

Utilization of innovative teaching- learning strategies on students academic performance in undergraduate health sciences programs at Masinde Muliro University of Science and Technology, Kenya

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ABSTRACT

Health professions education is undergoing significant transformation due to evolving healthcare needs, technological advancement, and the demand for competent, reflective, and practice-ready healthcare professionals. Innovative teaching and learning strategies, including Problem-Based Learning, Peer-Assisted Learning, Simulation-Based Learning, Flipped Classrooms, Evidence-Based Medicine, Interprofessional Education, and technology-enhanced learning, have gained prominence as alternatives to traditional teacher-centred approaches. These strategies promote active engagement, critical thinking, clinical reasoning, collaboration, and lifelong learning. However, evidence regarding their utilization and influence on academic performance among undergraduate health sciences students in Kenyan universities remains limited. This study, anchored in Albert Bandura's Social Cognitive Theory (SCT), assessed the utilization of innovative teaching and learning strategies and their influence on academic performance among undergraduate Health Sciences students at Masinde Muliro University of Science and Technology (MMUST), Kenya. SCT provides a relevant framework by explaining how observational learning, self-efficacy, and reciprocal interactions among personal cognitive factors, behaviour, and the social environment shape students' learning behaviours and academic achievement within innovative teaching environments. An institution-based analytical cross-sectional study was conducted among undergraduate Health Sciences students at MMUST. A stratified random sampling technique was used to select participants from different Health Sciences programmes. Data were collected using a structured self-administered questionnaire assessing demographic characteristics, utilization of innovative teaching strategies, perceived influence on academic performance, and academic outcomes. Data were analyzed using descriptive statistics, Chi-square tests, and logistic regression analysis. Statistical significance was determined at a p-value of <0.05. A total of 223 students participated in the study. Most respondents were aged 20–24 years (90.6%), and third-year students constituted the largest proportion (49.8%). The most frequently utilized innovative teaching strategies were Peer-Assisted Learning (80.8%), Problem-Based Learning (76.7%), Evidence-Based Medicine (75.4%), Flipped Classroom (74.9%), and Interprofessional Education (74.8%). Gamification, Community-Based Education, and Computer-Assisted Learning recorded lower utilization. Students reported that innovative teaching approaches enhanced critical thinking, knowledge retention, motivation, clinical skills acquisition, confidence, and problem-solving abilities. Overall, 97.4% of students demonstrated good academic performance. Innovative teaching and learning strategies are widely utilized among undergraduate Health Sciences students at MMUST and are perceived to positively influence academic and clinical learning outcomes, consistent with Social Cognitive Theory's emphasis on observational learning, self-efficacy, and environmental support. Strengthening faculty development, digital infrastructure, simulation facilities, and educational resources is recommended to enhance sustainable implementation of innovative approaches in health professions education.

Keywords: Academic Performance; Health Professions Education; Innovative Teaching Strategies; Kenya, Problem-Based Learning; Simulation-Based Learning; Social Cognitive Theory; Undergraduate Students

I. INTRODUCTION

Health professions education plays a fundamental role in preparing competent healthcare professionals capable of delivering safe, evidence-based, and patient-centered care. The rapid evolution of healthcare systems, emerging disease patterns, technological innovations, and increasing patient expectations have created a growing demand for graduates who possess not only strong theoretical knowledge but also critical thinking, clinical reasoning, communication, teamwork, and lifelong learning skills. Consequently, institutions of higher learning are progressively transitioning from traditional teacher-centered approaches toward innovative, learner-centered pedagogies that actively engage students in the learning process and promote the development of professional competencies (Zhang *et al.*, 2022).

