-Learning Related Attitudes (TeLRA) scale: development, reliability and validity study*. In this tool, the responses in the Likert scale range from strongly agree, agree, neutral, disagree, and strongly disagree, with each weighing 5, 4, 3, 2, and 1, respectively. A positive attitude was regarded as an average score of $\geqslant 4$ out of 5 on all the 5 items on the scale. Three (3) questions on preference of teaching delivery and e-learning methods were adopted from a validated tool developed by Olum et al, (2020) for their Uganda study, *Medical Education and E-Learning During COVID-19 Pandemic: Awareness, Attitudes, Preferences, and Barriers Among Undergraduate Medicine and Nursing Students at Makerere University, Uganda*.

The FGD interview schedule was direction-oriented and open to enable group members to give their views freely and without inhibitions.

3.8.2 Reliability

This refers to the degree to which a research instrument yields consistent results. A reliable instrument is one that will constantly produce the expected results when used more than once to collect data on several trials. The goal of developing reliable measures is to minimize the influence of chance on scores or other variables unrelated to the intent of the measure (McMillan and Schumacher, 2001; Creswell, 2009). According to Wiersma (2000), in a conceptual sense, an observed score can be seen as consisting of two parts: one part, the individual's true score, and the other part, an error score, which is due to the inaccuracy of measurement. If there is little error in the scores, the reliability is high.

For this study, a pilot survey involving ten (10) ODeL orthopaedic students from the North Coast Medical Training College was conducted. This was done to ensure the consistency of the responses to the questions and make the necessary corrections to the research tool.

3.9 Data Analysis

The quantitative data collected were analyzed using the Stata/SE statistical software, version 16. Descriptive statistics such as mean, proportions, standard deviation, frequency tables, and graphs were generated. Binary variables (Yes/No) were expressed in percentages. Measures of association between the different categorical independent and dependent variables were determined using Chi-square tests and prevalence odds ratios at a 95% confidence interval. P values of < 0.05 were considered statistically significant. Hypotheses were tested using Chi-square by univariate and bivariate analysis.

Qualitative data from FDGs were thematically analyzed (deductive codebook thematic analysis approach) using NVivo software. This method enabled the systematic identification and organization of themes based on pre-determined concepts derived from the study objectives and theoretical framework.

The FGD was audio-recorded and transcribed verbatim. The transcripts were read several times in order to familiarize with the data. A deductive codebook was developed prior analysis, containing codes that reflected key concepts from the research questions and literature. The transcripts were then coded according to this codebook using NVivo 12 software, which facilitated efficient organization, retrieval and management of coded data. New codes were added only if the data did not fit the pre-existing codes, ensuring flexibility while maintaining the deductive approach. Codes were reviewed and grouped into overarching themes and sub-themes. These themes were interpreted in relation to the research objectives, highlighting patterns, relationships, and insights relevant to the study.

Representative verbatims were used to support each theme.

Analyzing Attitude

Attitude can be defined as a psychological tendency to view a particular behavior with a degree of favor or disfavor. Attitudes are generally formed through a process of individual evaluation and are influenced by emotional responses and related to beliefs. Attitudes are specific to a behavior or object.

In this study, students' attitude to e-learning was measured by the use of a Likert scale where responses range between two extremes, i.e., strongly agree or strongly disagree. Strongly disagree represents a very negative attitude, while strongly agree depicts very

positive attitude. In the data collection tool, the responses ranged from strongly agree, agree, neutral, disagree, and strongly disagree, with each weighing 5, 4, 3, 2, and 1, respectively. A positive attitude was regarded as an average score of $\geqslant 4$ out of 5 on all 5 items on the scale.

Analyzing Preferences

Analysis of e-learning usage, student proficiency in the most common e-learning platforms, and preference for teaching delivery and e-learning methods was done. Numerical data on preferences was summarized as means and standard deviations. Categorical data was presented as frequencies and percentages. To assess the associations between categorical variables (sociodemographic characteristics) and e-learning preferences, the chi-square test was performed using the statistical software Stata/SE version 16.0 software. A $p < 0.05$ was considered statistically significant.

Analyzing Barriers

Qualitative responses relating to perceived barriers to e-learning were analyzed using a deductive codebook thematic analysis approach. This allowed for systematic identification and organization of themes based on pre-determined concepts from the study objectives and theoretical framework. A five-point Likert scale was used to measure the extent to which a barrier is considered to negatively affect e-learning outcomes.

3.10 Data Dissemination Plans

The findings of this study have been peer-reviewed and published in the journal *International Organization of Scientific Research*, DOI 10.9790/7388-1504035263. The findings will also be share with the Moi University School of Medicine, and the

KMTC Department of Orthopaedics and Trauma Medicine, as well as at the KMTC annual scientific conference.

3.11 Ethical Consideration

Ethical approval was obtained from the Institutional Research and Ethics Committee (IREC) of Moi University and the National Commission for Science, Technology & Innovation (NACOSTI). Approval was also sought and granted by the CEO, Kenya Medical Training College and from the Principals of the respective KMTC campuses sampled.

Informed consent was obtained from the study participants before enrolling them into the study. The participants had the right to withdraw their consent at any time during the study without prejudice. All information obtained from the participants was treated with the utmost confidentiality, and all data securely protected electronically by encrypting the folder containing the raw data.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents the analysis results on the data collected regarding attitudes, preferences, and barriers to e-learning among upgrading ODeL orthopedics and trauma medicine at the Kenya Medical Training College. Descriptive statistics, measures of association, and hypothesis testing were performed using the statistical software Stata/SE version 16, and thematic analysis using NVivo for qualitative responses. Data were collected from 156 participants out of the calculated target of 168, translating to a response rate of 93%.

Those who did not participate in the study failed to respond to email and telephone communication that was sent every fortnight. After three months the effort to get responses from the non-responders was halted. Lack of response was construed as failure to consent to participate in the study.

4.1 Descriptive Statistics

Table 2: Demographic Characteristics of the Study Participants

Variable	Category	Frequency	Percent
Age (years)	20-24	109	70
	25-29	39	25
	>30 years	8	5
Gender	Male	55	35
	Female	101	65
Campus	Kangundo	36	23
	Makindu	39	25
	Nakuru	41	26
	Port Reitz	40	26
Marital Status	Single	142	91
	Married	14	9
Prior experience in e-learning	Yes	76	49
	No	80	51
Need e-learning training	Yes	136	87
	No	20	13
Digital literacy skills	Excellent	51	33
	Good	61	39

	Poor	44	28
Residence	Rural Urban	66 90	42 57
Laptop/Smartphone ownership	Yes No	154 2	99 1
Designated study area	Yes No	92 64	59 41
Total		**156**	**100**

The demographic profile of the study participants reveals several poignant characteristics relevant to understanding ODeL orthopaedic students' engagement with e-learning. A substantial majority of the respondents (70%) were between the ages of 20 and 24, indicating that most were within the typical age range for college-level training. A smaller proportion (25%) were aged between 25 and 29, while only 5% were older than 30, suggesting that mature learners formed a minority in the sample.

The findings showed a predominantly female population, with female students comprising 65% of the respondents and male students accounting for 35%. This aligns with broader trends of female predominance in certain health training programs. In terms of marital status, an overwhelming majority (91%) reported being single, while only 9% were married, reinforcing the youthful composition of the study population.

Participants were fairly evenly drawn from the four KMTC campuses while considering class populations and gender distribution: Nakuru (26%), Port Reitz (26%), Makindu (25%), and Kangundo (23%). This proportionate sampling enhances the representativeness of the findings across the institutional settings.

Nearly all respondents (99%) reported owning a smartphone or laptop, indicating a high level of basic technological access. Nonetheless, 51% had no prior exposure to e-learning, highlighting a potential gap in readiness. The majority (87%) expressed a clear

need for training in e-learning and on the use of the College e-learning portal, underlining a strong demand for capacity-building in digital education.

