Utilization of Simulation Models in Clinical Teaching at Medical Training Colleges, Kakamega County, Kenya

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DECLARATION

This dissertation is my original work prepared with no other than the indicated sources and support and has not been presented elsewhere for a degree or any other award.

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CERTIFICATION

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DEDICATION

For their undying love, support, and role as my supporters, my wife Becky and daughter Brielle.

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God, the giver of life, Asante.

I thank my mentors, Dr. DK Kigaya and Dr. Sabella Kiprono.

ABSTRACT

Simulation is a teaching and learning technique that amplifies real experiences with guided experiences in clinical practice. Clinical simulation learning as an educational tool is recommended in the clinical officers' training. The spectrum of clinical scenarios that clinicians may not have encountered throughout their training are expected of them when they enter the workforce. In general, there is little inquiry about how clinical simulation underwrites the 'thinking' facet of professional practice and the instruction of simulation practices. The broad objective was on the utilization of simulation models in clinical teaching at Medical Training Colleges, Kakamega County, Kenya. A descriptive cross-sectional design was used where qualitative and quantitative data was collected. The target population of the study consisted of 916 students, 27 lecturers and 10 clinical instructors in medical training colleges in Kakamega County. The sample size was 10 clinical instructors, 25 lecturers and 278 students adopted by Yamane's method. The study site was MTC's within Kakamega County. Ethical consideration was addressed. A pilot study was conducted to test for validity and reliability of research instruments. Approval to collect data was obtained from the Institutional Research and Ethics Committee's (IREC's) chapter of Masinde Muliro University of Science and Technology and National Commission for Science Technology and Innovation (NACOSTI). Permission to collect data from the institutions was obtained from respective administrations and consent from participants was also obtained. Data were analyzed using SPSS software ver. 26. Research findings were presented in the form tables, graphs and charts. The major findings revealed that Mannequin usage was at 40.6%, simulated patients' usage was at 18.0%, skills trainer usage was at 16.5%, team-based patient scenario usage was at 10.1% and objective structured clinical examination usage was at 14.7%. Therefore, it was predicted that simulation models used for clinical teaching were equal to 4.207 – 1.511 (age) - 0.402 (gender) + 0.727 (year of study) + 0.262 (institution). Sociodemographic characteristic (age, t = -14.381, $p < 0.001$; gender, t = -3.357, $p = 0.001$; year of study, t = 9.610, $p < 0.001$; and institutions, t = 3.001, $p = 0.003$) influenced the utilization of the simulation models used for clinical teaching. The study concluded that simulation models used at the clinical learning experience opens students to critical thinking, promotes clinical judgement and helps in clinical problem-solving. This study notes gaps in the quantity and practicality of the simulation models. Therefore, it recommends improvement of usage of simulation models in the facilitation of clinical learning experience. The medical colleges and the hospitals should liaise to promote the usage of simulation models frequently to enhance practical experience.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CO	Clinical Officer
DES	Debriefing Experience Scale
EPSS	Educational Practices Simulation Scale
HFS	High-fidelity patient simulator/high-fidelity simulation
HPE	Health Professions Education
HPS	Human patient simulation
IREC	Institutional Review and Ethics Committee
KMTC	Kenya Medical Training College
LFS	Low-fidelity simulation
MMUST	Masinde Muliro University of Science and Technology
NACOSTI	National Commission for Science, Technology and Innovation
OSCE	Objective Structured Clinical Examination
PCA	Principal Component analysis
PP	Paper/pencil case study
SDS	Simulation Design Scale
SM	Static mannequin simulation
SPs	Simulated patients
SSS	Student Satisfaction and Self-Confidence in Learning
WHO	World Health Organization

OPERATIONALIZATION OF TERMS

Clinical area: In this study, it consists of skills laboratory hospital wards, hospital outpatient and community settings; each with their own distinct uniqueness. It is in this environment that students learn what it means to be a real health practitioner.

Clinical teaching: In this study clinical teaching refers to the teaching and learning for students that takes place near a patient. Clinical teaching prompts opportunities for student s to apply the knowledge, concepts and skills learnt in the classroom, hence preparing them for their professional roles.

Course: a sequence of classes or a study schedule on clinical medicine and surgery that typically results in an exam or qualifying for a clinical medicine and surgery diploma.

Debriefing: the period of time after a simulation that is set aside for assisted discussion of the events that took place during the learning exercise.

Health Professional: A medical professional with a diploma in clinical medicine and surgery as a minimal requirement.

Program: A course of study of the diploma in clinical medicine and surgery at college.

Rapid Response: A group of skilled clinicians that responds to a request from other healthcare professionals for assistance in the event of a patient's health rapidly deteriorating.

Simulation: Refers to techniques that "…replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion".

Skills laboratory: In this study, it refers to a simulated setting located in the college of Clinical Medicine and Surgery that closely mimics patient care areas used by clinical officers' students to learn and practice clinical medicine and surgery skills using mannequins, peers, and models

Training: The activity of learning or teaching the skills and knowledge needed for the practice of clinical medicine and surgery.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter presents the background of the study, statement of the problem, objectives of the study, research questions, justification of the study, significance of the study, scope of the study, limitation of the study and delimitation of the study. An explanation of the link between the independent and dependent variables, as well as the methodological approaches used in this study, is provided in a conceptual framework.

1.1 Background to the Study

There are no universal standards for clinical simulation training; the Clinical Officers Council of Kenya (CoC) advocates for flexible medical training combining mentorship, constructive feedback and evaluation (Mbindyo et al., 2013; Bitonye et al., 2022). There are essential differences in the composition of medical educational programs, especially in clinical simulation teaching (Muthathi et al., 2017).

In the last decade, use of simulation model as a learning technique has intensified in preparation of students for clinical practice. Issues driving this move are: amplified competitiveness and the need to asses student in clinical assignments; the aspiration to reduce homoeopathic errors and improve patient care (Kelly, 2014; Varras et al., 2020). In this regard, simulation plays a major role to students learning of clinical competence.

American context describes clinical teaching as a proportion of clinical placements in clinical curricula with skills laboratory training and using models of simulation in measured practical lessons (Oxidases et al., 2004).

Consideration to liability at an individual and organizational level, has been the attention to improve safety and quality for better patient care. These initiatives are also featured in continuous professional development that concoct clinicians for best professional practice (Walsh et al., 2020). Clinical simulation exercises are used to enhance performance and raise knowledge of safe patient care in situations when potential error may arise (Willi et al., 2020).

Up until now, articles in journals for medical education have primarily concentrated on the effects of simulation events on technical and psychomotor abilities, measuring things like attainment, precision, efficacy, advancement, rate of error, and time to complete a task properly (Hardie et al., 2021). Whereas it is important to enumerate basic skill presentation, these illustrations replicate more single circlet learning skills where "participants … are encouraged to learn to perform [but not question fundamental aspects] of organizations" (Bradshaw, 2017). Hereafter, methodological skills practice may be isolated from context to represent solitary a portion of the work health professional's scope. Equally, study in the zone of technical competences is restricted in scope and does not justify for the complete magnitude of training where interrogation, response and reflection shape the health professional (Lee et al., 2020).

According to Vuurberg et al., (2019) study 's at the University of Amsterdam on the efficiency of interprofessional classroom-based training in medical programs, simulation learning techniques have been shown to improve performance overall and student satisfaction.

In China, Yang et al., (2017) came to the conclusion that improving inter-professional skills can improve patient care in their prospective comparison study on simulation-based inter-professional instructions to promote attitudes toward cooperative practice.

In South Africa, Capelli et al., (2018), found out that patient- specific simulation for planned treatment had no intra-operative complications. Apprenticeship programs may not always guarantee that physicians will learn a comprehensive set of patient-centered skills. The location, timing, and favorable chances for controlled practice determine the type of experience. Clinical staff are assured they have adhered to desired clinical processes and understand the care and patient management expected of them by revelation to fundamental patient care status quo in simulation setups (Mueller-schoell et al., 2021).

Historically, clinical teaching is derived through training apprenticeships as in the era of Florence Nightingale in which an aspiring student learnt the profession from the "Master" (Bradshaw, 2017). In KMTC, skill laboratory training is commonly used as a teaching technique to assist clinicians develop clinical skills before to attending obligatory clinical appointments. Nevertheless, when clinicians embark on their first clinical placements, they experience conflict between the theoretical ideal of expected medical training and the realism of the medical setting (Ariko, 2018).

1.2 Statement of the Problem

Some research information propose that the use of simulation can provoke anxiety to students and cause cognitive overload. However, the use of simulation in clinical practice offers clinicians a consistent learning experience and a practical way of discovering attitudes and instructing clinical skills (Aarkrog, 2019).

Unanswered questions relate to the palpable educational and practical benefits of simulation, a relatively expensive instructional technique. Stakeholders want to see persuasive proof that simulation improves patient safety, practice, and outcomes (So et al., 2019).

In Kenya, skills laboratories training has not been standardized consequently, each health training institution implements its own curriculum as long as they observe Clinical Officers' Council of Kenya requirements of set hours of skills laboratory training. Moreover, medical training colleges integrate skills laboratory training differently resulting in variances in levels of proficiencies acquired by the students, poor clinical judgement leading to errors in patient management (Ariko, 2018).

In addition, inadequate numbers of clinical faculty members to teach the large number of clinical officers' students is of concern (Nyamu et al., 2018).

1.3 Objectives of the Study

1.3.1 Broad objective

The broad objective of the study is on utilization of simulation models in clinical teaching at Medical Training Colleges, Kakamega County, Kenya.

1.3.2 Specific objectives

The specific objective of the study was as follows:

i. To identify the use of simulation models for clinical teaching by lecturers at Medical Training Colleges in Kakamega County, Kenya.
ii. To determine the roles played by clinical mentors in the use of simulation models at Medical Training Colleges, Kakamega County, Kenya.
iii. To determine the perception level among clinical officers' students on the effectiveness of simulation models as a learning strategy at Medical Training Colleges, Kakamega county, Kenya.

1.4 Research Questions

i. How are simulation models for clinical teaching by lecturers used at Medical Training Colleges in Kakamega County, Kenya?
ii. What roles do clinical mentors play in the use of simulation models at Medical Training Colleges, Kakamega County, Kenya?
iii. What is the perception level among clinical officers' students on the effectiveness of simulation models as a learning strategy at Medical Training Colleges, Kakamega County, Kenya?

1.5 Justifications of the Study

Although simulation models in clinical teaching is an important aspect of clinical medicine and surgery, there is scanty literature about the subject documented in Kenya. Quality health care is critical in Kenya. However, the correlation between clinical simulation and practice seem not to match because medical grandaunts need orientation and mentorship into practice. There is no evidence on the use of simulation

models in clinical teaching in diploma training, necessitating more study to examine the effectiveness of teaching and learning methodologies (Bogren et al., 2019).

The clinical officer students relate theory into practice during clinical teaching. This aids them acquire the necessary interpersonal and technical skills, make sound based clinical judgments, become socialized into the profession, and begin to appreciate its values and ethics (Anshasi, 2019). In order to improve learning environments and students' lifelong learning skills and habits, training institutions may significantly change their current teaching methods and resources. (Greif et al., 2021).

Thus, research must be done to examine clinical officer students' simulation in Kakamega County clinical education and to track the effectiveness of steps taken to enhance learning in the clinical simulation sites.

1.6 Significance of the Study

The benefits of simulation need not to be overemphasized (Meerdink & Khan, 2021). Findings from the study would greatly assist the Medical Training Colleges to determine the exact position of simulation training in medical training colleges, readiness to use simulation in learning and to enable trainers to better use skills to promote quality health care. The current study of the status and use of simulation in medical education is crucial towards capacitating medical training colleges to ward off pressure and keep pace with training in a fast-changing world. Research and technology in the medical field have tremendously changed and has become complex and similarly, training of medical professionals must be in tandem with changes in the industry (Jiang, 2018).

1.7 Scope of the Study

The scope of the study was on the simulation in clinical teaching at medical training colleges in Kakamega County, in the western region, Kenya. The colleges were; KMTC Kakamega, Lurambi sub-county and St. Mary's School of Clinical Medicine, Mumias West sub-county. The study did not cover all the medical training colleges in the western region because some of them do not offer clinical medicine and surgery.

1.7.1 Limitations of the Study

Due to the differing schedules of the many respondents who participated in the study, the researcher was limited to sampling from students who were registered for the session at the time of the study. Because this was a mixed study with a limited sample size, the findings are unlikely to be generalizable to the general population.

1.7.2 Delimitations of the Study

The researcher was delimited to medical training colleges. The study was also delimited to use of questionnaires, small group discussions guides and interview schedules therefore, only rely on the information given by the respondents.

1.8 Theoretical Model

Decisions making regarding a patient scenario that allow practitioners to deliver the best treatment is a crucial component of clinical medicine and surgical practice.

1.8.1 The Dreyfus approach for developing clinical problem-solving abilities

Dreyfus, (2004) defines skill acquisition is a strong starting point for further research in various fields. Clinical knowledge in the health professions is identified and described using an interpretative method. This model of professional expertise plots a

person’s development through a sequence of five levels: beginner, advanced beginner, competent, proficient and master. According to Benner (2019), the unspoken information of knowledgeable health professionals and the application of aphorisms in patient care are examples of how the areas of clinical practice are presented. Intuition plays an important role in a health professional’s problem- solving. This instinct is formed over time as a result of professional and patient care experiences. It begins to develop in the advanced beginning stage, when the health professional begins to recognize situational aspects intuitively from practical experiences in concrete situations with meaningful elements (Honken, 2013; Benner, 2019).

1.8.2 Experiential Learning (Kolb, 1984)

Experiential learning is defined by Kolb (1984) as "the process by which knowledge is formed through the transformation of experience." It consists of a four-phase learning cycle that involves concrete experience, reflective observation, abstract conception, and active exploration. The adoption of an experience approach is justified by the goal of clinical instruction. Simulation is an excellent way to include experiential learning in medical education. Experiential learning is the process of learning through doing. The "experience" is the student exercising the skills learnt and applying their classroom knowledge to the skills laboratory on a patient simulator. The debriefing session that follows the simulation is the "reflection" part. Students, peers, and clinical instructors discuss what happened during the simulation. They may analyze their group's strengths and limitations and determine how they can improve

their patient care and apply their knowledge to various patient circumstances.