In terms of digital literacy, 39% rated their skills as ‘good’, 33% as ‘excellent’, and 28% as ‘poor’, showing a mixed level of confidence and competence in the use of technological tools. A majority of the participants (57%) resided in urban areas, and 59% reported having a designated study space at home, suggesting moderately favourable learning environments for most respondents.

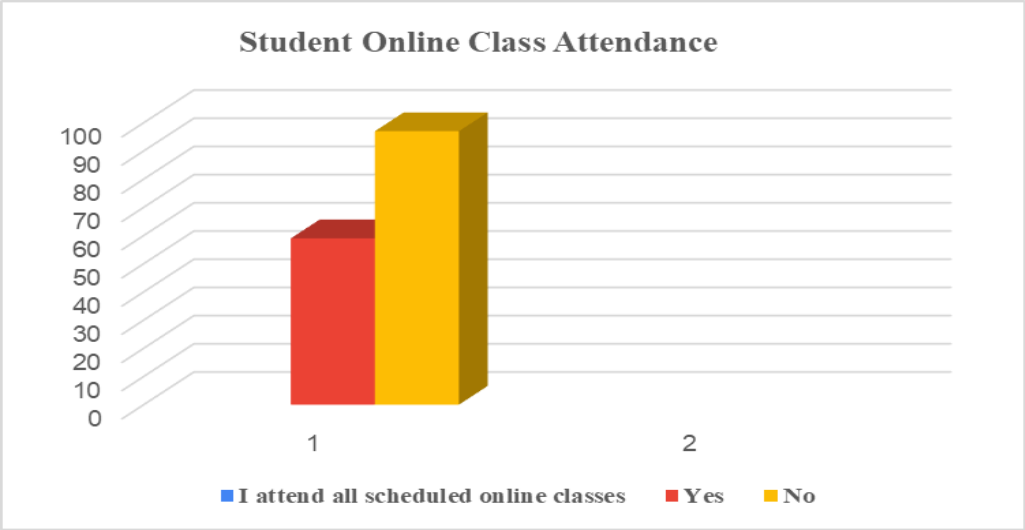

Figure 2: Student Attendance of Scheduled Online Classes

A majority (n=97, 62%) of the students did not attend all scheduled online classes, a large proportion of whom were female (60% vs 40%) and resided in rural areas (53% vs 47%). The results show that a majority of ODeL orthopaedic students do not consistently attend all scheduled online classes. This indicates a notable gap in regular attendance, which may reflect underlying challenges such as connectivity issues, competing responsibilities, or limited engagement with the College e-learning portal.

4.2 Attitudes of ODeL Orthopaedic Students Towards E-Learning

A five-point Likert scale was used to measure the students' attitudes towards e-learning, with responses ranging from "Strongly Disagree (1)" to "Strongly Agree (5)".

Table 3: Attitudes of the Students Towards e-Learning

Attitude Variable	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I feel comfortable using e-learning	11	9	61	50	25
I am interested in e-learning	9	13	39	64	30
e-Learning is not time-consuming	18	11	36	52	38
e-Learning is very convenient for me	14	22	44	76	36
e-Learning enhances my learning process	10	15	51	48	30
I am optimistic about e-learning	14	12	52	39	35
e-Learning is effective for acquiring clinical and technical skills	29	29	43	21	32
e-Learning is suitable for taking exams/CATs	25	23	25	39	42
I find e-learning to be cost-effective	26	16	39	38	35
Overall, I prefer e-learning, and I believe it is better than classroom learning	36	29	38	20	31
Percentage distribution	**3%**	**9%**	**20%**	**28%**	**40%**

The majority of participants (68%) expressed a positive attitude towards e-learning, suggesting that it is an effective and convenient learning method. The mean attitude score was 4.1 (± 0.6), indicating an overall positive attitude towards e-learning. About 20% of respondents were neutral, while 12% held negative attitudes, citing challenges

such as lack of interaction, certain modules that need demonstrations, and technical difficulties with the internet.

Data Triangulation: Qualitative Findings

Qualitative data from FDGs were thematically analyzed using the NVivo software through the deductive codebook thematic analysis approach.

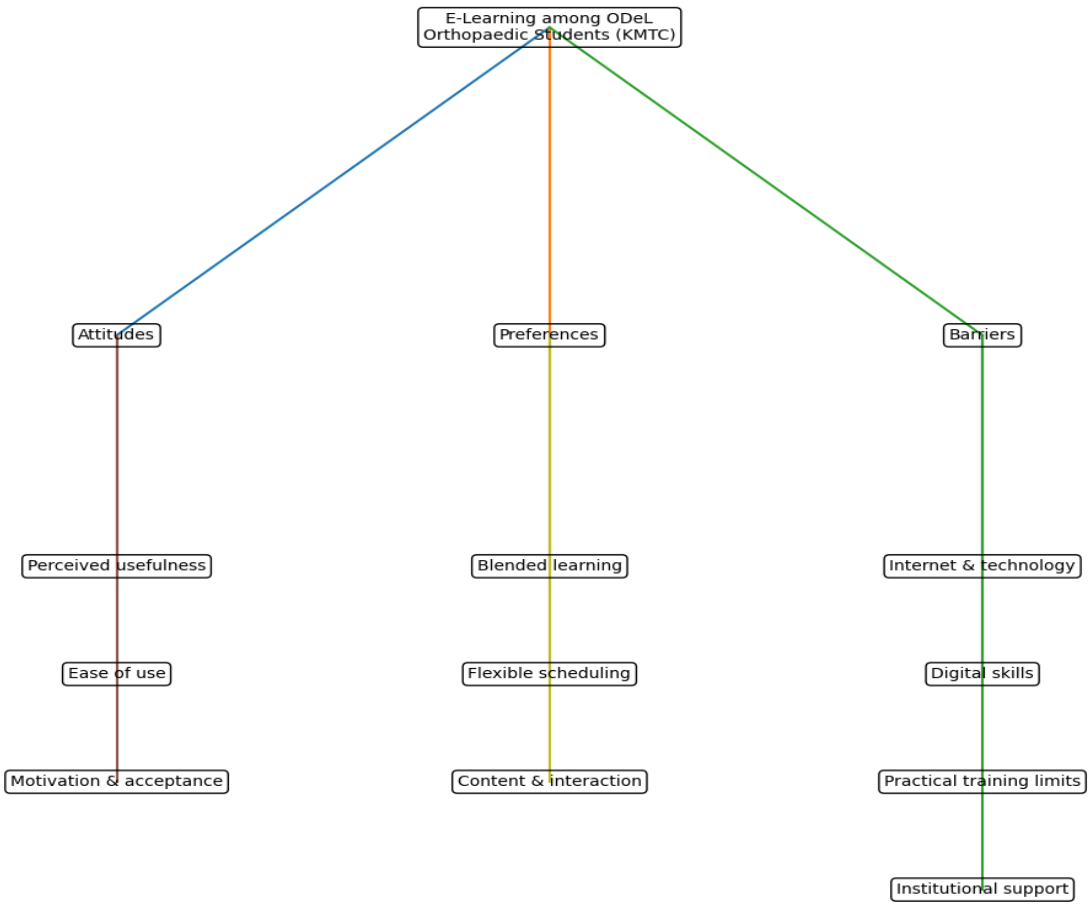

Figure 3: Concept map for thematic analysis of qualitative data

The concept map shows how the various codes group into categories, and how the categories for the three (3) broader themes of attitudes, preferences, barriers. The attitudes capture students' evaluative views of e-learning, including perceived usefulness, ease of use, and overall motivation or acceptance. These attitudes shape how learners engage with online platforms and instructional content.

Preferences reflect how students wish e-learning to be structured and delivered. Key preferences include blended learning approaches, flexible scheduling that accommodates work and family responsibilities, and suitable content formats with meaningful interaction.

Barriers represent constraints that limit effective participation in e-learning. These include internet and technological challenges, limited digital skills, difficulties in teaching practical orthopaedic competencies online, and gaps in institutional support.