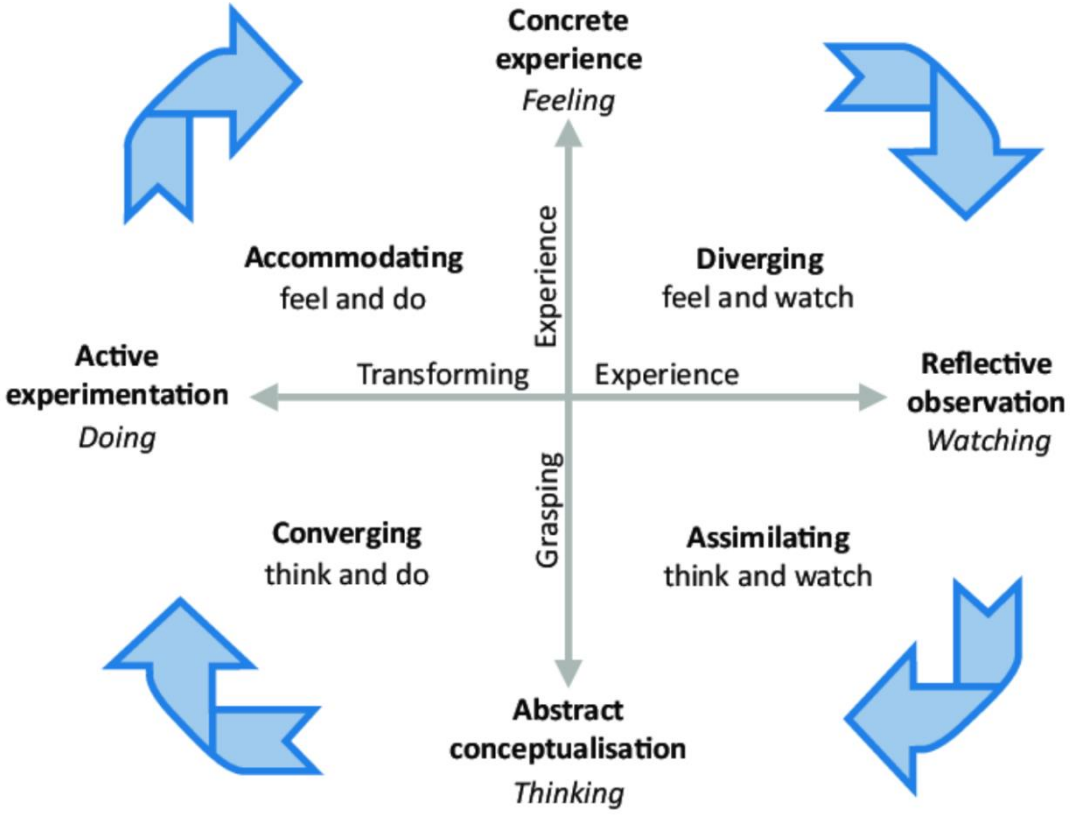

Figure 1.1: Model depicting the Kolb's experiential learning theory (Kolb, 1984)

The learner may begin at any point, but must then proceed through the following stages: tangible experience, the feeling phase; reflective observation, the watching phase; abstract conceptualization, the thinking phase; and active experimentation, the doing phase (McLeod, 2017).

1.9 Conceptual Framework

The conceptual model (Figure 1.1) illustrates the framework adopted form the utilization of simulation models in clinical teaching.

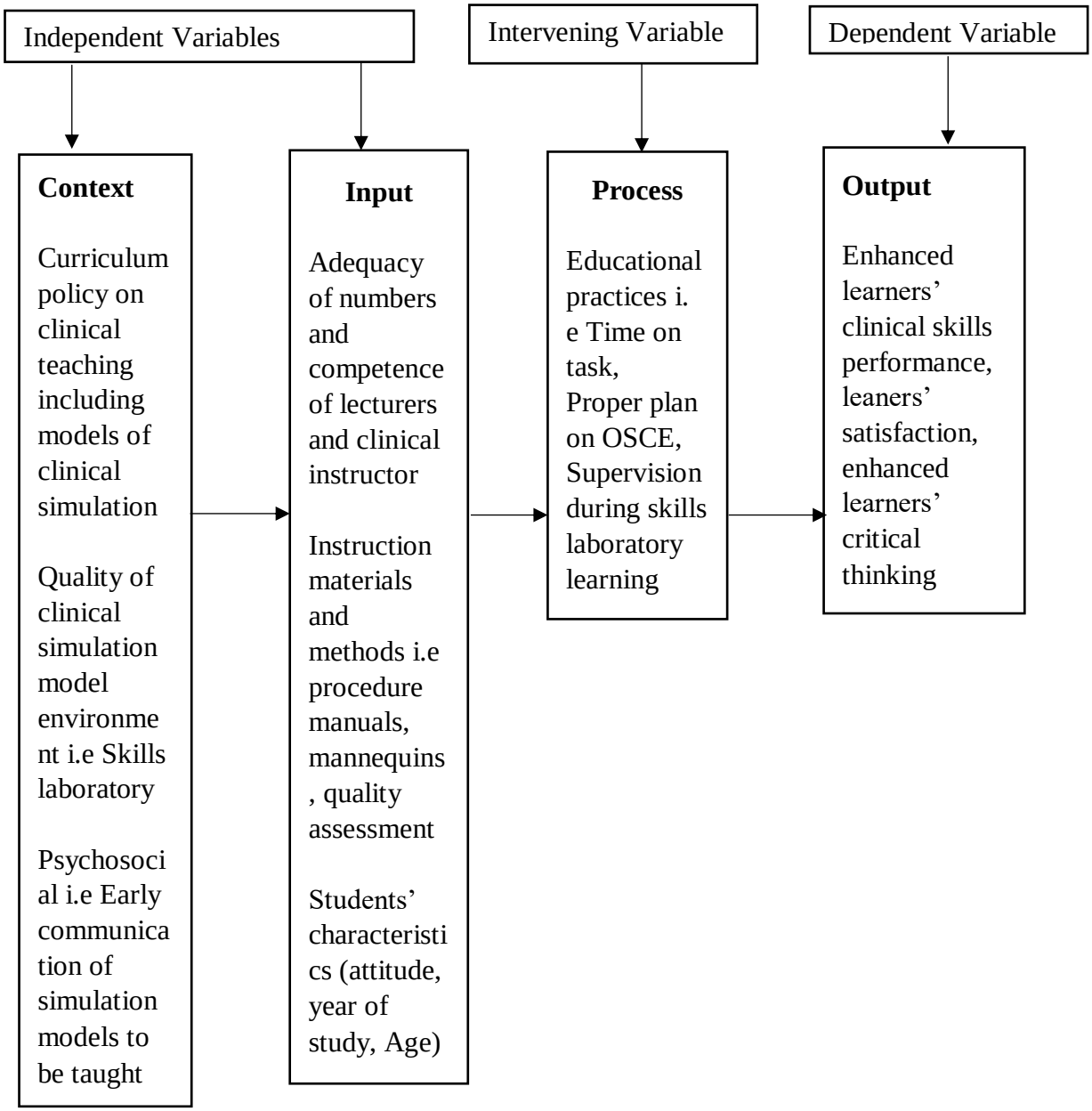

Figure 1.2: Model depicting the CIPP model- based conceptual framework (McLeod, 2017)

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section evaluates literature in relation to the study's background problem, study objectives, and developed questions. The literature was assessed from a global perspective and then refined down to regional perspectives. It discusses models for clinical simulation learning, role of mentorship in clinical simulation training and perception of students towards clinical simulation.

2.1 Models for Clinical Simulation Learning

Simulation learning experiences as part of medical education, help students facing difficulties in evaluating its effectiveness in theory and practice. (Rajaguru & Park, 2021). Similar to real-world patient care experiences, simulation-based learning interactions can offer chances to halt, debate, and safely explore key ideas, to demonstrate best practices, to debrief and reflect, and to develop and consolidate clinical experiences. (Nordquist et al., 2019). Simulation has been used for many years in clinical medicine, surgery, and other fields, thus it is not a novel idea in medical education. This section offers a general overview of contemporary methods for creating and delivering medical education simulations, highlighting influential models and texts. Nyamu et al., (2018) , affirms that the commonly used simulation models include: Manikins, hybrid simulators, simulated patients, skills trainers, team- based patient scenarios and objective structured clinical examinations.

2.1.1 Mannequins

According to Sakuma et al., (2020), benefits of using mannequins in simulation-based learning are knowledge attainment, critical thinking, problem-solving, and clinical judgment aptitudes of medical students.

The entire clinical group of students assemble during the simulation activity at the bedside of a pre-selected manikin that will be used in the learning experience to be taught. Then the clinical mentors coordinate the activity in conjunction with students in the skills laboratory. Students are also allowed to contribute certain genuine points regarding patient care. The main focus is made on medical care and only important aspects of the care are discussed. However, the background information of the activity can be provided away from the skills laboratory (Handeland et al., 2021).

In the end, the clinical mentor concludes the discussion by giving her opinion, guidance and relevant instructions on the performed activity. The students are finally briefed upon the conclusions reached. Then the students record all the instructions and suggestions given by the mentor and a register of the simulated activity is maintained in the skills laboratory (Barker & Durst, 2021).

2.1.2 Amalgamated simulators

Medical researchers around the world have made advances in response to the demand for more real-world learning experiences by developing patient care abilities. Researchers have noted the advantages of mixing team-based patients, skill trainers, and mannequins so that students can interact with the "patient" while doing treatments on the mannequins. (Mcwilliams & Malecha, 2017).

Takahashi et al., (2019) research demonstrated how umbilical catheterization; a model of a hybrid simulation is safe when used in new born feeding.

Training to increase skill performance may result in fewer errors, shorter process durations, and a better understanding of how to respond when anything goes wrong. A doctor or other allied health professional, on the other hand, rarely works alone; they are part of a larger team, and each member contributes significantly to successful patient care outcome (Brett-fleegler et al., 2012). As a result, multidisciplinary teams of practicing clinicians and trainees have found that team-based clinical simulations that depict both expected and unexpected situations are crucial learning opportunities (Lee et al, 2018). Team-based patient scenarios go beyond skill demonstration and more accurately capture the variety of professional qualities needed for clinicians to function effectively and safely in healthcare environments (Doermann et al., 2017).

2.1.3. Simulated patients

Patient interaction has historically been essential to medical education. But as healthcare delivery changes and worries about the objectivity or consistency of clinical exams grow, the ‘simulated patient' is introduced (SP). SPs are currently frequently used in education and assessment. SPs are typically lay-people, but not always, who have received training in how to depict a patient with a particular ailment in a realistic manner, occasionally in a standardized manner; giving a constant clinical picture from student to student (Akaike et al., 2012).

In real-world, SPs can be utilized for teaching and evaluating in objective structured clinical examination (OSCE) (Fiona Dudley, 2018).

SPs have scripted roles to play, but they can also be utilized to provide feedback and assess student achievement (Ruddock, 2021). Given this possible level of involvement in medical education, it is obvious that it is essential to properly recruit, train, and utilize SPs. For both teaching and assessment purposes. (Roberts et al., 2021).

2.1.4 Skills trainers

For many years, health professionals and the general public have practiced basic resuscitation techniques on "Annie," a manikin made by the Laerdal Corporation. With increasingly hybrid simulators, medical practitioners can practice advanced life support techniques such as cardiopulmonary resuscitation, tracheostomy, and systemic cannulation (Biancardi et al., 2020). For clinical officers' students seeking annual certification in resuscitation, these abilities and tools continue to be the cornerstone.

More recently, a variety of advanced surgical simulators have been created to help surgical trainees practice procedures in simulated settings before conducting them on real patients in the operating room (Nguyen et al., 2019). Repeated, focused work on the trainers can help with hand-eye coordination and fine motor abilities (Yari et al., 2018). The spectrum of instructional techniques for health professionals has more recently included computer-based simulations and simulators, which can be set up to give users quick feedback and guide learning in interesting, creative ways. The primary emphasis is on surgical talents, like gall bladder removal, and clinical procedures, such as putting a cannula into an artery or vein (Atesok et al., 2019). Like in the gaming industry, the integration of visual media, interface, and sensory feedback in these computerized programs can enhance the immersive nature of the experience and prepare beginners and students to conduct treatments on patients in a clinical setting (Tabatabai, 2020).

2.1.5 Team-based patient scenarios

The most common type of modern simulation involves practicing aspects of patient care in team settings using mannequins that closely resemble real patients in a skills lab or simulation centre. These simulations are regarded as safe experiential learning opportunities if they are given in accordance with best standards. (Nykänen, 2020). According to Bailez et al., (2019) , students can explore, make mistakes, ask questions "in the present," and receive feedback without influencing patient results. In addition to actively participating in roles, others can observe the simulation, provide input during the debriefing session, and then take on an active role as the scenario is repeated (Kneebone et al., 2005).

Additionally, simulation scenarios can include the kinds of clinical experiences that become harder and harder to find in the service industry, such placements in pediatric and mental health facilities (Huitt et al., 2015). Mannequins are being used to model clinical scenarios with small groups of learners as a way to teach individuals how and when to work in teams to deliver patient care. Scenarios might include skill sets, quasi or behavioral abilities, legal and moral aspects of professional activity, and promoting a comprehensive patient care strategy that includes family and key others (Elshama, 2020). A modern high-fidelity mannequin may mimic human characteristics such as palpable pulses, rising and falling chest, heart, lung, and bowel sounds, as well as blinking eyes that respond to light and verbal orders (O'Leary et al., 2018). When the mannequin is placed in a mock medical ward with associated objects, realistic learning experiences are possible. It is believed that practicing in groups, which replicates medical treatment, promotes deeper levels of thought, assessment, and reflection on clinical practice difficulties (Diáz et al., 2021).