Together, the three domains interact to influence students' engagement, satisfaction, and learning outcomes within the ODeL orthopaedic programme.

ODeL Students' Verbatims Relating to Attitudes Towards e-Learning;

The following are some of the most compelling verbatim responses relating to the thematic area of "attitudes towards e-learning";

"I like e-learning because it enables me to work and study at the same time. I can raise my tuition fee."

"With eLearning, there's flexibility in scheduling classes. Most of the lecturers agree to listen to the students' requests to schedule the class to a more convenient time."

"KMTC's e-learning platform is always crashing or lagging, making it really frustrating to use. However, I don't experience the same difficulty when the lecturer uses Zoom or Google Meet for online classes."

Perceived Benefits

A majority of respondents (81%) appreciated the flexibility offered by e-learning, which allows them to study at their own pace and time. On IT skills development, most

of the students (64%) agreed that eLearning improved their technological skills and self-discipline for student-directed learning.

4.3 E-Learning Preferences of ODeL Orthopaedic Students

Table 4: Learning Preferences of ODeL Orthopaedic Students

Variable	Categories	Frequency	Percentage
Preferred method for learning	E-learning only	23	15
	Classroom learning only	21	13
	Blended learning	112	72
Preferred e-learning platform	Google Meet	72	47
	Kenet	13	8
	KMTC e-learning portal	27	17
	Zoom	35	28
Preferred e-learning method	Asynchronous	17	11
	Synchronous	139	89
Asynchronous online content preferences	Videos	122	78
	Quizzes	25	16
	Downloadable texts	9	6

Preferred Method for Learning

The majority (72%) of the students preferred a blended learning model that combines online and face-to-face sessions. They report that physical interaction during practical sessions complements theoretical e-learning. Only 18% of students preferred a fully online model, citing convenience as the main reason. However, 15% of them still favored traditional learning methods over e-learning.

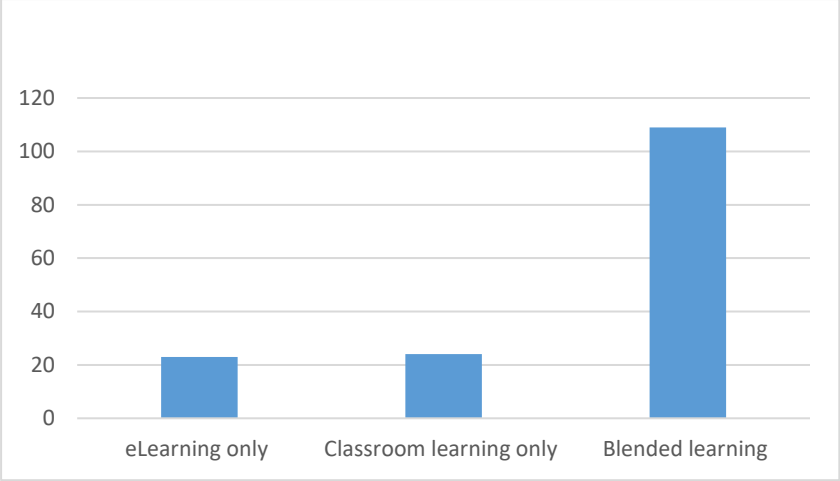

Figure 4: Preferred Method for Content Delivery

Preferred eLearning Platforms and Methods

The majority of the students (47%) preferred using the Google Meet video conferencing platform, followed by Zoom (28%) and the KMTC e-learning platform (17%). The least preferred was the Kenet platform at 8%.

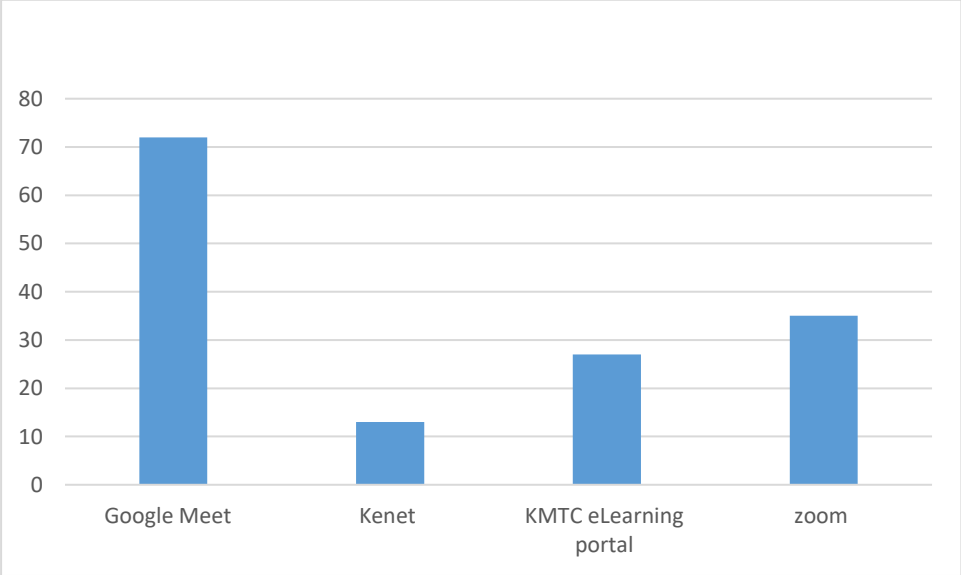

Figure 5: Preferred e-Learning Platform

Between synchronous and asynchronous e-learning methods, 89% favored the synchronous method that affords live sessions, while 11% preferred asynchronous learning delivered through recorded lectures.

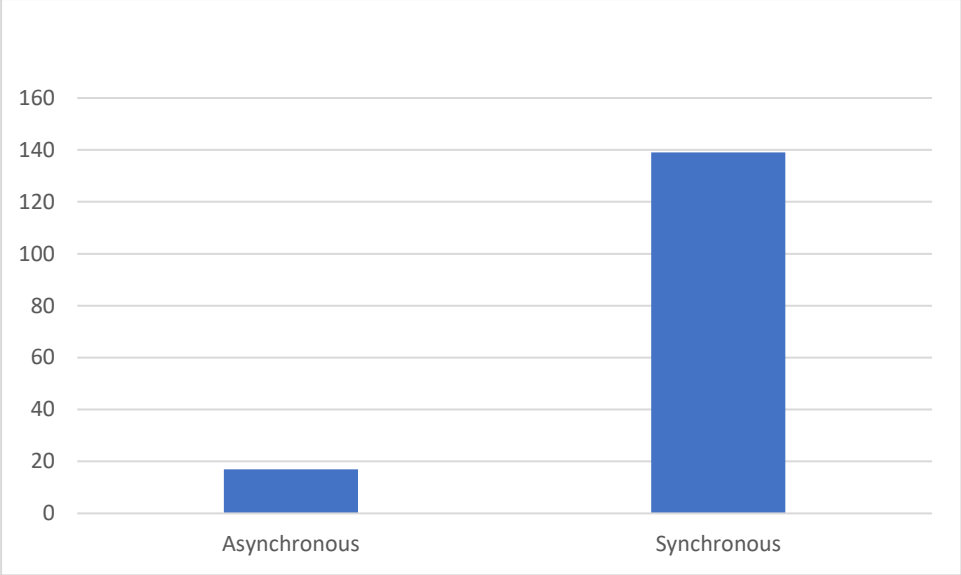

Figure 6: Preferences for Asynchronous vs Synchronous e-Learning

For asynchronous content, most students (78%) preferred to have engaging video content and quizzes (16%) over text-based materials (6%).

ODeL Students' Verbatims Relating to Learning Preferences

Some of the most compelling quotes relating to their preferred learning methods include;

"The arrangement where we attend physical classes and other times online classes is good for me because I can work and study"

"I can access lectures and readings from anywhere with an internet connection, which is really helpful whether I'm at home or on clinical rotations."

"I can study at my own pace whenever it fits into my schedule, even late at night."