2.1.6 Objective structured clinical examination (OSCE)

In the 1960s, Harden proposed the OSCE hypothesis. He said that the OSCE is designed to reduce bias in the examination of clinical competence by thoroughly, uniformly, and structural analyzing numerous aspects of clinical practice, paying particular consideration to the process's impartiality while presenting candidates' clinical talents and behaviors (Mard & Ghafouri, 2020).

At OSCE stations, which are socially situated activities, candidates typically engage with "patients" depicted by simulated patients. They have the potential to encourage strategic "tick-box" test-taking behaviors in medical students and fall short of preparing them for complicated and variable patient encounters in real life because of their highly regimented framework and reliance on checklists. (Gormley et al., 2021).

The most often utilized competency-based or performance-based assessment instrument is the OSCE. It is accurate, trustworthy, and fair. Because the content and scoring guidelines are standardized, OSCE are objective. (Boursicot et al., 2020).

Each testing location is made to concentrate on a specific clinical competency. A consistent scoring system is utilized to track your performance. Every OSCE candidate encounters an identical task and is required to complete the same task within the same amount of time. These tasks are simulations of actual clinical scenarios. (Htay et al., 2019).

A vital component of clinical medicine is assessment, which should take into account not only the information and abilities that can be attained but also professionalism and communication (Kolivand et al., 2020).

In Kenya, Medical Training Colleges, Clinical Medicine department administers an OSCE examination to their first year students just before they are allowed to go for junior clerkship in the wards (Kiptoo et al., 2019). Simulated patients and manikins are used conduct this exercise (Meraj et al, 2019).

2.2 Role of Mentorship in Simulation Training

In a purely instructional situation, teachers may have restricted duties, whereas a clinical mentor usually performs several tasks at once, switching from one responsibility to another throughout the same interaction. (Meerdink & Khan, 2021). The great majority of clinical mentors worldwide have received substantial training in medical knowledge and abilities, yet minimal or no training in teaching. Being a competent mentor in the setting of increasing clinical responsibilities and decreasing time for teaching becomes increasingly difficult as primary clinical officers become increasingly busy in their own clinical practice (Hagel et al., 2021).

By serving as a role model and a facilitator and providing services like listening, guiding, counselling, advising, and being a critical friend, the personal development process of mentoring develops the resources of each individual. (Garmire, 2021). It also enables a person to identify her/his own potential (Mubuuke et al., 2020).

Through mentoring programs, a clinician student builds confidence in their ability to learn new information as well as a variety of new abilities. Mentorship boosts performance and self-assurance in addition to professional development (Gagliardi et al., 2009). Similar to this, when students are supervised by clinical mentors from the same faculty who were formerly students and have qualified, the students feel inspired. (Alidina et al., 2021).

According to Ssemata et al., (2017), clinical officer students are an important part of the team throughout the mentoring and socializing process, which improves feelings of contentment with one's employment in the unit.

2.2.1 Simulation as a teaching strategy

Competency in simulations is necessary for students to learn and is crucial for a successful learning outcome (Alanazi et al., 2017). This includes becoming acquainted with and using guiding principles and techniques employed in teaching and learning (Ruddock, 2021). Simulated learning creates problems for group organization and the facilitator's ability to lead the session, making a good learning environment a priority for attaining learning goals. Some anxiety is beneficial in that it motivates people to take action, but it is contingent on the person's ability to cope with such sensations (Williams et al., 2021). If the learner perceives the scenario as having problems that surpass the learner's ability to cope, generating a high level of tension and worry, effective learning will be hampered. One of the recognized hurdles to success in the usage of HPS is a reluctance to actively participate and be involved. There is also a need to reduce rivalry and emphasize the importance of accepting mistakes as a necessary component of education (Williams et al., 2021;Kim, 2017).

Although simulation-based learning is a complicated intervention that requires planning, the facilitator needs to be simulation-competent, just like the students. In addition to planning the session, the facilitators are responsible for creating a secure, private environment that fosters learning (Nyamu et al., 2018). The use of small groups of about 6 people is advised in skills laboratory learning to assist in fostering a secure learning environment (Bapteste et al., 2020). It has been documented those huge classes of medical students can study well. Large group instruction may allow for more

regular and repeated skills laboratory training, which helps each student become more accustomed to the teaching style (Dornan et al., 2019).

Clinical simulation's pre-briefing phase focuses on locating systems gaps and may potentially result in successes or failures (Dubé et al., 2019). Debriefing can be done either immediately after the scenario, which seems to be ideal, or as a break in the action to instruct and allow for contemplation throughout the encounter (Leigh & Brumfield, 2017).

Lieb, (2020) found no proof that a systematic debriefing in simulation was helpful, and many students indicated feeling unprepared, inexperienced, and overwhelmed in their new job. Controlled debriefing seems to provide more time for thought and boost student engagement. Individual or group debriefing sessions can be held with instructor facilitation, video assistance, self-debriefing, multimedia debriefing, and simulation debriefing. Studies to determine the strongest proof of the usefulness of debriefing cannot be generalized (Gasc et al., 2018). To fully comprehend the learning process that takes place in debriefing sessions, more information is still needed regarding how the participants interact with them (Coppens et al., 2018).

2.2.2 The landscape of current simulation practices

For a long time, health professional educators have prepared students for practice through a variety of educational methodologies. In the past, knowledge requirements have tended to be more bioscience-based (e.g., human pathology and biochemistry), but clinically-oriented practice difficulties are frequently explained utilizing paper-based patient scenario (Fraux et al., 2019). Due to the contextual nature of these paper-based cases, students are able to study while analyzing patient data and making

judgments in light of actual, work-related situations. Other popular learning techniques include role playing, facilitated discussions, group projects, and deliberate, repeated clinical skill practice on static manikins or task trainers. In clinically based tests or examinations, actors can take on the role of the "patient" to encourage more genuine synchronous answers, although being rather pricey (Meguerdichian et al., 2019). Due of the high costs and generally limited funding possibilities, this technique has been utilized more in the medical industry than in medical education. Historically, students have used evaluations and skill practice on one another as an alternative, real learning technique, but most institutions in Kenya no longer permit invasive procedures to be conducted on anybody, even students (Ariko, 2020). Manufacturers of medical care simulation products have responded to these needs as technology has advanced, and currently provide a wide range of real human task trainers and manikins for learning and perfecting technical or clinical skills (Herman, 2020).

2.2.3 Recommended simulation practices

It is essential that patient care scenarios include a briefing session, the actual simulation, and a debriefing session immediately afterward (Diáz et al., 2021; Wong *et al.,* 2018). To ensure that learners are aware of the environment, how the mannequin can be used, how to find out more information to help with decisions regarding the care of the "patient," and what their role will be within the team and throughout the scenario, all of these phases are integrated into the learning process. Given that it is thought that most introspection and learning starts at this point, the guided recap session should last at least as long as the simulation itself (Huang et al., 2019). Many organizations promote rerunning the simulation to put new insights from the debriefing into practice, improve performance, and increase enjoyment (Aldhafeeri &

Alosaimi, 2020) yet, there is little proof to back up this tactic. It is possible to record the simulation's audio and/or visual content for later playback during the debriefing. This can be done to highlight vital passages, to corroborate noteworthy actions or remarks, to assess patient metrics and team performance at key junctures throughout the scenario. It is important to carefully evaluate the integrity of each participant's performance throughout the scenario, participant authorization to record the simulation, and what happens to the data afterwards. Although there are many stories of this procedure leading to major learning, there is also a potential of embarrassment and harm (Haerling, 2018).

Modeling good professional behavior also benefits from simulating patient care settings. In order to improve recollection, audio-visual recordings of medical personnel giving patient care during a simulation activity might be made. The edited recordings can subsequently be used to address practice-related topics with students in class or to prepare less experienced students for their simulation experiences. Students have noted benefits from watching professionals act out the simulation scenario they would soon be performing themselves since the audio-visual portrayal gives context for the simulation, clinical practice, and probable patient reactions (Salanger et al., 2020). The audio-visual recordings can also be utilized during continuous professional development.

Commentary on the usage of simulation within and across curriculum has surfaced on a more general level. Although the majority of supporters have embraced simulation as a cutting-edge teaching and learning tool, the approach it has often taken in regard to the theoretical and clinical content of curriculum has been more of a "add on" than an integrated one. Clinical Medicine and Surgery curricula for Kenya Medical

Training are periodically updated, and programs are accredited on a five-year cycle. Whilst this research thesis doesn't go into great detail, problems about curriculum integration and best practices in simulation are still being addressed.

2.3 Perceptions of Students towards Simulation

Perception is an individual's awareness, insight and opinion about a situation Lambert et al., (2021).

Although Khan et. al., (2021) alludes that a legitimate indicator of quality clinical teaching in medical training is the student's perception. The benefit from the simulation depends on how students perceive the clinical teaching. Therefore, if the students perceive simulation as meaningful and helping, they will be motivated to learn and the experiences will be beneficial. Similarly, if the students have a low perception about them, the reverse will be the case.

Several research back up the idea that simulation can improve learning environments and boost self-confidence (Rodriguez et al., 2017). None the less, there isn't enough data to determine whether simulation-based learning and students' confidence are related (Coppens et al., 2018). Studies that compare the level of self-confidence attained through traditional lectures with simulation-based learning have produced a variety of findings. Other studies found that students who were further along in their studies exhibited lower levels of self-assurance and happiness with simulation-based learning than those who had just started the program (Alamrani et al., 2018; Li et al., 2020).

A positive learning environment is thought to depend on things like inspiration and enthusiasm (Cheraghi et al., 2019).

Yucel et al., (2020), reported a thorough and methodical evaluation of the various simulation modalities. They used the Kirkpatrick model to provide proof that studies into obstetric simulation value determining how effective simulation is at the most advanced level of translation. This review bolsters the idea that simulation, at the very least, helps staff members feel more confident handling obstetric emergencies.

In their investigations on the use of simulators in the training or evaluation of sonographers, (Dromey et al., 2021) conclude that the best applications of simulation are for the cultivation of technical skills and image optimization. When simulation is integrated with traditional learning, the best outcomes are obtained, with a heavy emphasis on quantified, specified, and objective abilities. Students may be able to provide clinical help while learning if simulation is integrated into the training curriculum.

Students' experiences in clinical settings are being impacted by changes in patient safety concerns, patient acuity rises, adjustments in health care services, and technological breakthroughs (Morgan & Trinh, 2017). There are few options for students to practice in specialist departments including maternity, pediatrics, and mental health due to competition for student placements (Hughes & Byrom, 2019). Alternative community placements are used by many health professional education programs, including day care centers, consulting clinics, outpatient clinics, churches, jails, and refugee camps. Clinical medicine schools are substituting more high fidelity simulations for clinical encounters when these community assignments become more difficult to get or are overrun with students (Staples & Sangster-Gormley, 2018).

The current environment of tight budgets and understaffed health institutions has increased stress and had a negative impact on the wellbeing of trainees. Time available for educational endeavors has been significantly impacted by financial restrictions and clinical efficiency requirements (Inbar, 2021).

Students' learning opportunities and access to a variety of yet comparable patient care experiences are impacted by the change in how medical care is delivered. For students to better learn fundamental ideas, concepts, and clinical care, they must have more than one chance to interact with patients (Liu et al., 2020). For example, in maternal care, the usual length of stay for regular deliveries has decreased from five days in the 1980s to two days in 2013, reducing the time available for students to engage with patients (Baek et al., 2018).

In Kenya, the corona virus pandemic has shifted the traditional healthcare delivery whereas, ambulatory clinics have replaced hospital stays thus affecting students' learning (M. et al., 2020).

CHAPTER THREE

MATERIALS AND METHODS

3.0 Overview

The precise methods and techniques utilized in data collecting and analysis to address the study questions are described in this chapter. The study area, study design, study population, sampling method, sample size calculation, data collection procedure, research instrument, reliability and validity, data management, analysis and presentation, and ethical consideration were the chapter's main topics.

3.1 Study Area

The study was carried out at St. Mary's School of Clinical Medicine, Mumias, and Kenya Medical Training College, Kakamega, the only medical training schools in Kakamega County offering diploma in Clinical Medicine and Surgery. One of the 47 counties of the Republic of Kenya is Kakamega County. It shares borders with the counties of Vihiga to the south, Siaya to the west, Bungoma to the north, and Nandi to the east. The county has a surface size of 3,050.3 km^2 and sits between 1,240 and 2,000 meters above sea level (Kenya National Bureau of Statistics, 2019). The study site was purposively selected because, of its vast involvement in training diploma holders in Kakamega County who provided the numbers of students required.

3.2 Study Design

A research design is a strategy, plan, or approach utilized to come up with solutions to research challenges (Tobi & Kampen, 2018). For a better understanding of the research problem, a cross-sectional survey study design was utilized, integrating both qualitative and quantitative research. A cross- sectional study design is a type of an

observational study where a researcher measures variables at a single point in time without influencing them (Kilani & Kobziev, 2016). Data was collected at a single point in time. This design also enabled testing of cause-and-effect relationships of the variables under study. The study employed a systematic way of gathering information (Sovacool et al., 2018). The information gathered described simulation in clinical teaching, specifically a case study of medical training colleges in Kakamega county Kenya.

3.3 Study Population

A population denotes to a whole cluster of persons or elements that have same characteristics which samples are taken for measurement (McBride et al., 2021). KMTC- Kakamega, department of clinical medicine has a student population of 611, 19 lecturers and 6 clinical instructors according to the register book Ref No KMTC/QP-07/LDL and St. Mary's School of Clinical Medicine has a student population of 305, 8 lecturers and 4 clinical instructors according to the register book Ref No MTC/QMS-012/2018 (see pages 48, 49 &50). This study was carried out amongst first, second and third-year students and Lecturers of Medical Training colleges in Kakamega County – KMTC Kakamega campus and St. Mary's school of Clinical Medicine. The target population comprised of students in the department of clinical medicine and surgery of KMTC Kakamega and St. Mary's school of Clinical Medicine campuses. Also targeted were mentors in the clinical placement areas.

3.3.1 Inclusion criteria

Only Students studying Clinical Medicine in KMTC – Kakamega campus, St. Mary's School of Clinical were qualified to partake in this study. Lecturers and clinical mentors working and teaching at Clinical Medicine and Surgery department at KMTC – Kakamega campus and St. Mary's school of Clinical Medicine, Mumias were eligible to participate in this study.

3.3.2 Exclusion criteria

Students who did not consent to participate in the study were excluded.

The clinical officers' students who had not registered during that specific semester of data collection.

All Lectures, clinical instructors and mentors who were on off duty and those working as adjunct lecturers.

3.4 Sampling Technique

In identifying sub-groups in the target population, the stratified sampling method was used, that is to say, students and tutors in the two Medical Training Colleges (Hardwick and Stout, 2011). When a researcher decides who to include in the sample for investigation, Purposive sampling method is used, i.e. selecting the subjects with the required information thus selecting use cases only (Bordens & Abbott, 2013); purposive sampling method was used because the respondents were sparsely populated hence pointing out and getting them to put into consideration the time and cost challenges were really difficult. In such a cross sectional research, the researcher is required to consider respondent who is more accessible or a respondent with whom he/she can spend most of the time with (Bordens & Abbott, 2013).

3.5 Sample Size Determination

Sampling is the practice of choosing a group of people to represent a wider number of subjects (Abrham et al., 2020). The goal of sampling is to identify a representative sample that will allow the researcher to learn more about the population. A sample is thus described as a more condensed group drawn from the accessible population. Using Yamane's formula from 1967, this study determines the sample size (Naing, 2003).

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

n = the desired sample size

N = the total population

e = the level of statistical significance (0.5)

Therefore, the sample size for the students is

$n = \frac{916}{1+916(0.05^2)}$ =278 (see table 3.1)

With the use of proportionate stratification, the sample size for each strata was established. When stratification was proportional, the sample size for each stratum matched its population size. (Hong & Sullivan, 2013). The following equation was used to determine the strata sample sizes:

$$n_h = \frac{N_h}{N} \times n$$

Where;

$$n_h = \frac{N_h}{N} \times n$$

$n_h = samle\ \ size\ \ for\ \ strata$

$N = the\ \ total\ \ population\ \ size$

$n = the\ \ total\ \ sample\ \ size$

$N_h = population\ \ size\ \ for\ \ strata$

$n_{h=\frac{611}{916}\times 278=185}$ KMTC- Kakamega

$n_{h=\frac{305}{916}\times 278=93}$ St. Marys Mumias MTC

Table 3.1: Sample population

Strata	**Target population**	**Sample size**	**Method of sample size**
Students	916	278	Yamane's
Lecturers	27	25	Yamane's
Clinical Instructors	10	10	Yamane's
Total	**953**	**313**	

Table 3.2: Sample size per class in KMTC- Kakamega

Strata for KMTC Kakamega	**Population**	**Proportionate stratification approach**	**Sample size**	**Method of sample size determination**
Year 1.1	80	0.13	24	Yamane's
Year 1.2	84	0.14	25	Yamane's
Year 2.1	84	0.14	25	Yamane's
Year 2.2	90	0.15	28	Yamane's
Year 3.1	95	0.16	29	Yamane's
Year 3.2	95	0.16	29	Yamane's
FQE class	83	0.14	25	Yamane's
Total	611	1.00	185	

Table 3.3: Sample size per class in MTC- Mumias

Strata for St. Marys' Mumias	Population	Proportionate stratification approach	Sample size	Method of sample size determination
Year 1.1	35	0.11	11	Yamane's
Year 1.2	90	0.30	27	Yamane's
Year 2	89	0.29	27	Yamane's
Year 3	91	0.30	28	Yamane's
Total	305	1.00	93	Yamane's

Sample size determination for lecturers

Yamane's method

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

N = the total population

e = the level of statistical significance level

n = the desired sample size

$n = \frac{27}{1+27(0.05^2)}$ =25

Proportion of population to be sampled

$n_{h=\frac{17}{27}\times 25=16}$ **KMTC-Kakamega**

$n_{h=\frac{10}{27}\times 25=9}$ **MTC- Mumias**

Sample size determination for clinical instructors was 16 for KMTC- Kakamega and 9 for MTC- Mumias

Yamane's method

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

N = the total population

e = the level of statistical significance level

n = the desired sample size

$n = \frac{10}{1+10(0.05^2)}$=10

Proportion of population of clinical mentors to be sampled

$n_{h=\frac{7}{10}\times 10=7}$ **KMTC-Kakamega**

$n_{h=\frac{3}{10}\times 10=3}$ **MTC- Mumias**

The lecturers and mentors were purposively selected through census sampling technique as follows: Lecturers 25 and Clinical mentors 10.

3.6 Data Collection Procedure

Data collection is the process of obtaining specific information with the intention of proving or disproving some claims, which enables the dissemination of factual information and the creation of useful programs (Fraux et al., 2019; Emmert et al., 1971). Under the supervision of the researcher and research assistant, primary data for this study were gathered using self-administered questionnaires, small group discussions, and interview guides (see Appendix I).

3.7 Instruments for Data Collection

This made reference to the creation of the tools that were employed in the data collection exercise. The researcher created questionnaires, schedules for small group discussions, and interviews in order to gather the necessary data in order to address the research topics.

3.7.1 Questionnaires

This is one of the research strategies that is frequently used in academic studies to quickly and clearly learn about attitudes and opinions while also learning about existing conditions and practices. (Raskind et al., 2019). Questionnaires were administered to students by the researcher. A 5-point Likert-type scale was included in the questionnaires' questions to encourage respondents to express their opinions by allocating points on the scale. Ordinal, interval, and ratio data were intended to be collected via questionnaires in order to apply the more potent statistical method.

3.7.2 Interviews guide

This particularly refers to person to person communication. The respondent is asked questions to elicit his/her own information or opinion (Jamshed, 2014). The researcher created an interview schedule for lectures and clinical instructors as the basis for gathering the necessary data. There were both open-ended and closed-ended questions in the written interview guide.

3.7.3 Focus group

A few processes made it apparent that the focus group discussions were focus group dialogs rather than a second debriefing. The focus group talks were first led by the researcher. After leading the initial scenario debrief, the co-facilitator took notes during the focus group discussion. Also, the researcher used a list of pre-planned

questions to direct the focus group discussions and ensure consistency among focus groups as they discussed their various simulation experiences and teaching and learning methodologies.

3.7.4 Piloting

Piloting was done in KMTC-Bungoma before the study's actual data were gathered. The primary goal was to demonstrate the accuracy and dependability of the research tools. It also helped the researcher ensure that the questions were clear and to take into account feedback from respondents that aided in the development of the instruments.

3.8 Reliability and Validity

3.8.1 Reliability

The consistency with which a test measures the subject matter is referred to as reliability. For assessing the internal reliability of items in both expectation and observation, the Cronbach's Alpha coefficient was utilized. In the majority of social science studies, a reliability Cronbach's Alpha coefficient of 0.70 or above is regarded as adequate. (Taber, 2018). The results from the pilot study items looking at the simulation models used in clinical teaching, the perception level among clinical officers' students on the effectiveness of simulation models helped the researcher calculate the reliability index using the Cronbach alpha index at 0.96, indicating that the research instrument had high reliability and internal consistency. Reliability of the data collection tools was enhanced by ensuring clear and easily understood instructions.

3.8.2 Validity

Validity was achieved by using a well- designed and pretested structured questionnaire, small group discussions tool and interview guide in relation to the study conceptual framework and objectives as well as provision of operational definition of study variables. These variables were informed by literature review, review of skills laboratory and discussion with lecturers, mentors and clinical instructors. Structured questionnaires, small group discussion tool and interview guides were pretested to determine their validity and reliability during the pilot phase.

Clinical medicine and education research professionals reviewed the questionnaire's items to ensure the construct validity of the data gathering techniques. Measurement is necessary for content validity, which also examines the measuring instrument's precision.

3.9 Data management, analysis and presentation

With regard to quantitative data, SPSS software (statistical package for social sciences) Version 26 was used for data entry, cleaning, coding, and analysis. The distribution of each variable in the study objective was described using a univariate analysis, and appropriate descriptive analysis was utilized to produce frequency distributions, tables, and other drawings that were used to analyze diagnostic treatment methods. The strength of the link and any discrepancies between the outcome variable and the other independent variables were examined using bivariate analysis. If there is a correlation between socio-demographics and the research variables, it was found using the chi square test of independence at the 0.05 level of significance. Bivariate and multivariate analyses of the variables were performed, and odds ratios with a 95% confidence level were computed.

3.10 Logistic and Ethical Consideration

Authorisation: Research protocol was submitted to Masinde University of Science and Technology, Institutional Ethic Review committee for approval before the study commenced. Research permit was also sought from National Commission for Science, Technology and Innovation (NACOSTI). Permission to collect data was sought from management of KMTC- Kakamega and St. Marys' School of Clinical Medicine. Further, the study was conducted in accordance with the principles of the Declaration of Helsinki and International ethical guidelines for biomedical research involving human subjects, published by the Council for International Organisation of Medical Sciences.

Informed consent (Autonomy): Prior to enrolment to the study, the purpose, objective, benefits and risk of the study were explained to students, clinical instructors and clinical mentors. A written informed consent to participate in the study were obtained. Consent was also sought from relevant authorities.

Privacy: Privacy of the study participants was safeguarded throughout the study period. Interviews and small group discussion with students, clinical mentors and clinical instructors was done in a space away from the rest of faculty members.

Confidentiality: Confidentiality and autonomy was applied at all stages of the research (data collection, data analysis and reporting, etc.). A unique identification number was used for recording purposes.

Publication and dissemination: Results of this study was made publicly available by publishing them in peer reviewed journals and disseminated through national and international conferences.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the findings from the study in accordance with the research questions and the laid research methodology. The findings were guided by the research objectives. The findings of the study were analysed based on the data collected through the questionnaires distributed. Data collected using questionnaires were coded, entered and analysed using a computer statistical package for social scientist (SPSS) program version 26. In presenting the study findings, frequency tables with varying percentages and charts were used. The chapter is organized by preliminary analyses conducted to address missing data, the analytical strategy and subsequent findings from the analyses are then presented.

4.1 Missing data

Kang, (2013), defined the parameters for missing values as the figure rate that is not stored for a variable in the observation of awareness. Missing data oscillated from a range of 0.4% to 8.7% in all the variables in the study. This study is based on the work of Schlomer et al., (2010) on best practices for missing data. A visual examination of the data revealed that missing data appeared to be missing at random. To avoid biases in parameter estimates, the variances of missing items were imputed using the Expectation- Maximization (EM) approach within SPSS 26. When data is missing completely at random (MCAR), EM is regarded to be a superior method for imputation (Kang, 2013). This also eliminates the inconsistent bias that occurs when case deletion or mean substitution approaches are used. For greater accuracy, missing data

imputation was performed per subscale based on data missing on each particular subscale.

4.2 Socio-demographic characteristics

It was observed that 54.7% of the participants were under the age of 24, which corresponds to the age range of medical training college students in Kenya. Females made up 59.0% of the study's participants. Kakamega KMTC had 66.5% of the participants, which was in line with its student population, compared to St. Marys' Mumias (33.5%). The findings are as in Table 4.1.

Table 4.1 Socio-demographic characteristics of the respondents

Socio-demographic characteristics		Frequency (n)	Percent (%)
Age (Years)	< 24	152	54.7
	≥24	126	45.3
Gender	Female	164	59.0
	Male	114	41.0
Year of Study	Year 1	98	35.3
	Year 2	81	29.1
	Year 3	99	35.6
Training Institution	Kakamega KMTC	185	66.5
	St. Marys' Mumias	93	33.5

Results are presented in frequencies (n) and proportions (%); *n*=278

4.3 Use of simulation models for clinical teaching by lecturers at Medical Training Colleges

This objective sought to identify the simulation models used in clinical teaching, simulation models used in the skills laboratory assessment, simulation models for assessing knowledge, skill and attitudes. In addition, the lead investigator used multiple liner regression and correlation to examine the strength of correlations and the direction of the variables.

4.3.1 Simulation models used in clinical teaching

From the question on the extent of simulation model used in clinical teaching, it was identified that Mannequin usage was 40.6%, simulated patients' usage was 18.0%, skills trainer usage was 16.5%, team-based patient scenario usage was 10.1% and objective structured clinical examination usage was 14.7%. Table 4.2 summarizes the findings.

Table 4.2 Simulation Models Used for Clinical Teaching

Simulation Models used for Clinical Teaching	Frequency (n=278)	Percentage (%)
Mannequin	113	40.6
Simulated Patients	50	18.0
Skills Trainers	46	16.5
Team based Patient Scenarios	28	10.1
Objective Structured Clinical Examination	41	14.7

Results presented in frequency (n) and proportion (%); n= 278

4.3.2 Multiple regressions for simulation models used for clinical teaching

Multiple linear regression was computed to predict simulation models used for clinical teaching based on the sociodemographic factors (age, gender, year of study and institution). There was significant outcome from the regression equation F (4, 273) = 469.046, $p < 0.001$), R^2 of 0.873. Therefore, it was predicted that simulation models used for clinical teaching were equal to 1.404 – 0.348 (age) - 0.784 (gender) + 0.241 (year of study) + 1.593 (institution). Sociodemographic characteristic (age, t = -2.085, $p < 0.001$; gender, t = -4.120, $p < 0.038$; year of study, t = 2.008, $p < 0.046$; and institutions, t = 11.456, $p < 0.001$) influenced the utilization of the simulation models used for clinical teaching.

Table 4.3: Model Summary - simulation models used for clinical teaching

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.934[a]	.873	.871	.526

a. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	519.313	4	129.828	469.046	.000[b]
	Residual	75.564	273	.277		
	Total	594.878	277			

a. Dependent Variable: Simulation Models used in Clinical Teaching
b. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.404	.340		4.135	.000
	Age (Years)	-.348	.167	-.119	-2.085	.038
	Gender	-.784	.190	-.263	-4.120	.000
	Year of Study	.241	.120	.139	2.008	.046

Training Institution	1.593	.139	.514	11.456	.000

a. Dependent Variable: Simulation Models used in Clinical Teaching

4.3.3 Simulation models used in the skills laboratory assessment

The following strategies are used in the skills laboratory to assess students. The utilization of objective structured clinical examinations (OSCEs) contributes for 36.0% of the total; simulated patients and mannequins account for 21.6%, team-based patient scenarios account for 18.0%, and skills trainers account for 2.9%. Table 4.4 displays the results.