Student Concerns Relating to E-Learning

A majority of the students (58%) expressed concerns about the lack of face-to-face interaction with lecturers and peers, which they felt negatively impacted their understanding of complex concepts in orthopaedics.

On assessing the quality of the eLearning content, 55% of them reported that the e-learning platforms did not provide access to a wide range of learning materials, including videos, e-books, and interactive discussion forums. A further 25% were unsure whether e-learning content matched the quality of traditional classroom lectures.

4.4 Barriers to E-Learning as Perceived by ODeL Orthopaedic Students

Table 5: Individual Student Barriers

Individual Student Barriers	**SD**	**D**	**N**	**A**	**SA**
I have sufficient time to participate in e-learning activities	45	41	21	29	20
I am motivated to participate in e-learning	20	27	35	43	31
I consider my digital literacy skills adequate to facilitate my e-learning	37	43	12	49	15
I have a suitable e-learning environment at home	32	23	27	53	21
I have Wi-Fi at home or can afford data bundles for my e-learning	50	39	22	31	14

Time management was a challenge cited by the majority (55%) of students struggling to balance e-learning with personal and professional commitments. Another 30% considered self-motivation a challenge, especially during prolonged periods of e-learning.

Lack of digital literacy skills (51%), coupled with the lack of a suitable learning environment at home (35%) and high data costs (57%), emerged as other significant individual barriers to e-learning

Table 6: Technological Barriers

Technological Barriers	**SD**	**D**	**N**	**A**	**SA**
I have access to at least a smartphone or a laptop to facilitate my e-learning.	1	1	0	28	126
My internet is fast, stable, and reliable for e-learning	71	30	23	20	12
I find the KMTC e-learning portal easy to navigate, access, and upload my work	37	29	43	29	18
Lack of access to power and frequent power blackouts affect my online studies	32	18	25	46	35

The majority of the students (99%) had access to digital devices such as smartphones and laptops that facilitated their online learning. However, a majority of them (65%) cited unreliable internet access as a major challenge, and most of them (42%) had difficulties navigating and making use of the KMTC e-learning portal. Lack of access to power and/or frequent power blackouts were cited by the majority (52%) of the students as a significant technological barrier to their e-learning.

4.4.2 Institutional Barriers

Table 7: Institutional Barriers

Institutional Variable	**SD**	**D**	**N**	**A**	**SA**
Technical support is available when I need assistance regarding e-learning	69	29	25	21	12
On campus internet is available and stable	61	26	22	30	17
Online course content is available at campus	42	30	37	20	27
I was trained on ICT and the use of the KMTC e-learning platform	39	41	14	39	23
ODeL student concerns are heard and addressed	32	43	27	22	32

Lack of technical support was cited as a barrier to e-learning by the majority of the students (63%), which made it difficult to resolve technical issues promptly. Intermittent and weak on-campus internet was also cited by 56% of the students as a hindrance to seamless e-learning when on campus. Another factor cited as a barrier was

the lack of training on digital skills and the use of the KMTC e-learning portal by the majority (51%) of the students. However, most of the students agreed that online course content was provided by the College (46%) and that their concerns were heard and addressed when they raised them with the institution (48%).

4.4.3 Pedagogical Barriers

Table 8: Pedagogical Barriers to E-learning

Pedagogical Variable	**SD**	**D**	**N**	**A**	**SA**
There is adequate communication between the lecturers and students during e-learning	15	8	41	56	36
There is good interaction between students and lecturers during online learning	51	49	23	21	12
Lecturers are flexible in scheduling online classes	13	15	54	47	27
The module content is suited for online learning	51	36	30	25	14
Lecturers are accessible for guidance and consultation after class	23	18	38	45	32
Lecturers provide feedback on my progress	16	17	38	49	36

The majority of the students agreed that there's adequate communication (59%), but largely decried the lack of interaction (64%) between the students and lecturers and among the students themselves. Most of them (47%) found the lecturers to be flexible in the scheduling of the online classes. Regarding the coverage of module content online, a majority of the students (56%) considered technical modules unsuitable for online learning.

A proportion of the students consider the lecturers to be not accessible for guidance and consultation (26%) and not being provided individualized feedback on their academic progress (21%).

ODeL Students' Verbatims Relating to Barrier to e-Learning

Individual Student Concerns;

"It's quite a hustle for me to balance work and school."

Pedagogical Concerns;

"Some of the modules, such as statistics in year 1.2 are too technical to understand online. I believe for such modules, face-to-face interactive sessions with lecturer demonstrations would help me understand better."

"It's impossible to practice techniques online."

"I miss the face-to-face interaction with lecturers and classmates.

Technological Concerns;

"Sometimes, I have a slow internet connection. So, it takes forever to load videos and simulations, and sometimes I'm not able to maintain uninterrupted attendance to an online class."

"Sometimes, I'm not able to join a class because I do not have bundles."

"I found it hard to navigate and upload assignments to the online portal in the first semester. It generally requires students to have technical IT skills. Some of us are not good at this."

Suggestions to Improve e-Learning;

"It would really help us if, in the first semester, we were taught how to navigate the student e-learning portal and other online platforms. Training on basic computer skills and how to use online learning tools could also help, as some of us do not have these skills."

"A more reliable and user-friendly student eLearning platform, faster internet speeds on campus, and regular technical support would be a huge improvement."

"A better balance between online and face-to-face learning would be ideal. "

"Lecturers should include regular feedback, and guide us appropriately because for some of my classmates, this is the first instance of interaction with e-learning."

4.5 Inferential Statistics

4.7 Hypothesis Testing

Hypothesis 1 (H_o1):

There's no significant relationship between ODeL orthopaedic students' demographic factors and their attitudes towards e-learning:

The relationship between ODeL students' demographic characteristics and their attitudes towards e-learning was analyzed using stepwise linear regression on the 156 respondents.

Model Summary:

- **Adjusted R^2 (coefficient of determination):** 0.62 (The adjusted R^2 value indicates that 62% of the variation in attitudes towards e-learning can be explained by the demographic characteristics included in the model.)

Significant Predictors:

1. Age ($p = 0.01$)
2. Digital literacy skills ($p = 0.03$)

Interpretation:

- **Age (p = 0.01):**
  Younger respondents are more likely to have a positive attitude towards e-learning, with a statistically significant relationship observed. This suggests that attitudes towards e-learning may improve with younger age groups.
- **Digital literacy skills (p = 0.03):**
  Those with high digital literacy skills tend to have a more favorable attitude towards e-learning, as shown by the statistically significant relationship between digital literacy skills and attitude (p = 0.03)

Decision on H_o1

With 156 respondents, the stepwise regression model indicated that age and digital literacy skills are significant predictors of attitudes towards e-learning. The model explains 62% of the attitude variation, suggesting a strong relationship between demographic factors and attitudes towards e-learning. There's strong evidence to reject the null hypothesis.

Test of Normality

A test of normality was performed on the data to validate the results of the regression analysis and to determine the most appropriate statistical test for the data. Shapiro-Wilk test was performed to assess the normality of numerical variables among the 156 respondents.

Results:

1. **Age:**
   - **W = 0.96**, **p = 0.08**

- **Interpretation:** The p-value is greater than 0.05, indicating that age follows a normal distribution in this sample of 156 respondents. No significant deviation from normality is detected.

2. **Attitude Scores:**
    - **W = 0.91**, **p = 0.01**
    - **Interpretation:** The p-value is less than 0.05, suggesting that attitude scores do not follow a normal distribution. This result is consistent with the non-normality of attitude scores in this sample.

Analysis Approach:

- For 156 respondents, age follows a normal distribution, while attitude scores are non-normally distributed.
- The non-normal variable, i.e., attitude scores were analyzed using the Chi-square test, a non-parametric method to account for the non-normal distribution of the data.