Table 4.4 Simulation models used in the skills laboratory assessment

Model used for Clinical Teaching	Frequency (n=278)	Percent (%)
Mannequin	60	21.6
Simulated Patients	60	21.6
Skills Trainers	8	2.9
Team based Patient Scenarios	50	18.0
Objective Structured Clinical Examination	100	36.0

Results presented in frequency (n) and proportion (%); n= 278

4.3.4 Multiple regressions of the simulation models used in the skills lab assessment

From the findings, it could be seen that computed multiple regression has a variance of 95.9% that collectively the socio- demographic characteristics (age, gender, year of study and institution) significantly influenced the simulation models used in the skills laboratory assessment (F (4, 273) = 1,604.217, $p < 0.001$), R^2 of 0.959). Therefore, it

was predicted that simulation models used for clinical teaching were equal to 4.207 – 1.511 (age) - 0.402 (gender) + 0.727 (year of study) + 0.262 (institution). Socio-demographic characteristic (age, t = -14.381, p < 0.001; gender, t = -3.357, p = 0.001; year of study, t = 9.610, p < 0.001; and institutions, t = 3.001, p = 0.003) influenced the utilization of the simulation models used for clinical teaching.

Table 4.5: Model Summary - the simulation models used in the skills lab assessment

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.979[a]	.959	.959	.331

a. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	702.487	4	175.622	1604.217	.000[b]
	Residual	29.887	273	.109		
	Total	732.374	277			

a. Dependent Variable: Simulation Models used in the Skills laboratory Assessment
b. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

4.3.5 Simulation models for assessing knowledge, skill and attitudes

The study found out that the combination of the team-based patient scenarios, OSCE, simulated patients and skills trainer accounted for 47.8% of the simulation models for assessing knowledge, skill and attitudes. Singly, OSCE accounted for 11.2%; skills trainers accounted for 19.4%; simulated patients accounted for 21.5%. The findings are presented in Table 4.4.

Table 4. 6 Methods for assessing knowledge, skill and attitudes

Methods for assessing knowledge, skill and attitudes	**Frequency (n)**	**Per cent (%)**
Objective structured clinical examination (OSCE)	31	11.2
Skills Trainer	54	19.4

Simulated patients	60	21.5
Team based Patient Scenarios, OSCE, Simulated Patients, Skills Trainer	133	47.8

Results are presented in frequencies (n) and proportions (%); n=278

4.3.6 Multiple regressions of Methods for assessing knowledge, skill and attitudes

From the computed multiple regression to predict determine how methods of assessing knowledge, skills and attitudes was influenced by age, gender, year of study and institution. Therefore, it was found out that F (4,273) = 312.785, $p < 0.001$), R^2 of 0.821. It could be deduced from this regression equation that simulation models used for assessing knowledge, skills and attitude were equal to 2.992 – 0.581 (age) - 0.200 (gender) + 0.951 (year of study) - 0.533 (institution). Sociodemographic characteristic (age, t = -4.059, $p < 0.001$; year of study, t = 9.230, $p < 0.001$; and institutions, t = -4.468, $p = 0.001$) significantly influenced the utilization of the simulation models used for clinical teaching.

Table 4.7: Model Summary - Methods for assessing knowledge, skill and attitudes

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906[a]	.821	.818	.451

a. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	254.441	4	63.610	312.785	.000[b]
	Residual	55.519	273	.203		
	Total	309.960	277			

a. Dependent Variable: Simulation Models for assessing knowledge, skill and attitudes
b. Predictors: (Constant), Training Institution, Gender, Age (Years), Year of Study

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.992	.291		10.276	.000
	Age (Years)	-.581	.143	-.274	-4.059	.000
	Gender	-.200	.163	-.093	-1.225	.222
	Year of Study	.951	.103	.758	9.230	.000
	Training Institution	-.533	.119	-.238	-4.468	.000

a. Dependent Variable: Simulation Models for assessing knowledge, skill and attitudes

4.3.7 Correlation on simulation models for clinical teaching used in clinical medicine

From the computed correlation, there was a strong statistically significant association between simulation models used in clinical teaching and simulation models used in skills laboratory assessment and simulation models used in clinical teaching and simulation models used in skills laboratory assessment (r = 0.0.878; $p < 0.001$) and

between simulation models used in clinical teaching and simulation models used to assess knowledge skills (r = 0.778; p< 0.001). There was a strong statistically significant association between simulation models used in the skills laboratory assessment (r = 0.915; p < 0.001) and simulation models for assessing knowledge, skill and attitudes (r = 0.915; p < 0.001) Findings are presented in Table 4.6.

Table 4.8 Correlation on simulation models for clinical teaching used in clinical medicine

		Simulation Models used in Clinical Teaching	Simulation Models used in the Skills laboratory Assessment	Simulation Models for assessing knowledge, skill and attitudes
Simulation Models used in Clinical Teaching	Pearson Correlation	1	.878**	.778**
	Sig. (2-tailed)		.000	.000
	N	278	278	278
Simulation Models used in the Skills laboratory Assessment	Pearson Correlation	.878**	1	.915**
	Sig. (2-tailed)	.000		.000
	N	278	278	278
Simulation Models for assessing knowledge, skill and attitudes	Pearson Correlation	.778**	.915**	1
	Sig. (2-tailed)	.000	.000	
	N	278	278	278

**. Correlation is significant at the 0.01 level (2-tailed).

The researcher performed correlation test in Table 4.6, which show that the simulation models used in clinical teaching is strongly influences simulation models used in the skills laboratory assessment (r = 0.878) and simulation models for assessing knowledge, skill and attitudes (r = 0.778). Moreover, simulation models used in the skills laboratory assessment (r = 0.915) and simulation models for assessing knowledge, skill and attitudes (r = 0.915) strongly influence each other. Therefore, the

simulation models help the clinical medicine students to improve their competence and attitudes.

4.4 Roles of Clinical Instructors and lecturers in clinical simulation training

4.4.1 Preparation of student for clinical assessment

On the question of the preparation of the students for clinical assessment, 43.5% of the clinical medicine students were moderately prepared while 34.1% were very much prepared for clinical experience. Moreover, 18.8% were fairly prepared for clinical experience. However, it was revealed that 3.6% of the clinical medicine students were not prepared for clinical experience as shown in Figure 4.1

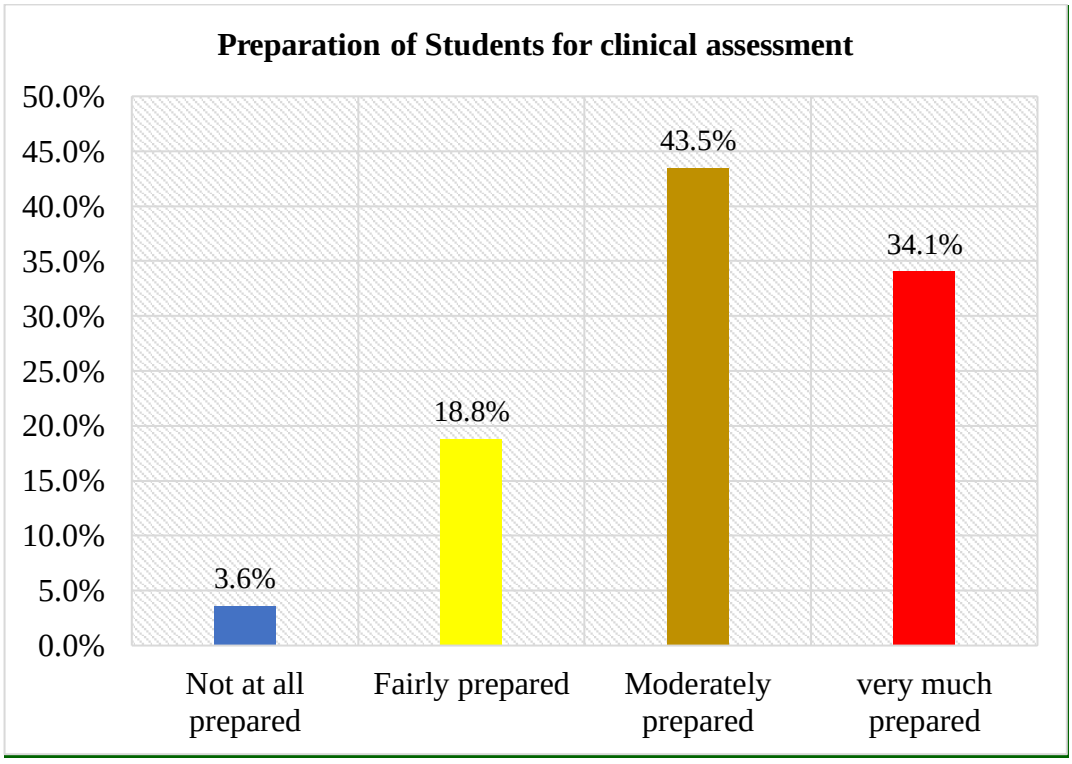

Figure 4.1 Preparation of students for clinical assessment

4.4.2 Clinical assessment

This section sought to establish the variables under clinical assessment experienced by the clinical medicine students. The researcher looked at the teaching methods, mentorship and demonstration experiences during clinical assessment.

4.4.2.1 Teaching methods

When it came to the teaching methods employed for the simulation experience, 70.5% of the students agreed that simulation teaching methods provided a beneficial learning experience. Furthermore, 70.2% of the students believed that the simulation teaching approaches helped encourage the learners' critical thinking. 70.2% of students agreed that the knowledge gained via simulation teaching approaches was transferable to the clinical setting. Furthermore, 69.5% of students felt that simulation teaching approaches helped them better understand clinical medicine principles. During the simulation exercises, the models are given animated life and are realistic (61.9%), so they are treated as living beings, which 63% of the students reported feeling concerned about.

Table 4.9: Teaching methods for simulation models training

Statement	Strongly Agree		Agree		Disagree		Strongly Disagree	
Valuable learning experience	56	20.1%	140	50.4%	60	21.6%	22	7.9%
Helped to stimulate critical thinking	65	23.4%	130	46.8%	53	19.1%	30	10.8%
Knowledge gained can be transferred to the clinical setting	65	23.4%	130	46.8%	53	19.1%	30	10.8%
Simulations helped to better understand concepts	63	22.7%	130	46.8%	45	16.2%	40	14.4%
Experienced nervousness during simulation	55	19.8%	120	43.2%	60	21.6%	43	15.5%
Was realistic	42	15.1%	130	46.8%	60	21.6%	46	16.5%

4.4.2.2 Opinion of the key informants and Focus Group Discussion (FGD) on their role in clinical teaching

a) Key informants (clinical instructors) interview

It was established that core roles of the clinical instructors to clinical medicine students were guiding and mentorship to students in the clinical area, demonstration of the clinical examination, follow-up, and supervising students.

One of the Clinical Instructors stated that;

> "… Instructors goal at the clinical setting is to identify an objective, prepare and facilitate clinical teaching" CI01

Another added that;

> "… Our role and sole responsibility to clinical learning experience, we teach the students on clinical experience and the rest is up to them to acquire skills." CI09

Another one stated that;

> "… As an instructor, we endeavour to connect theory and practice making the students ready for the clinical experience." CI12

b) Focus Group Discussion

From the Focus Group Discussion with the students, it was discussed that Clinical Instructors were vital for the clinical experience. That the Clinical Instructors guided them in the clinical environment. They helped the students with important semester notes as materials for future reference.

A member at the FGD forum stated that;

> "… We were given a lot of information during clinical simulation in the skills laboratory and that bequeathed us with the foundation of a clinical medicine and the behaviour of a clinician at the clinical environment." MFD4

Another member stated that:

> "… A lot of instruction received from Clinical Instructors which were practical informed a lot on the theories we had covered in class. Thus, this information helped to open up our critical thinking and interaction with the real patients in clinical environment." MFD6

4.4.2.3 Multiple regressions of the teaching methods

The study found out that the preparation of students for clinical assessment was significantly influenced by the student perception regarding the valuable learning experience, helped stimulate critical thinking, knowledge gained was transferable to the clinical setting, the simulations helped to better understand concepts, experienced nervousness during simulation and was realistic. The regression equation F (5, 272) = 247.138, $p < 0{,}001$), R^2 of 0.820 shows that there is a variance of 82% that predicts the perception of students on the methods of teaching. Therefore, it was predicted that the student perception on the teaching methods were equal to 1.250 + 0.101 (valuable

learning experience) + 0.195 (knowledge gained is transferable to the clinical setting) + 0.059 (simulations helped stimulate critical thinking) + 0.423 (experienced nervousness during simulation) + 0.032 (was realistic).

Perception of student on the teaching method (valuable learning experience, $t = 1.042$, $p = 0.298$; knowledge gained is transferable to the clinical setting, $t = 1.613$, $p = 0.108$; simulations helped stimulate critical thinking, $t = 0.509$, $p = 0.612$; and experienced nervousness during simulation, $t = 3.939$, $p < 0.001$ and was realistic $t = 0.367$, $p = 0.714$) showed that influenced the utilization of the simulation models used for clinical teaching.

Table 4.10: Model Summary - teaching methods

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.905[a]	.820	.816	.350

a. Predictors: (Constant), Was realistic, Valuable learning experience, Simulations helped to better understand concepts, Experienced nervousness during simulation, Knowledge gained can be transferred to the clinical setting

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	151.704	5	30.341	247.138	.000[b]
	Residual	33.393	272	.123		
	Total	185.097	277			

a. Dependent Variable: Preparation of students for clinical assessment
b. Predictors: (Constant), Was realistic, Valuable learning experience, Simulations helped to better understand concepts, Experienced nervousness during simulation, Knowledge gained can be transferred to the clinical setting

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.250	.062		20.016	.000
	Valuable learning experience	.101	.097	.104	1.042	.298
	Knowledge gained can be transferred to the clinical setting	.195	.121	.217	1.613	.108
	Simulations helped to better understand concepts	.059	.115	.069	.509	.612
	Experienced nervousness during simulation	.423	.107	.498	3.939	.000
	Was realistic	.032	.086	.036	.367	.714

a. Dependent Variable: Preparation of students for clinical assessment

4.4.2.4 Mentorship at the clinical experience

On the question of the student perception on mentorship, the researcher found out that the 75.5% of clinical medicine students felt that mentorship during simulation experiences supported their reasoning and ability to perform their roles and responsibilities at the clinical environment. Figure 4.2 illustrates the finding.

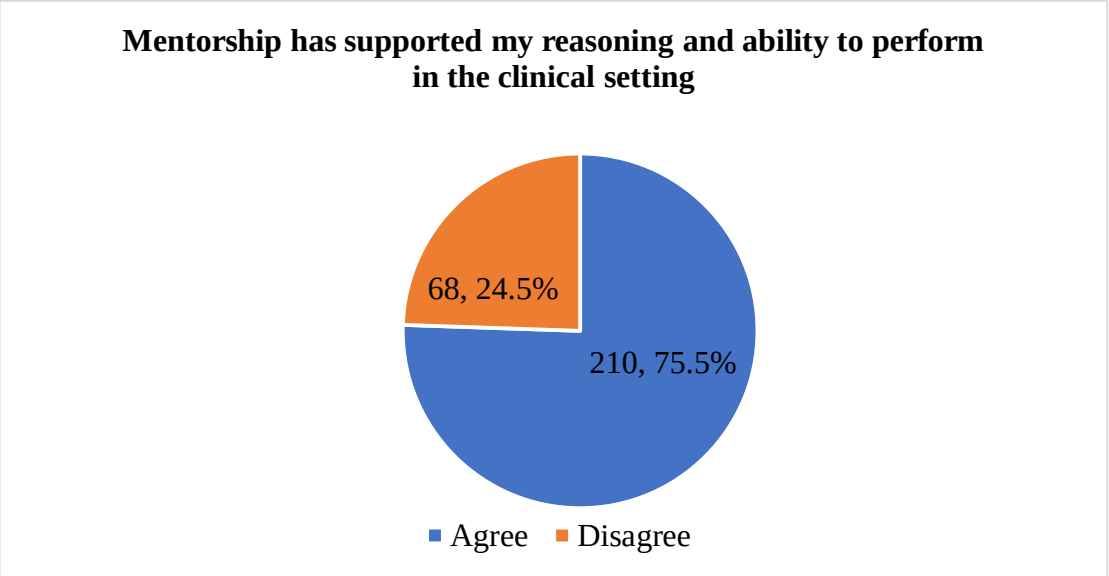

Figure 4.2: Mentorship in clinical setting

a) Opinion of students on mentorship in Focus Group Discussion forum

From the Focus Group Discussion with the students, it was revealed that Clinical Instructors guided them to enhance confidence and professionalism at the clinical environment. They observed and used patients to help connect with the theory. It was established that Clinical Instructors provided supervision, discipline, guiding and counselling.

A student stated that:

> "… We are guided and mentored in reviewing literature and comparing them with the clinical client review" MFD8

Another one stated that:

> "… Clinical instructors are crucial in promoting a sense of belonging and professionalism in the way clinical medicine students relate with patients regarding clinical clerkship and diagnosis of health condition." MFD9

Another student said that:

"… Despite limitation in resources at the facility, the clinical Instructors are committed to us." MFD10

4.4.2.5 Multiple regressions on the perception of students on mentorship

Student perception on mentorship had a variance of 72.6% which was significantly influenced by the support of mentorship on reasoning and ability to perform in the clinical setting. The regression equation F (1,276) = 732.506, $p < 0.001$), R^2 of 0.726. Mentorship thus was equal to 1.246+ 0.883 (mentorship supported on reasoning and ability to perform in the clinical setting). There according to $t = 17.170$, $p = 0.001$ mentorship significantly influenced the reasoning and ability of the students to perform at the clinical setting.

Table 4.11: Model Summary – perception on mentorship

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.852[a]	.726	.725	.428

a. Predictors: (Constant), Mentorship has supported my reasoning and ability to perform in the clinical setting

]

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	134.441	1	134.441	732.506	.000[b]
	Residual	50.656	276	.184		
	Total	185.097	277			

a. Dependent Variable: Preparation of students for clinical assessment
b. Predictors: (Constant), Mentorship has supported my reasoning and ability to perform in the clinical setting

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.246	.073		17.170	.000
	Mentorship has supported my reasoning and ability to perform in the clinical setting	.883	.033	.852	27.065	.000

a. Dependent Variable: Preparation of students for clinical assessment

4.4.2.6 Demonstration in the clinical experience

On the question of student perception on the usage of simulation models for demonstration, 69.5% of the students felt that simulation models should remain an integral part of the clinical experience. It was also revealed by 60.1% of the students that usage of simulation models to experience clinical experience, it was helpful to them in managing nervousness during actual clinical interaction with actual patients. Moreover, 48.6% of the students felt that demonstration of simulation models could partially be substituted for clinical experience.

Table 4.12: Demonstration at the skills labs

Statement	Strongly Agree		Agree		Disagree		Strongly Disagree	
Simulation should continue to be an integral part of the clinical experience	33	11.9%	160	57.6%	53	19.1%	32	11.5%
Because of simulation, I will be less nervous in the clinical setting when providing care for similar patients	47	16.9%	120	43.2%	61	21.9%	50	18.0%
Can be partial substitute for clinical experiences	55	19.8%	80	28.8%	103	37.1%	40	14.4%

Results are presented in frequency (n) and proportion (%); n = 278

a) Opinion of students on demonstration in Focus Group Discussion forum

From the Focus Group Discussion, it was revealed that Clinical Instructors through simulation and demonstration improves experiences at the clinical environment. Where it was unanimously stated at the FGD forum that:

> "… Clinical Instructors conduct clinical demonstrations by using procedure manuals and to guide students" MFD12

4.4.2.7 Multiple regressions on the demonstration

Demonstration at the clinical setting had a variance of 80.0% which significantly was influenced by the suggestion of simulation being a continuous usage for clinical experience, simulation makes one less nervous in the clinical setting and simulation can be partially substituted for clinical experiences. The regression equation F (3, 274)

= 365.868, $p < 0.001$), R^2 of 0.800. Demonstration thus was equal to 1.143 + 0.147 (simulation being a continuous usage for clinical experience) + 0.336 (simulation makes one less nervous in the clinical setting) + 0.322 (and simulation can be partially substituted for clinical experiences). Therefore, simulation being a continuous usage for clinical experience, $t = 2.480$, $p = 0.014$; simulation makes one less nervous in the clinical setting, $t = 5.950$, $p < 0.001$; simulation makes one less nervous in the clinical setting, $t = 5.946$, $p < 0.001$ Therefore, demonstration at the clinical environment helps the students to achieve competition and confidence in clinical practice.

Table 4.13: Model Summary - Demonstration

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895[a]	.800	.798	.367

a. Predictors: (Constant), Can be partial substitute for clinical experiences, Simulation should continue to be an integral part of the clinical experience, Because of simulation, I will be less nervous in the clinical setting when providing care for similar patients

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	148.121	3	49.374	365.868	.000[b]
	Residual	36.976	274	.135		
	Total	185.097	277			

a. Dependent Variable: Preparation of students for clinical assessment
b. Predictors: (Constant), Can be partial substitute for clinical experiences, Simulation should continue to be an integral part of the clinical experience, Because of simulation, I will be less nervous in the clinical setting when providing care for similar patients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.143	.067		17.190	.000
	Simulation should continue to be an integral part of the clinical experience	.147	.059	.148	2.480	.014
	Because of simulation, I will be less nervous in the clinical setting when providing care for similar patients	.336	.066	.399	5.090	.000
	Can be partial substitute for clinical experiences	.322	.054	.381	5.946	.000

a. Dependent Variable: Preparation of students for clinical assessment

4.5 Perceptions of students towards clinical simulation as a learning strategy

Majority of respondents disagreed that clinical teaching methods used were adequate and suitable for students learning (*n* = 161, 57.91%). Majority agreed that clinical teaching site was conducive and provides a positive learning environment (*n* = 149, 53.60%). In addition, students strongly disagreed that the skills laboratory and clinical medicine faculty provided them with procedure Manual books for reference (*n* = 91, 32.73%). They however agreed that the logbooks were accurate and useful during the Clinical Teaching (*n* = 110, 39.57%). They also strongly disagreed that teaching and learning materials were available and adequate (*n* = 142, 51.08%). Majority disagreed that there was good coverage of the clinical instruction curriculum (*n* = 166, 59.71%). Most students strongly disagreed that clinical objectives are always met at each clinical placement (*n* = 109, 39.21%). Majority also strongly disagreed that the mentor was

friendly and approachable throughout the period of skills laboratory teaching (*n* = 157, 56.47%). Most students strongly disagreed that they are always available (*n* = 137, 49.28%). Students also strongly disagreed that teaching tips like preparation introduction, interaction and summarization were used by the mentor (*n* = 146, 52.52%). Summary of frequencies and percentages are presented in Table 4.10.

Table 4.14: Perceptions of students towards clinical simulation as a learning strategy

Variable	SA		A		D		SD	
	N	%	N	%	N	%	N	%
Clinical teaching methods used are adequate and suitable for students learning	64	23.0%	2	0.7%	159	57.2%	53	19.1%
The clinical teaching site is conducive and provides a positive learning environment	53	19.1%	149	53.6%	31	11.2%	45	16.2%
The skills laboratory and clinical medicine faculty provide me with procedure Manual books for reference	65	23.4%	91	32.7%	75	27.0%	47	16.9%
The logbooks are accurate and useful during the Clinical Teaching	40	14.4%	110	39.6%	75	27.0%	53	19.1%
The objectives of teaching are well known to clinical Instructors	84	30.2%	127	45.7%	28	10.1%	39	14.0%
The teaching and learning materials are available and adequate	142	51.1%	54	19.4%	68	24.5%	14	5.0%
There is good coverage of the clinical instruction curriculum	16	5.8%	30	10.8%	166	59.7%	66	23.7%
Clinical objectives are always met at each clinical placement	1	0.4%	80	28.8%	87	31.3%	110	39.6%

The Mentor is friendly and approachable throughout the period of skills laboratory teaching	1	0.4%	15	5.4%	106	38.1%	156	56.1%
The instructors are always available	80	28.8%	103	37.1%	62	22.3%	33	11.9%
Varied teaching tips like preparation introduction, interaction and summarization are used by the mentor	64	23.0%	12	4.3%	56	20.1%	146	52.5%

Note: SD=strongly disagree, D=disagree, A=agree and SA=strongly

4.5.1 Multiple regressions on the perception clinical simulation as a learning strategy

Perception on clinical simulation as a learning strategy from the computed regression had a collective variance of 93.4% as obtained from the regression equation F (11, 266) = 341.721, $p < 0.001$), R^2 of 0.934. Therefore, perception clinical simulation as a learning strategy was significantly influenced by clinical teaching methods used are adequate and suitable for students learning, $t = 5.095$, $p = 0.001$; the logbooks are accurate and useful during the clinical teaching, $t = -3.713$, $p < 0.001$; the objectives of teaching are well known to clinical instructors, $t = -11.699$, $p < 0.001$; the teaching and learning materials are available and adequate, $t = 3.073$, $p = 0.002$; there is good coverage of the clinical instruction curriculum, $t = 8.563$, $p < 0.001$; clinical objectives are always met at each clinical placement, $t = 4.104$, $p < 0.001$; the mentor is friendly and approachable throughout the period of skills laboratory teaching, $t = 2.002$, $p = 0.046$; and the instructors are always available, $t = 9.036$, $p < 0.001$.

Table 4.15: Model Summary-perception clinical simulation as a learning strategy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.966[a]	.934	.931	.214

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	172.864	11	15.715	341.721	.000[b]
	Residual	12.233	266	.046		
	Total	185.097	277			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.086	.125		.685	.494
	Clinical teaching methods used are adequate and suitable for students learning	.282	.055	.353	5.095	.000
	The clinical teaching site is conducive and provides a positive learning environment	.077	.056	.089	1.391	.165
	The skills laboratory and clinical medicine faculty provide me with procedure Manual books for reference	.086	.063	.107	1.353	.177
	The logbooks are accurate and useful during the Clinical Teaching	-.192	.052	-.225	-3.713	.000
	The objectives of teaching are well known to clinical Instructors	-.530	.045	-.635	-11.699	.000
	The teaching and learning materials are available and adequate	.125	.041	.148	3.073	.002
	There is good coverage of the clinical instruction curriculum	.424	.050	.394	8.563	.000
	Clinical objectives are always met at each clinical placement	.228	.056	.232	4.104	.000
	The Mentor is friendly and approachable throughout the period of skills laboratory teaching	.103	.052	.078	2.002	.046
	The instructors are always available	.484	.054	.580	9.036	.000
	Varied teaching tips like preparation introduction, interaction and summarization are used by the mentor	-.065	.045	-.097	-1.444	.150

a. Dependent Variable: Preparation of students for clinical assessment

4.5.2 Students' perception on use of simulation models in clinical teaching

On the question of perception on the use of simulation models in clinical teaching, the following agreement were established. It revealed by 58.6% of the students that simulation demands for proper organization, time management and skills for effective utilization. Therefore, simulation models according to 40.3% of the students that it ensures good coverage of the clinical instruction curriculum. Simulation models enhances communication skills (52.2%) as it makes one (student) a competent clinical officer in practice (62.6%). However, 70.2% of the students were in disagreement that simulation models helped ensures the objectives of the clinical experience were met. Findings are presented in Table 4.12.