Hypothesis 2 ($H_0$2):

There's no significant difference in learning preferences among ODeL orthopaedic students for face-to-face learning, e learning, and blended learning:

A univariate analysis was performed using STATA to determine ODeL orthopaedic students' preference for either face-to-face only, e-learning only, and blended learning methods of teaching delivery. The results were tabulated as below;

Table 9: Chi-Square contingency table for learning preference (Observed vs Expected frequencies, n = 156)

Learning Preference	**Observed Frequency (O)**	**Expected Frequency (E)**
Face-to-face only	10	52
E-learning only	34	52
Blended learning	112	52
Total	156	156

Test Statistic	**Value**
Chi-square (χ^2)	109.38
Degrees of freedom	2
P value	**0.001**

The tables present the distribution of learning preferences among ODeL orthopaedic students at the Kenya Medical Training College. The majority of students, 112 (72%), preferred blended learning, while 34 students (22%) indicated a preference for e-learning only. A small proportion of respondents, 10 students (6%), preferred face-to-face learning exclusively.

The Chi-square goodness-of-fit test demonstrated a statistically significant difference in students' learning preferences, $\chi^2(2) = 109.38$, $p = 0.001$. This indicates that the observed distribution of learning preferences differs significantly from the expected distribution, with blended learning being the overwhelmingly preferred mode.

Table 10: Comparing Urban-based vs Rural-based ODeL Students on Preferred Mode for Content Delivery

Variable	**Category**	**Total (n=156)**	**Urban (n=90)**	**Rural (n=66)**	**P-value**
Preferred Mode of Content Delivery	e-Learning only	23	15 (65.2%0	8 (34.8%)	0.042
	Face-to-fac only	24	5 (20.8%)	19 (79.2%	0.035
	Blended learning	109	57 (52.1%)	52 (47.9%)	0.510
Preferred e-learning method	Synchronous	17 (10.8%)	9 (52.9%)	8 (47.1%)	0.522
	Asynchronous	139 (89.2%)	81 (58.3%)	58 (41.7%)	0.684

The bivariate analysis demonstrates a significant difference between urban and rural students in their preferences for the various modes of content delivery. Urban-based students were more likely to prefer e-learning only (65% vs. 35%, p=0.042), whereas

rural-based students showed a stronger preference for classroom-only learning (79% vs. 21%, p=0.035). However, there was no significant difference for the blended mode of learning (p=0.510) and preferred e-learning method, i.e., synchronous vs. asynchronous, (p=0.684). These findings show that both urban-based and rural-based students largely prefer the blended learning mode of content delivery.

Decision on $H_0$2

The null hypothesis is thus rejected based on the strength of the evidence against it (p=0.001). This finding indicates that ODeL orthopaedic students at the Kenya Medical Training College exhibit a clear and statistically significant preference for specific modes of learning, with blended learning being the most preferred option. The follow-up analysis shows that both urban-based and rural-based students prefer blended learning.

Hypothesis 3:

There's no significant correlation between ODeL orthopaedic students' prior e-learning experience and their participation in the current e-learning:

Table 11: Bivariate Analysis to Determine the Influence of Prior e-learning on Current e-learning (Ho2)

Variables	Odds ratios	95% CI lower	95% CI upper	P value
Without prior e-learning experience (reference)	1.00	-	-	-
With prior e-learning (n=76)	3.84	1.71	8.63	0.001

The table presents the results of a bivariate analysis examining the influence of students' prior e-learning experience on their participation in current e learning among ODeL orthopaedic students at the Kenya Medical Training College.

Using students without prior e-learning experience as the reference group, those with prior e-learning experience had significantly higher odds. Students with prior e-learning experience were significantly more likely to participate in current e-learning compared with those without such experience. The odds ratio of 3.84 indicates that students who had previously engaged in e-learning were nearly four times more likely to participate in current e-learning activities. This association was statistically significant, as evidenced by a p-value of 0.001 and a 95% confidence interval ranging from 1.71 to 8.63, which does not include the null value of 1. The association between prior e-learning and current e-learning is statistically significant.

Decision on $H_0$3

The findings provide sufficient evidence to reject the null hypothesis. There's a strong association between prior e-learning and participation in current e-learning among ODeL orthopaedic students (OR = 3.84, p=0.001). The results suggest that prior exposure to e learning plays a significant role in shaping students' engagement with current e-learning modalities, underscoring the importance of early and structured introduction to e-learning within the training program.

CHAPTER FIVE

5.0 DISCUSSIONS

5.1 Introduction

This chapter provides a detailed interpretation of the findings of the study, which sought to investigate the attitudes, preferences, and barriers to e-learning among orthopaedic students enrolled in the Open, Distance, and e-Learning (ODeL) programme at the Kenya Medical Training College (KMTC). The discussion draws on existing literature to contextualize and critically reflect on the results, highlighting points of convergence and divergence with previous studies. The aim is to offer a deeper understanding of the dynamics shaping the e-learning experience in a practical and resource-constrained medical education setting.

5.2 Attitudes Toward E-Learning

The study revealed that a majority of the respondents (68%) expressed a generally positive attitude toward e-learning. Students appreciated its flexibility, ease of access, and the autonomy it offers in managing their learning pace. These findings align with Bączek et al. (2021), who reported that medical students found online platforms beneficial for accommodating academic demands alongside personal and professional obligations. Similarly, Dhawan (2020) emphasized the value of self-paced learning as a key strength of e-learning, especially in environments where students juggle multiple roles or are otherwise constrained by other demands on their time.

However, this optimism was counterbalanced by a significant proportion of students (58%) who expressed concern over the limited opportunities for face-to-face interaction between students and lecturers and among the students themselves. This mirrors the findings of Bali and Liu (2018), who noted that the absence of real-time engagement and collaborative learning in online settings could hinder knowledge construction and

retention, particularly in fields like orthopaedics that require critical discussion and demonstration. For KMTC students, where the subject matter involves highly practical and tactile skill development, the inability to interact with peers and lecturers in person emerged as a real concern.

Moreover, some students questioned the adequacy and relevance of the learning materials provided through e-learning platforms. These reservations echo the work of Adnan and Anwar (2020), who pointed out that the quality of digital content, especially in underfunded institutions, is often suboptimal. Poorly curated or overly theoretical materials that lack practical application risk diminishing learner engagement and comprehension in technical disciplines such as orthopaedic medicine.

While the majority of students responded positively to e-learning, 12% expressed openly negative attitudes, citing challenges such as unreliable internet access, lack of digital fluency, and limited communication with lecturers. These findings support observations by Adedoyin and Soykan (2020), who argued that in low- and middle-income countries (LMICs), infrastructural barriers frequently erode the perceived value of digital education. The voices of these students remind us that access to e-learning alone does not guarantee effective adoption and engagement. Technology must work in concert with pedagogy and existing support systems to foster meaningful learning experiences.

While attitudes toward e-learning are generally favourable, the results suggest that appreciation for its convenience is tempered by concerns about isolation, insufficient interaction, and the variable quality of digital content that may not adequately meet the demands of technical medical disciplines.

5.3 Preferences for E-Learning

The preference for blended learning was strikingly emphatic in the responses, with 72% of students indicating it as their ideal model. This preference reinforces similar findings from Kaloki et al. (2023) and Chingos et al. (2022), who observed that blended learning provides a more balanced experience, merging the flexibility of online content delivery with the social and practical benefits of in-person learning. For orthopaedic students at KMTC, whose training involves a delicate blend of theoretical knowledge and hands-on clinical skills, this model appears to best accommodate the ODeL orthopaedic students' learning needs.

This finding is particularly important given the nature of medical education, where purely online instruction may struggle to meet the demands of practical skills acquisition. The value of human interaction, whether with lecturers during demonstrations or with peers in collaborative tasks, cannot be replicated in exclusively virtual formats. Students' preference for a model that retains some level of physical presence is a call for a more balanced instructional design that recognizes these complexities.

The study also found a strong preference for Learning Management Systems (LMS), with 85% of participants identifying them as crucial to their learning experience. LMS platforms such as the KMTC e-learning portal, Moodle and Google Classroom were valued for their ability to organize materials, monitor progress, and provide asynchronous access to resources. This supports Dhawan's (2020) view that LMS platforms offer structural consistency and progress tracking, which are essential for students managing complex course loads across various subjects.