Table 4.16: Students' perception on use of simulation models in clinical teaching

Statement	Strongly Agree		Agree		Disagree		Strongly Disagree	
Demands for organization and time management skills more	42	15.1%	121	43.5%	60	21.6%	55	19.8%
Ensures good coverage of the clinical instruction curriculum	65	23.4%	47	16.9%	75	27.0%	91	32.7%
Which model tests good communication skills	67	24.1%	78	28.1%	75	27.0%	58	20.9%
Makes you a competent clinical officer	33	11.9%	141	50.7%	53	19.1%	51	18.3%
This model ensures objectives are met	29	10.4%	54	19.4%	70	25.2%	125	45.0%

Results are presented in frequencies (n) and proportions (%); n=278

4.5.3 Multiple regressions on the perception on use of simulation models in clinical teaching

Computed regression equation revealed that there was a collective statistically significant association between preparedness of the student and their perception on the use of the simulation models in the clinical setting. The perception on use of simulation models in clinical teaching at the clinical setting had a variance of 88.1% as provided by the regression equation F (5, 272) = 410.894, $p < 0.001$), R^2 of 0.881. The perception on use of simulation models in clinical teaching at the clinical setting thus was influenced by ensures good coverage of the clinical instruction curriculum, t = 9.764, $p = 0.001$; makes you a competent clinical officer, $t = 3.933$, $p < 0.001$ and this model ensures objectives are met, $t = 3.062$, $p = 0.002$.

Table 4.17: Model Summary - perception on use of simulation models in clinical teaching

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.940[a]	.883	.881	.282

a. Predictors: (Constant), This model ensures objectives are met, makes you a competent clinical officer, ensures good coverage of the clinical instruction curriculum, which model tests good communication skills, Demands for organization and time management skills more

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	163.456	5	32.691	410.894	.000[b]
	Residual	21.641	272	.080		
	Total	185.097	277			

a. Dependent Variable: Preparation of students for clinical assessment

b. Predictors: (Constant), This model ensures objectives are met, makes you a competent clinical officer, ensures good coverage of the clinical instruction curriculum, which model tests good communication skills, Demands for organization and time management skills more

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.051	.059		17.802	.000
	Demands for organization and time management skills more	.041	.072	.049	.568	.570
	Ensures good coverage of the clinical instruction curriculum	.442	.045	.627	9.764	.000
	Which model tests good communication skills	-.098	.057	-.128	-1.697	.091
	Makes you a competent clinical officer	.241	.061	.272	3.933	.000
	This model ensures objectives are met	.129	.042	.163	3.062	.002

a. Dependent Variable: Preparation of students for clinical assessment

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter discusses the findings in relation to the research objectives. To explain *"the utilization of simulation models in clinical teaching at medical training colleges in Kakamega County, Kenya,"* the findings were triangulated with existing literature and key informant findings.

5.2 Usage of simulation models for clinical teaching at Medical Training Colleges

Mannequin usage was mostly preferred simulation model because it opens up the critical thinking and promotes clinical judgement based on the patient's preconditions and helps solve the existing problem. The students in the skills laboratory are subjected to manikin patients by which student gather and are directed by the clinical instructors. This is an interactive session where students are given an opportunity to contribute towards patient care and improve communication skills. As noted by Sakuma et al., (2020) mannequin learning approach at the skills lab at clinical experience is of grave importance in bequeathing knowledge, critical thinking and problem-solving skills as well as their ability in clinical judgment.

Practical learning at the skills lab and the clinical experience usage of a simulated patients has been gaining traction. Simulated patients provide the real experience of a patients whom the students practice to provide diagnosis and interaction. Despite its importance, it was established in this study that it was fairly employed at the clinical learning experience. Simulated patients are essential for clinical learning experience due to them modelling the real patients but as it stands it is not given as much prominence as it should. It could be that the facilities are not available to cater for high

number of students on a clinical experience. In reference to Fiona Dudley, (2018) findings on simulated patients, such patients provide simulated health problems for students to offer professional diagnosis and test their consultative skills and feedback. Therefore, an area that seeks to broaden the student's ability to examine and diagnose health conditions for the patients. Therefore, Roberts et al., (2021) noted that through simulated patients' different health conditions can be identified and prompt redress or treatment availed. Looking at the study by Wafula et al., (2022) variation in initial and final diagnosis has influenced wrong treatment hence increased fatalities, thus with the use of simulated patients and identification of various causes or health conditions results to matching diagnosis and right treatment.

Skills trainer is central to life support and professional handling of a patient. This is at the epicentre of proper clinical experience and patient service but is seldom used at the clinical experience as suggested in this study. According to Biancardi et al., (2020), clinical students use mannequins to develop their skills in patient life support such as cardiopulmonary resuscitation, artificial ventilation, and intravenous catheterization. These abilities and equipment remain the foundation of annual resuscitation certification for both practitioners and clinical officers' students. However, inasmuch as it is critical to advance the skills and abilities to enhance life support, it was seldom used according to the findings in this study. Skills training enhances the student's confidence and morale when dealing and handling patients in real life experience. Therefore, Nguyen et al., (2019) reported that skills training prepared the clinical students in performing their duties at the work station. It was established that the students were not taken through skills training often in order to elevate their practical skills in this area. The limitation may contribute to under preparedness of the students

towards real engagement with the patients in the clinics and provide the best examination as they ought to.

The team-based patient scenario is one of the approaches that the clinical medicine students are taken through while at the clinical learning experience. But in this study, it was revealed that team-based patient scenario was less likely used in providing training to the students on clinical experience. Team-based patients' scenario is deemed as one of safest approaches of simulation of a patient's health conditions for clinical learning experience as corroborated by Bailez et al., (2019) and Nykänen (2020). Therefore, simulation scenarios can encompass the types of clinical experiences which are increasingly difficult to obtain in the service sector such as mental health and paediatric placements. It has become a preferred method of learning on how to work within teams to deliver patient care. Simulation models offer opportunities for students who work in team to provides examination such as palpable pulses, chest rise and fall, heart, lung and bowel sounds, eyes that blink and react to light and vocal responses (O'Leary et al., 2018). Moreover, students rehearsing in teams are believed to develop higher levels of thinking, analysis and reflection of clinical practice issues (Diáz et al., 2021).

Objective structured clinical examination was one of the least used approaches in the facilitation of clinical learning experience in this study. Despite OSCE leaning towards reducing bias in the assessment of clinical competence as noted by Fouad et al., (2019), this was least preferred at the clinical learning experience. It is clear that OSCE is focused with the comprehensive, consistent, and structured manner, paying close attention to the objectivity of the process while demonstrating candidates' clinical skills and behaviours, it was seldom used in this study. OSCE being a competency-

based tool widely used, was not the main preferred approach in this study. Through OSCE approach, students at the clinical learning experience record all the instructions and suggestions given by the mentor and a register of the simulated activity is maintained in the skills laboratory (Barker & Durst, 2021). But this was the least preferred approach.

The sociodemographic factors (age, gender, year of study and institution) influenced that simulation models used for clinical teaching influenced the utilization of the simulation models used for clinical teaching. Therefore, the sociodemographic characteristics in the skills laboratory, objective structured clinical examination (OSCE), simulated patients and use of mannequins and team-based patient scenarios were fairly used. It was an indicator that the students on clinical a learning experience are not given the best of the experience in relation to the clinical learning experience demands. To enhance the competence of the learners with practical performance prepares them and improves their knowledge and skills towards clinical medicine field. Therefore, the simulation models for assessing knowledge, skill and attitudes were preferred. It could be deduced from this regression equation that simulation models used for assessing knowledge, skills and attitude significantly influenced the utilization of the simulation models used for clinical teaching. With the simulation models used in clinical teaching is strongly influences simulation models used in the skills laboratory assessment and simulation models for assessing knowledge, skill and attitudes. Moreover, simulation models used in the skills laboratory assessment and simulation models for assessing knowledge, skill and attitudes strongly influence each other. Therefore, the simulation models help the clinical medicine students to improve their competence and attitudes.

5.3 Roles of Clinical Instructors and lecturers in clinical simulation training

Clinical medicine students were prepared for clinical learning experience. This was important for them to apply the theoretical experience to practical experience at the clinical environment. Moreover, student preparation level helps the clinical instructors to focus on the task at hand of sharpening practical skills of the students. Prior information of what to expect at the clinical experience also endeavour to mitigate mistakes at the clinical learning environment.

The teaching methods used for the simulation experience helped the students to achieve their learning objective and enhance their competence and skills in clinical medicine practice. Clinical instructors were important part of the student's achievement in the clinical environment. The students were prepared in advance prior to commencement of the clinical experience and were therefore, ready to partake of the clinical experience. Therefore, the preparation of students for clinical assessment was significantly influenced with a variance of 82%, which helped stimulate critical thinking, knowledge gained is transferable to the clinical setting, the simulations helped to better understand concepts, experienced nervousness during simulation and was realistic. Therefore, the teaching methods were established to influence the utilization of the simulation models used for clinical teaching. This is in agreement with Williams *et al*., (2021), that, to ensure a good learning environment, organizing students into groups for the facilitator's ability to conduct the session improves skills acquisition. If the learner perceives the situation as possessing challenges that exceed the learner's ability to cope, this will cause a high level of stress and anxiety thus, impede effective learning.

Mentorship during simulation experiences supported student reasoning and ability to perform their roles and responsibilities at the clinical environment. Clinical Instructors provided guidance to students that enhanced their confidence and professionalism at the clinical environment. Mentorship helped connect practical experience with class theory. Therefore, mentorship provided to the students on clinical learning experience were achieved through the Clinical Instructors providing supervision, discipline, guiding and counselling to them. Clinical instructors who double up as the mentors to the students on clinical learning experience often play many roles simultaneously, switching from one role to another during the same encounter (Meerdink & Khan, 2021). Therefore, this study scores the importance of mentorship to students which propagates and boosts their reasoning ability to perform in the clinical environment. The large majority of clinical mentors around the world have received rigorous training in medical knowledge and skills but little to none in teaching. As primary clinical officers become ever busier in their own clinical practice, being effective mentors becomes more challenging in the context of expanding clinical responsibilities and shrinking time for teaching (Hagel *et al*., 2021). However, in this study the mentors gave prominence to the needs of the students under their care and helped them manage nervousness during actual clinical practice. Having taken the students through demonstration of the applicable method of learning clinical procedures and processes, it has influenced utilization of simulation in clinical experience. Clinical environment helps the students to achieve competition and confidence in clinical practice.

5.4 Perceptions of students towards clinical simulation as a learning strategy

Competence of students towards clinical simulation is highly influenced utilization of simulation models for clinical experience. It has enhanced communication skills,

proper organization and time management that promotes clinical practice. Perception is an individual's awareness, insight and opinion about a situation (Lambert *et al*., 2021). The perception of students has ensured good coverage of the clinical instruction curriculum and enhanced their communication skills. Preparedness of the student and their perception on the use of the simulation models in the clinical setting. However, the students felt that the objectives of the clinical experience were not met. This is in line with the findings on OSCE where it was the least used method or approaches at the clinical learning experience. To achieve the objective of clinical learning experience, the student perception is critical (Khan *et al*., 2021). The benefit from the simulation depends on how students perceive the clinical teaching. Therefore, if the students perceive simulation as meaningful and helping, they will be motivated to learn and the experiences will be beneficial. Similarly, if the students have a low perception about them, the reverse will be the case. Some studies support simulation to help create a positive learning environment and contribute to self-confidence (Rodriguez *et al*., 2017).

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter looked at the conclusions of the study focusing on the specific objectives guiding this study as per the findings. The recommendations were drawn from the findings. Moreover, suggested areas for further studies were provided.

6.2 Conclusion

Simulation models used in clinical learning experience opens up the critical thinking, promotes clinical judgement and helps in clinical problem-solving. However, simulation models are fairly employed at the clinical learning experience. OSCE as a competency-based tool widely used clinical learning experience, was not the preferred approach in this study. The sociodemographic factors (age, gender, year of study and institution) influenced the utilization of the simulation models used for clinical teaching. Practical performance prepared students and improved their knowledge, skills and attitude towards clinical medicine field.

Preparation for the student towards clinical learning experience positive, which was important and helped the clinical instructors to focus on the task at hand of sharpening practical skills of the students. The teaching methods used for the simulation experience helped the students to achieve their learning objective and enhance their competence and skills in clinical medicine practice. Teaching methods influenced the utilization of the simulation models used for clinical teaching. Mentorship supported student reasoning and ability to perform their roles and responsibilities at the clinical environment. Mentors gave prominence to the needs of the students under their care and helped them manage nervousness during actual clinical practice.

Competence of students towards clinical simulation enhanced communication skills, proper organization and time management that promoted clinical practice. Meeting students' objectives on clinical learning experience, students' perception will help motivate clinical learning experience that are beneficial.

6.3 Recommendation

Based on the study's findings, the study makes several recommendations. The study established that Medical Training colleges in Kakamega County was yet to be fully effective in the implementation of simulations as a teaching and learning tool. The study therefore recommends that:

i. The management to highly prioritize this during strategy formulations and budgetary allocation.
ii. The management should also redesign the curricula, train the lectures and clinical instructors and sensitize the clinical officers' students on the importance of the adoption of simulation methods.
iii. The study recommends that the Ministry of Health to develop and equip simulation laboratories across country.
iv. The ministry should formulate and develop monitoring tools that will ensure that there are proper simulation facilities in all the clinical institutions. They should also put measures to provide mentoring and continued support to the simulation programs integration.

6.4 Suggested areas for further studies

Based on the research findings, the study suggested a further study in the following areas:

a) An evaluation to determine the usage of virtual learning on clinical simulation teaching at medical training institutions.

b) Analyse and evaluate national occupation standards (NOS) to understand the occupation of a clinical trainee for purposes of developing learning guides for competency-based clinical education and training.

c) Analyse and evaluate clinical practice techniques for procedures for which there is no standard in a bid to develop guidelines for such practice.

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APPENDICES

Appendix I: Informed consent

TITLE: Simulation in Clinical Teaching in Medical Training Colleges, Kakamega County, Kenya

Introduction

I am Benjamin Koroboi Wamalwa, second-year student pursuing a Master of Science in Health Professional education at the Masinde Muliro University of Science and Technology. My research is focusing on the Simulation in Clinical Teaching in Medical Training Colleges, Kakamega County, Kenya.

Purpose of the study

The purpose of this study is strictly for academic purposes. This study is a requirement for the fulfillment of my Master of Science in Health Professional Education

Participant role: The study is voluntary, and is strictly for academic purposes. There will be no money allowance or any compensation for participating in this study.

Confidentiality: All information collected will be confidential.

Benefits: There are no direct benefits but for the future student will benefit as they will integrate the theory and practice, there for enacting an effective performance. Also this finding will help high authorities, policy makers, program developers, curriculum developers and other educational stakeholders to be informed about the innovative means of facilitating learning to students and stipulate them in the policy.

Risk: There is no risk which is expected for participating in this study, though if the participant displays any risk will be cared according to the risk or injury

Right withdraw: You have the right to refuse to participate or withdraw from the study at any time without any penalty.

Whom to contact: In case you have any question or you need explanation concerning this study, you can contact me, Benjamin Koroboi Wamalwa. My mobile phone number is 0726512708, my Supervisor Prof. Gladys Mengich through her email address: gmengich@mmust.ac.ke

NOTE:

You have to read and understand all explanations provided above, before deciding to participate in this study.

Signature……. Date……...

Appendix II: Questionnaire

The researcher wishes to bring to attention of the respondents that any response given in the course of this research will only be used as an input for the research work.

Confidentiality is assured to the respondents. The researcher is grateful to the respondents for the sacrifices to complete the questionnaires.

Instruction

i. Do not identify yourself by writing your name

ii. Please complete all items in the questionnaire by ticking the appropriate response

iii. Complete exercise by yourself, do not be influenced by your colleagues

Section A: Students' utilization and perception of Simulation

1. Gender

Male { } Female { }

2. Age <24 { } ≥24 { }

3. What is your year of study?

Year 1{ } Year 2 { } Year 3 { }

3. In which college/institution do you belong? KMTC-Kakamega { } St. Marys' Mumias { }

iv. Identify the extent of usage of simulation models for clinical teaching by lecturers at Medical Training Colleges in Kakamega County, Kenya.

Tick (✓) the appropriate response. (SD=strongly disagree, D=disagree, Neutral= N A=agree and SA=strongly agree.

Simulation models	SA 1	A 2	N 3	D 4	SD 5
Use of Mannequin					
Use of team based- patients scenarios					
Use of skills trainers					
Use of hybrid simulators					
Simulated Patients					

Others. Please specify on the space ……

ii. Determine the roles played by of clinical mentors in the usage of simulation models at Medical Training Colleges, Kakamega County, Kenya.

Roles of Clinical Mentors	**SD 1**	**D 2**	**N 3**	**A 3**	**SA 4**
Supports students who faces difficulties during clinical teaching					
Conduct lectures and training in the skills laboratory and health care facilities					

Testing the students' knowledge by performing actual clinical duties and medical procedures under their supervision.					
Monitor students' progress					
Creating comprehensive strategies to enhance interactive learning					
Assist all student CO to adjust to trainee group and ensure optimal work performance in assign ward					

Please give other roles apart from those listed below……

iii. To determine the perception level among clinical officers' students on the effectiveness of simulation models as a learning strategy at Medical Training Colleges, Kakamega county, Kenya.

ITEMS	SD 1	D 2	N 3	A 4	SA 5
Clinical teaching methods used are adequate and suitable for students learning					
The clinical teaching site is conducive and provides a positive learning environment					

The skills laboratory and clinical medicine faculty provide me with procedure Manual books for reference					
The logbooks are accurate and useful during the Clinical Teaching					
The objectives of teaching are well known to clinical Instructors					
The teaching and learning materials are available and adequate					
There is good coverage of the clinical instruction curriculum					
Clinical objectives are always met at each clinical placement					
The Mentor is friendly and approachable throughout the period of skills laboratory teaching					
The instructors are always available					
Varied teaching tips like preparation introduction, interaction and					

summarization are used by the mentor					
Clinical teaching methods used are adequate and suitable for students learning					
The clinical teaching site is conducive and provides a positive learning environment					
The skills laboratory and clinical medicine faculty provide me with procedure Manual books for reference					

Make possible comments which will improve the use skills laboratory training in the college……

Thank you so much

Appendix III: Key Interview Guide for Clinical Mentors/ Lecturers

Section 1: General information on the Clinical Mentor/ Lecturers

a) Which models of simulation do you use in Clinical Teaching during simulation and by what extent are they used?

……

b) How many students do you mentor at a time?

……

c) How do you reconcile differences in practice techniques for procedures for which there is no standard but reference?

…….

d) What are some of the challenges students face during clinical placement?

…….

e) Any other opinion you feel helps or will help improve teaching and learning in simulation training?

……..

Thank you for your time and responses

APPENDIX IV: Observational Checklist

Governance and administration	Availability of curriculum	***YES***	***NO***	***NOT SURE***
	Presence of examination policy			
	Availability of logbooks			
	Availability of procedure manuals			
Skills Lab	Adequacy of space			
	Adequacy of teaching equipment and Simulation models			
	Accessibility by learners			
Clinical placement	Availability of clinical			

	objectives Availability of mentors			

APPENDIX IV: Cronbach Alpha Test

Cronbach's Alpha

Case Processing Summary

		N	***%***
Cases	***Valid***	***34***	***97.14***
	Excluded [a]	***1***	***2.86***
	Total	***35***	***100***

a. *Expectation- Maximization (EM) algorithm on all variables in the procedure.*

Reliability Statistics

Cronbach's Alpha	N of Items
0.962	35

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
86.43	766.116	27.679	35

Cronbach's Alpha of 0.70 and above indicates a reliable tool

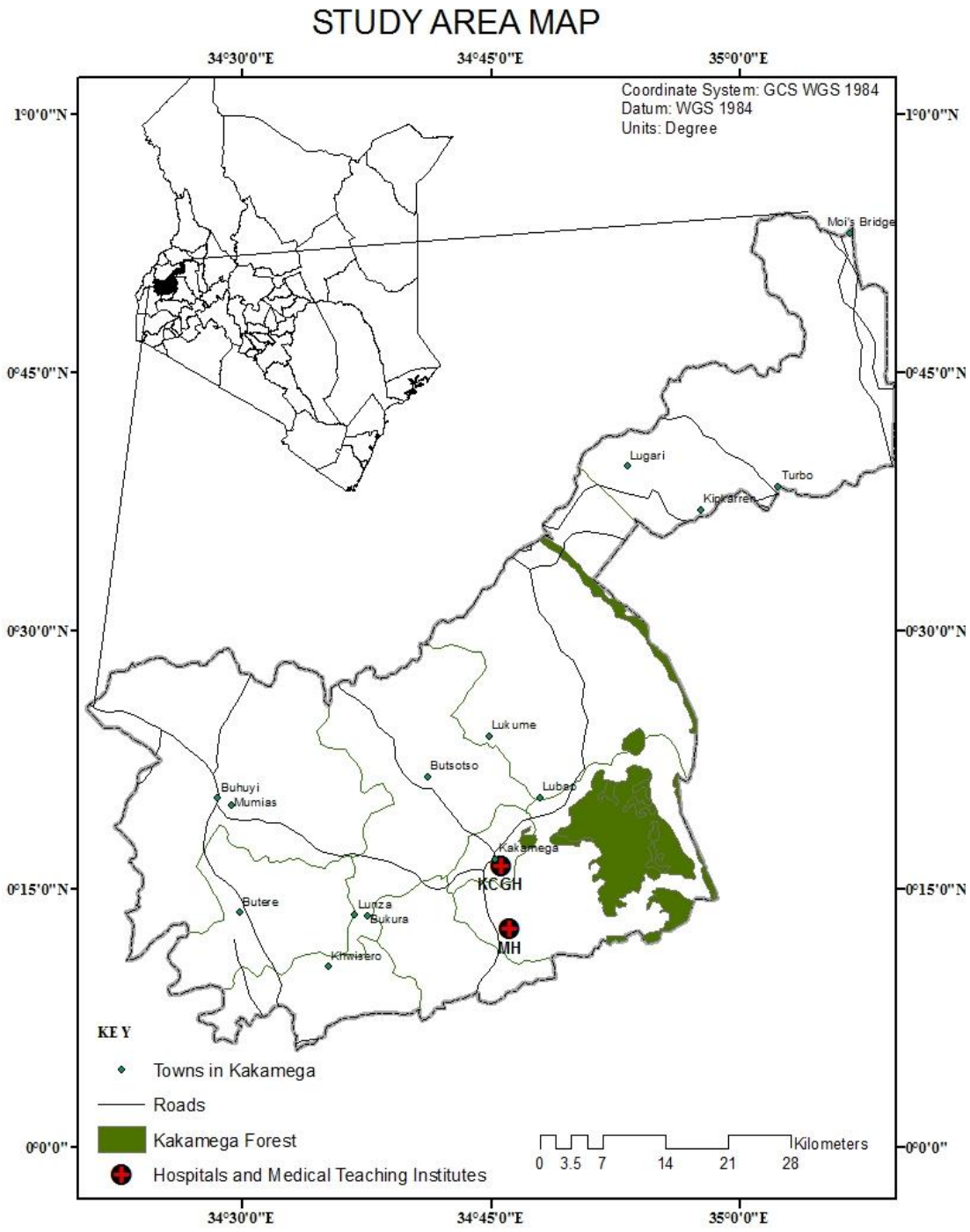
Appendix IV: Time Frame

ACTIVITY	September 2020-June2021	June - December 2021	October - January 2022	January-April 2022	May-December 2022	January 2023-February 2023	March 2023-DATE
Title identification							
Identification of objectives							
Concept Paper							
Proposal Writing							
Data collection tool development							
Departmental proposal presentation							
Correction of Proposal							
School Board Proposal Presentation							
Approvals from relevant authorities							
Data analysis							
Departmental Data presentation							
School Board data presentation Report							
Report writing and dissemination							

Appendix V: Budget Estimates

ITEM	UNIT COST in KSHS.	TOTAL in KSHS.
Transport & Accommodation	50,000	50,000
Stationary	Printing papers 10 reams @480 Stapler l pc @ 400 Staples 5 pkt @ 200 Pens l0pcs @ 20	4,800 400 1,000 200
Equipment& Materials	Disk drive	5,000
Airtime	5 Safaricom scratch cards@ 1,000	5,000
Printing		10,000
Internet services		20,000
Miscellaneous	10% of the total cost	9,640
TOTAL		**106,040**

Appendix VI: Study Map



Appendix VII: Approval of Proposal

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

Tel: 056-30870
Fax: 056-30153
E-mail: directordps@mmust.ac.ke
Website: www.mmust.ac.ke

P.O Box 190
Kakamega – 50100
Kenya

Directorate of Postgraduate Studies

Ref: MMU/COR: 509099

11th January 2022

Benjamin Koroboi Wamalwa,
HPE/G/01-54220/2019,
P.O. Box 190-50100,
KAKAMEGA.

Dear Mr. Wamalwa,

RE: APPROVAL OF PROPOSAL

I am pleased to inform you that the Directorate of Postgraduate Studies has considered and approved your Masters Proposal entitled: "***Efficacy Of Utilization of Simulation Models in Clinical Teaching at Medical Training Colleges, Kakamega County, Kenya.***" and appointed the following as supervisors:

1. Prof. Gladys Mengich (Ph.D.) - SPHBST, MMUST
2. Dr. Harun Chemjor (Ph.D.) - SPHBST, MMUST

You are required to submit through your supervisor(s) progress reports every three months to the Director Postgraduate Studies. Such reports should be copied to the following: Chairman, School of Public Health, Biomedical Sciences and Technology Graduate Studies Committee and Chairman, Health Professions Education Department. Kindly adhere to research ethics consideration in conducting research

It is the policy and regulations of the University that you observe a deadline of two years from the date of registration to complete your master's thesis. Do not hesitate to consult this office in case of any problem encountered in the course of your work.

We wish you the best in your research and hope the study will make original contribution to knowledge.

Yours Sincerely,

Prof. Stephen O. Odebero, PhD, FIEEP
DIRECTOR, DIRECTORATE OF POSTGRADUATE STUDIES

Appendix VI: Institutional Ethics and Review Committee (IREC) Approval

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

Tel: 056-31375
Fax: 056-30153
E-mail: ierc@mmust.ac.ke
Website: www.mmust.ac.ke

P. O. Box 190,
50100,
Kakamega,
KENYA

Institutional Ethics and Review Committee (IERC)

REF: MMU/COR: 403012 Vol 6 (01)

Date: February 22nd, 2022

To: Benjamin Koroboi Wamalwa

Dear Sir.,

RE: EFFICACY OF UTILIZATION OF SIMULATION MODELSIN CLINICAL TEACHING AT MEDICAL TRAINING COLLEGES IN KAKAMEGA COUNTY, KENYA

This is to inform you that ***Masinde Muliro University of Science and Technology Institutional Ethics and Review Committee (MMUST-IERC)*** has reviewed and approved your above research proposal. Your application approval number is **MMUST/IERC/016/2022.**The approval period is ***February 22nd, 2022-February 22nd, 2023.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MMUST-IERC.***
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 ***MMUST-IERC*** 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 ***MMUST-IERC*** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
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 ***MMUST-IERC.***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours Sincerely,

Prof. Gordon Nguka
Chairperson, Institutional Ethics and Review Committee

Copy to:
- The Secretary, National Bio-Ethics Committee
- Vice Chancellor
- DVC (PR&I)

Appendix VI: NACOSTI Approval

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **637208**

Date of Issue: **09/April/2022**

RESEARCH LICENSE

This is to Certify that Mr.. Benjamin Koroboi Wamalwa of Masinde Muliro University of Science and Technology, has been licensed to conduct research in Kakamega on the topic: Efficacy of Utilization of Simulation Models in Clinical Teaching at Medical Training Colleges, Kakamega County, Kenya for the period ending : 09/April/2023.

License No: **NACOSTI/P/22/16839**

637208

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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