Real-time interaction also emerged as a critical component, with 67% of respondents favouring synchronous learning via video conferencing tools such as Zoom and Google Meet. These platforms help provide a level of immediacy in instruction, narrowing the psychological distance between students and lecturers. The importance of this cannot be overstated, particularly for medical learners who rely on direct communication for clarification, discussion, and reassurance. These tools also provide the opportunity for live demonstrations and breakout rooms for group assignments.

In terms of content delivery, the study revealed a marked preference for short, engaging video lectures (78%) and the integration of interactive quizzes (16%). Guo et al. (2014) emphasized that video lectures under six minutes significantly improve student engagement, and this finding is clearly supported by the current study. Shorter videos allow students to process complex information incrementally, improving focus, comprehension and retention. Further, 60% of students recommended the use of instructional videos demonstrating clinical orthopaedic procedures. This reflects a demand for content that bridges the gap between theory and clinical practice, a point reinforced in numerous studies on digital medical education. Multimedia materials that simulate clinical procedures not only enrich understanding but also foster confidence before actual patient encounters.

Despite these promising trends, only 18% of respondents supported fully online learning. This relatively low figure reflects similar patterns reported by Bao (2020) and Kaloki et al. (2023), who noted that students in technical medical disciplines often perceive the fully online option as inadequate. The reasons are varied, from feelings of isolation to difficulties with self-motivation and the challenges of mastering content without practical reinforcement.

In essence, the study confirms that while students appreciate the efficiencies and convenience of online tools, their ideal learning environment remains one that incorporates meaningful human interaction, practical demonstrations, and responsive instructional design.

5.4 Barriers to E-Learning

A major area of concern that emerged from the data was the presence of persistent barriers that continue to hinder effective e-learning participation. Technological limitations had the most profound effect, with 72% of students citing poor internet connectivity as a significant issue. High data costs followed closely, with 65% of respondents indicating that affordability was a serious constraint. These findings mirror the work of Adedoyin and Soykan (2020), who underscored that access to reliable internet remains a fundamental bottleneck in digital education in low and middle-income countries (LMICs).

In Kenya's rural and semi-rural settings, where many KMTC students reside, network coverage is often patchy and unstable, and internet services are costly relative to household income. These festering infrastructural disparities exacerbate inequalities in access and performance among students. For digital learning to be viable and inclusive, these foundational issues must be addressed through both institutional investment and broader policy reforms.

Institutional barriers also featured prominently. More than half of the participants (58%) reported inadequate technical support, and 48% indicated that they found the platforms difficult to navigate. This supports Hodges et al. (2020), who warned that institutions often underestimate the importance of platform usability and real-time

assistance. When students encounter unresolved technical difficulties over time, their engagement and motivation decline.

Further compounding the problem are student-related challenges. Time management was cited by 55% of respondents as a significant barrier. This finding is not surprising, given that many students in ODeL orthopaedic students juggle employment, family obligations, and academic responsibilities. Bao (2020) also emphasized that time management is a key determinant of success in online learning, particularly in asynchronous environments where external influences compete for students' commitment to follow through with coursework.

Low motivation was noted by 30% of respondents, reinforcing the view that e-learning requires a high degree of self-discipline and intrinsic drive. Broadbent and Poon (2015) argued that the absence of routine, peer accountability, and physical presence in online learning settings can erode focus and persistence, especially among students not accustomed to self-directed study.

Pedagogical barriers were also evident, particularly in relation to interaction and feedback. More than half of the students (58%) expressed dissatisfaction with the level of interaction, while 35% cited inadequate feedback from lecturers. Peer-to-peer interaction alongside student-lecturer interaction is instrumental in the construction of knowledge, reinforced by prompt feedback. These concerns echo the findings of Bali and Liu (2018), who stressed the importance of prompt, meaningful feedback and interactive learning experiences in sustaining student engagement.

Collectively, these findings suggest that barriers to e-learning are layered and multifactorial, intersecting across technological, institutional, personal, and instructional dimensions. To overcome them, KMTC and similar institutions must take a coordinated, systemic approach addressing infrastructure, improving technical support, investing in instructional design, and fostering a culture of all-stakeholder engagement.

The findings provide a clear picture of the e-learning landscape for ODeL orthopaedic students at KMTC. On one hand, the overall attitude toward e-learning is positive, with students appreciating the flexibility, accessibility, and autonomy it provides. There is clear enthusiasm for blended learning models, interactive content, and structured platforms. On the other hand, the effectiveness of these tools is undermined by recurring barriers; technological, institutional, personal, and pedagogical.

A particularly compelling insight is the association between digital literacy and positive attitudes toward e-learning. Students who reported greater familiarity with digital tools tended to express more confidence and satisfaction with their online learning experience and were more likely to attend most of the scheduled classes. This underscores the need to embed digital literacy training early in students' academic journeys. Such training should go beyond basic computer skills to include the effective use of learning management systems (LMS), mobile learning tools, and emerging technologies such as artificial intelligence in education.

Another important observation is the correlation between prior exposure to e-learning and current levels of participation. Students with earlier prior exposure to online platforms showed higher levels of comfort and engagement. This suggests that institutional orientation programs should include structured exposure to digital learning

environments, particularly during the early stages of certificate training in orthopaedic trauma medicine.

The study's hypothesis testing provided a deeper understanding of the factors influencing e-learning attitudes and participation. The finding that younger students and those with higher digital literacy skills are more likely to hold a positive attitude towards e-learning (R2=0.62) is a critical insight. It suggests that a one-size-fits-all approach may be ineffective and that targeted training programs are necessary to bring less digitally-savvy students up to speed. Furthermore, the strong association between prior e-learning experience and higher participation (Odds Ratio = 3.84) highlights the importance of providing introductory training and support to new students, who may be encountering online learning for the first time.

This study is not without limitations. The cross-sectional design provides a snapshot of attitudes and preferences at a single point in time, and a longitudinal study would be required to assess the long-term impact of e-learning on learning outcomes and clinical competence. The reliance on self-reported data for digital literacy and participation may also introduce a degree of social desirability bias. However, the use of a mixed-methods design, with its triangulation of quantitative and qualitative data, mitigates some of these limitations by providing a more comprehensive and robust picture of the phenomenon.

While e-learning presents vast opportunities for transforming orthopaedic education, its success will depend on how well KMTC addresses the festering barriers, responds to student preferences, and builds learning management systems that are attractive to users in terms of navigability and content.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study provides a timely glimpse into the evolving landscape of e-learning among ODeL orthopaedic students at the Kenya Medical Training College, revealing not only how students perceive digital learning but also what is urgently required to make it truly effective. The findings affirm that e-learning is not an optional adjunct to traditional teaching and learning practices, but a central pillar of modern medical education, one that demands deliberate designing and redesigning, institutional commitment, and learner-centred innovation.

The prevailing attitude among students towards e-learning is encouragingly positive. Many embrace the flexibility, accessibility, and autonomy afforded by e-learning, especially its ability to accommodate diverse schedules and learning paces. Yet this optimism is restrained by persistent gaps in the learning experience. Students remain concerned about the lack of interaction, both academic and social, as well as recurrent technical setbacks. These are not minor inconveniences. They point to structural weaknesses that, if unaddressed, will continue to undermine the promising potential of digital education.

The overwhelming preference for blended learning is not incidental. Students are not rejecting digital platforms. They are asking for meaningful integration. They want the efficiency of online systems combined with the human interaction and immediacy of face-to-face engagement. Interactive content, such as video lectures, live discussions, and quizzes, is seen as not only beneficial but essential to sustaining interest and comprehension in complex, practical-oriented subjects that underpin orthopaedic training.

However, enthusiasm alone cannot overcome the significant barriers students face. Poor internet access, prohibitive data costs, and inadequate digital infrastructure continue to limit participation. Compounding this are institutional challenges such as inadequate technical support and hard-to-navigate LMS platforms that frustrate even the most motivated learners. Individual student constraints, time pressures, difficulty navigating digital content, and lack of real-time feedback further erode the effectiveness of current e-learning efforts.

This study makes it clear that the success of e-learning in orthopaedic and trauma medicine training lies not in broader adoption or hastened implementation, but in gradual, more responsive implementation. Addressing technological inequities, enhancing institutional support, and embracing a more balanced blended model grounded in student realities are no longer optional; they are imperative. With strategic investment and commitment, KMTC can lead in shaping an inclusive, user-friendly, and forward-looking ODeL model of medical education in orthopaedic medicine training.

6.2 Recommendations

To address the identified challenges and enhance the e-learning experience for ODeL orthopaedic students, the following recommendations are proposed.

6.2.1 National Policy Recommendations

- **Enhance Technological Infrastructure:** Reliable and affordable internet connectivity, particularly in rural and underserved areas, is a foundational requirement for equitable access to e-learning and online education. Without it, students placed in fringe campuses and those from remote areas remain disproportionately disadvantaged, limiting the reach and impact of ODeL initiatives.

- **Promote Digital Equity:** Institutional and national stakeholders should work collaboratively to ensure that students have access to essential learning tools, including laptops, tablets, and mobile devices. This may involve subsidized device schemes, data bundle partnerships, or direct financial support through grants aimed at e-learning participation. By narrowing the digital divide, such measures will not only enhance student engagement and performance but also contribute to broader educational equity. These policy shifts are not simply supportive, they are foundational to the sustainability and scalability of e-learning in medical training.
- **Promote Sustainable Integration of e-Learning:** Align institutional and national education policies to embed e-learning as a permanent, accessible feature of medical training, ensuring that digital equity is treated as a core component of academic quality and access.

6.2.2 Institutional Recommendations

- **Optimize Blended Learning:** KMTC should adopt a more balanced blended approach to ODeL learning as the core instructional model, strategically combining online theoretical content with scheduled face-to-face practical sessions. This approach respects the clinical and practical nature of orthopaedic training while leveraging the flexibility and reach of digital platforms.
- **Upgrade and Streamline e-Learning Platforms:** The institution must invest in modernizing its learning management system (LMS) to ensure it's learner-friendly, interactive, and engaging. Platforms should support multimedia content, real-time communication, and seamless navigation to enhance both student experience and instructional delivery.

- **Strengthen Technical and Instructional Support:** The College campuses should establish permanent technical support units to assist students and faculty in resolving digital access issues. Additionally, learning content must be enriched with practical, application-focused resources such as video demonstrations of orthopaedic procedures and interactive assessments, to bridge the gap between theory and hands-on practice, ultimately improving competence and skills retention.

6.2.3 Recommendations for Further Research

- **Conduct Longitudinal Evaluations:** Future research should track the long-term impact of e-learning on learning outcomes, clinical competence, and professional readiness among medical and orthopaedic students. Such studies will provide critical insight into whether digital learning methods produce sustained educational benefits over time.
- **Explore Cultural and Contextual Influences:** There is a need for research that examines how sociocultural norms, regional disparities, and local institutional practices shape the adoption and effectiveness of e-learning in Kenya and other low- and middle-income countries. Understanding these factors is essential for designing context-appropriate, scalable digital education models.
- **Investigate Gender-Specific Challenges:** Further inquiry should focus on whether male and female students experience different barriers in accessing or engaging with e-learning platforms, or in participating in e-learning in general. Identifying such disparities would support the development of inclusive policies and targeted interventions that ensure equitable access and participation for all learners.

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APPENDICES

Appendix I: Questionnaire

Questionnaire on Attitudes, Preferences and Barriers to e-Learning among ODeL Orthopaedics students of the Kenya Medical Training College.

Introduction

My name is Robert Ataada, studying for a Masters of Science in Medical Education at Moi University. I am conducting research on the Determinants of eLearning uptake among Learners at Kenya Medical Training College.

We have therefore developed this questionnaire to help collecting your views to facilitate improving the quality of counseling services in the college. We therefore appeal to you to take your time to complete this questionnaire as instructed. The responses given will be treated with confidentiality and will not be used for any other purpose but to help the college in improving teaching and learning services amid the Covid-19 pandemic.

Consent form

This consent form gives you information about the purpose of the study, the process involved, the risks, and the benefits of the study. Once you understand the study and if you agree to take part, you will be asked to sign and make your remark on this form and you will be given a copy. Your participation in this study is entirely voluntary. However, you may decide to withdraw from the study without facing any consequences at any time.

Purpose of the study:

Process: This study will involve filling in a questionnaire containing questions about

Risks: We do not anticipate any risks or discomfort to you during this study, and we will make every effort to protect your privacy and confidentiality while you participate in the study.

Benefits: Your participation is voluntary, and if you change your mind, you have the right to withdraw at any time. Where clarification is needed, we shall provide it to you. However, the results from this study will assist in improving

Cost: There is no cost for you to participate in this particular study.

Confidentiality

Every effort will be made to keep the information you provide to be very confidential. You will be identified by a code, no names will be indicated, and you will not be personally identified in any publication about this study. If you ever have questions about the study, contact principal investigator, Robert A. Okedo at robertokedo@gmail.com 0701 393 225, 0202 00 22 33.

Appendix IV: Consent form for participants

Study ID…….....…… Interview date……../…….../20..

I have fully understood the purpose of this study and now volunteer to participate in it. The researcher Robert A. Okedo has explained the processes involved, and now I am satisfied with it.

I understand that all the information obtained will be used for this study only and that I can withdraw my consent at any time without losing any benefits which I am entitled. I have had a chance to ask questions. If I have questions later about the study, I can ask the researcher.

Study participant's signature/thumbprint……..…..Date……

I Robert A. Okedo (researcher) confirm that I have explained the nature and effect of the study.

Signature……

Date……

Appendix V: Socio-demographic and clinical Questionnaire

Background Information of the Participant(s) (tick where applicable).

Note (please answer only those questions you fill are qualified to base on your experience/ Knowledge)

Instructions

1. Do not write your name on this paper, however information written is confidential.
2. Tick the most appropriate answer/response in the given space.
3. Your participation is voluntary, additionally; if any question makes you uncomfortable you can leave it out.
4. State where applicable
5. When done, kindly return the filled in questionnaire to me.

Part 1: Sociodemographic Data

1. Age: 20-24 yrs ☐, 25-29 yrs☐, 30 and above ☐
2. Sex: Male ☐ Female ☐
3. Campus: Nairobi ☐ Kangundo ☐ Port Reitz ☐
4. Marital status: Single ☐ Married ☐
5. Previous learning online: Yes ☐ No ☐
6. Current place of residence: Rural ☐ Urban ☐
7. Smartphone/ipad/laptop ownership: Yes ☐ No ☐
8. I have a designated study area at home: Yes ☐ No☐
9. Do you think you need training to learn to use the e-learning platforms?

Yes ☐ No ☐

10. How would you rate your digital literacy skills?

Excellent ☐

Good ☐

Poor ☐

Part 2: E-learning Preferences

1. Preferred learning methods (Olum et al, 2020) *Select one only*

E-learning only

Classroom learning only

Blended learning

- 2. Among the different online platforms used which do you prefer most?

a. KMTC e-learning portal ☐

b. Zoom ☐

c. Kenet ☐

d. Google classroom ☐

3. Which e-learning method do you prefer?

a. Synchronous, i.e., live, interactive

b. Asynchronous, i.e., prerecorded, non-interactive

4. what type of should be included more on asynchronous e-learning;

a. Videos

b. Quizzes

c. Downloadable texts

Part 3: Attitudes, Enablers and Barriers to E-learning

For each statement, put a tick to show your level of agreement; Strongly Disagree, Disagree, Agree, and Strongly Agree. Do not tick across two boxes.

Variable	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Attitudes to E-learning					
I feel comfortable using e-learning					
I am interested in e-learning					
e-learning is not time consuming					
e-learning is very convenient for me					
e-learning enhances my learning process					
I am positive about e-learning					
e-learning is effective for acquiring clinical and technical skills					
e-learning is suitable for taking exams/CATs					
I find e-learning cost-effective					

Overall, I prefer e-learning and I believe it is better that classroom learning					
Enablers for E-learning:					
Institutional support					
The library service provision was suitable for online learning					
On campus internet was good					
e-learning course materials were available					
Technical support was available to handle e-learning challenges					
Avenue to raise complaints was provided					
Lecturer support					
There was adequate communication between the teachers and students during e-learning					
There was good interaction between students and lecturers during the online learning					

I obtained adequate support from module lecturers					
Adequate guidance and support were provided from the department					
Lecturers are flexible in scheduling online classes					
Lecturers were accessible for consultation after class					
Online content is delivered in time					
Lecturers provide feedback on progress					
Intervening factors					
Where I live is conducive for online learning					
There is sufficient interaction with classmates online					
The e-learning portal is easy to use					
Barrier factors					
Lack of adequate individual training on the use of e-learning					

Limitation of personal resources such as smartphone, internet, laptop was a barrier to achieving good e-learning					
Some course contents were not suitable for e-learning					
Lack of suitable e-learning environment at home					
Difficulty navigating the e-learning portal					
Internet costs are high					
Poor internet connectivity					
Lack of access to electricity/frequent blackouts					

Appendix II a): FDG Interview Guide

- Students overall idea/opinion on e-learning
- What are the benefits of e-learning to you?
- What are the disadvantages of e-learning
- What do you consider to be barriers or challenges to e-learning?
- In what ways do you feel that e-learning could be improved?

b) Codebook for Qualitative Analysis

Theme 1: Attitudes towards e-learning

Theme Definition: Students' overall feelings, beliefs, and evaluative judgments about e- learning as a mode of instruction in orthopaedic training.

Code Name	Code Definition	Inclusion Criteria	Exclusion Criteria	Example Indicators
Perceived Usefulness	Beliefs about whether e learning enhances learning outcomes or clinical competence	Statements linking e-learning to improved understanding, skills, or performance	Statements focused only on convenience or access	"It helps me revise theory before practical sessions"
Perceived Ease of Use	Views on how easy or difficult e learning platforms are to use	References to navigation, usability, or technical simplicity	Complaints about internet or devices	"The platform is easy to follow once logged in"
Motivation and Engagement	Emotional responses related to interest, enthusiasm, or boredom	Expressions of motivation, interest, or disengagement	Comments on institutional requirements	"Online discussions keep me engaged"
Trust in E Learning	Confidence in the credibility and effectiveness of online instruction	Statements about quality, reliability, or seriousness of e learning	Preferences for face to face learning without evaluation	"I trust the content provided online"
Overall Acceptance	General approval or rejection of e learning	Broad positive or negative judgments	Specific technical or logistical complaints	"E learning is a good approach for KMTC students"

Theme 2: Learning Preferences

Theme Definition: Students' expressed choices and priorities regarding how e-learning is designed, delivered, and supported.

Code Name	Code Definition	Inclusion Criteria	Exclusion Criteria	Example Indicators
Learning Mode Preference	Preferred balance between online and face to face learning	Statements comparing blended, fully online, or traditional learning	Attitudes without stated preference	"I prefer blended learning for practical courses"
Content Format Preference	Favored formats for learning materials	References to videos, PDFs, live lectures, or simulations	Comments on content quality only	"Recorded videos are easier to understand"
Interaction Preference	Desired level and type of interaction	Mentions of lecturer contact, peer discussion, or feedback	Complaints about lack of access	"I prefer live sessions where I can ask questions"
Assessment Preference	Preferences regarding online tests and assignments	Statements about quizzes, exams, or submission methods	General anxiety about exams	"Online quizzes are more flexible"
Flexibility and Scheduling	Preferences related to timing and pacing	References to self paced learning or flexible schedules	Barriers related to time constraints	"I like studying at my own pace"

Theme 3: Barriers to e-Learning

Theme definition: Factors that hinder or limit effective participation in e learning among ODeL orthopaedic students

Code Name	Code Definition	Inclusion Criteria	Exclusion Criteria	Example Indicators
Sociodemographic factor barriers	Insufficient skills to use e learning tools	Lack of ICT skills, difficulty using platforms	Negative attitudes toward technology	I struggle with uploading assignments"
Technological barriers	Challenges related to devices, software, or platforms	Lack of computers, system failures, login problems	Internet connectivity issues	"The platform sometimes fails to open"
Institutional barriers	Inadequate support from the institution	Lack of training, delayed feedback, poor communication	Personal motivation issues	"We are not well guided on how to use the system"
Pedagogical barriers	Barriers related to the practical nature of orthopaedics	Difficulty learning clinical skills online	General dissatisfaction with content	"Some skills cannot be learned online"

Appendix III: Study Sites

The four campuses of KMTC where the study was carried out;

KMTC Kangundo campus

KMTC Port Reitz campus

KMTC Nakuru campus

KMTC Makindu campus

Appendix 4: IREC Approval

MTRH/MU-INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/388/2022
Approval Number: 0004533

23rd August, 2023

Robert Atsada Okedo,
Moi University,
School of Medicine,
Medical Education Department,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Mr. Okedo,

ATTITUDES, PREFERENCES AND BARRIERS TO E-LEARNING AMONG OPEN, DISTANCE AND E-LEARNING (ODeL) ORTHOPAEDIC MEDICINE STUDENTS OF THE KENYA MEDICAL TRAINING COLLEGE

This is to inform you that ***MTRH/MU-IREC*** has reviewed and approved the above referenced research proposal. Your application approval number is ***FAN: 0004533.*** The approval period is **23rd August, 2023- 22nd August, 2024.**
This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, Material Transfer Agreements (MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MTRH/MU-IREC.***
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***MTRH/MU-IREC*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***MTRH/MU-IREC*** within 72 hours.
v. Clearance for export of biological specimens must be obtained from ***MOH at the recommendation of NACOSTI*** for each batch of shipment.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to ***MTRH/ MU-IREC.***

Prior to commencing your study, you will be required to obtain a research license from the National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and other relevant clearances from study sites including a written approval from the CEO/MTRH which is mandatory for studies to be undertaken within the jurisdiction of Moi Teaching & Referral Hospital (MTRH) and its facilities sites.

23 AUG 2023
APPROVED
P. O. Box 4606 - 30100 ELDORET

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

Appendix 5: NACOSTI Approval

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **895200**

Date of Issue: **29/September/2024**

RESEARCH LICENSE

This is to Certify that Mr.. Robert Ataada Okedo of Moi University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nakuru on the topic: ATTITUDES, PREFERENCES AND BARRIERS TO E-LEARNING AMONG OPEN, DISTANCE AND E-LEARNING (ODeL) ORTHOPAEDIC STUDENTS OF THE KENYA MEDICAL TRAINING COLLEGE for the period ending : 29/September/2025.

License No: **NACOSTI/P/24/39527**

895200

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions

Appendix 6: Antiplagiarism Certificate

SR981

ISO 9001:2019 Certified Institution

THESIS WRITING COURSE

PLAGIARISM AWARENESS CERTIFICATE

This certificate is awarded to

ROBERT ATAADA OKEDO

MS/ME/5697/21

In recognition for passing the University's plagiarism

Awareness test for Thesis **entitled: ATTITUDES, PREFERENCES AND BARRIERS TO E-LEARNING AMONG OPEN, DISTANCE AND e-LEARNING (ODeL) ORTHOPAEDIC MEDICINE STUDENTS AT THE KENYA MEDICAL TRAINING COLLEGE with** similarity index of 9% and striving to maintain academic integrity.

Word count: 20347

Awarded by

Prof. Anne Syomwene Kisilu
CERM-ESA Project Leader Date: 08/08/2025