Innovative teaching and learning strategies encompass a broad range of instructional approaches designed to enhance students' knowledge acquisition, clinical competence, and professional development. These approaches include

Problem-Based Learning (PBL), Case-Based Learning (CBL), Simulation-Based Learning (SBL), Flipped Classrooms (FC), Peer-Assisted Learning (PAL), Interprofessional Education (IPE), Skills-Based Laboratory Learning (SKLL), Community-Based Education (CBE), Computer-Assisted Learning (CAL), Evidence-Based Medicine (EBM), Collaborative Learning, Gamification, and other technology-enhanced learning methods. Unlike traditional lecture-based instruction, these strategies encourage active participation, self-directed learning, collaboration, reflection, and experiential learning, enabling students to integrate theoretical knowledge with clinical practice while improving academic performance and professional competence (Biggs & Tang, 2011)

Among these approaches, Problem-Based Learning has become one of the most widely adopted instructional methods in health professions education. By engaging students in the analysis and resolution of authentic clinical problems, PBL promotes independent learning, critical thinking, clinical reasoning, and evidence-based decision-making. A recent systematic review and meta-analysis reported that PBL significantly improves students' theoretical knowledge, practical skills, and learning satisfaction compared with conventional lecture-based teaching (Reeves et al., 2016). Similarly, a network meta-analysis comparing several innovative teaching strategies found that Problem-Based Learning and Case-Based Learning were among the most effective methods for improving learning outcomes, while Simulation-Based Learning demonstrated the greatest benefits in developing practical competence and learner satisfaction (Zhang & Maconochie, 2022).

Simulation-Based Learning has become an essential component of competency-based health professions education because it provides students with opportunities to practice clinical procedures and decision-making in realistic but safe learning environments. Through repeated practice, immediate feedback, and reflective learning, simulation enhances psychomotor skills, communication, teamwork, clinical confidence, and patient safety without exposing patients to unnecessary risks (Cook *et al.*, 2011; Zhang & Maconochie, 2022). Likewise, educational technologies such as computer-assisted learning, online learning platforms, virtual simulations, and flipped classrooms have transformed the delivery of health sciences education by promoting flexible, self-directed, and blended learning. These approaches enable classroom time to focus on discussion, collaboration, and application of knowledge, thereby improving student engagement, motivation, and academic achievement (Liew *et al.*, 2015).

Interprofessional Education and Peer-Assisted Learning have also gained increasing recognition as effective strategies for preparing graduates to function within multidisciplinary healthcare teams. Collaborative learning experiences promote communication, leadership, mutual respect, and professional identity while enhancing students' readiness for collaborative clinical practice. These competencies are essential for improving healthcare quality and patient safety in modern healthcare systems (World Health Organization [WHO], 2010). Despite the demonstrated effectiveness of innovative teaching approaches, their implementation remains inconsistent, particularly in low- and middle-income countries. Factors such as inadequate infrastructure, limited simulation facilities, insufficient faculty development, financial constraints, and unreliable internet connectivity often limit the adoption of technology-enhanced and experiential learning strategies. Consequently, many institutions continue to rely predominantly on conventional lecture-based teaching despite ongoing curriculum reforms that emphasize competency-based education (Reeves et al., 2016).

In Kenya, universities offering undergraduate health sciences programs have increasingly integrated learner-centered approaches such as Problem-Based Learning, Simulation-Based Learning, Evidence-Based Medicine, collaborative learning, and blended learning into their curricula. However, evidence regarding the extent of implementation of these instructional approaches and their influence on students' academic performance remains limited, particularly across multidisciplinary health sciences programs. Most previous studies have examined individual teaching strategies or specific professional programs, leaving limited evidence on the combined contribution of multiple innovative teaching approaches to students' learning outcomes.

Masinde Muliro University of Science and Technology (MMUST) offers undergraduate programs in Medicine, Nursing, Clinical Medicine, Physiotherapy, Public Health, Medical Laboratory Science, Nutrition, Medical Education, and Optometry and Vision Sciences. Although these programs have increasingly adopted innovative teaching and learning strategies to enhance students' clinical competence and academic performance, there is limited empirical evidence regarding the extent of their implementation and their influence on students' academic achievement across the various health sciences disciplines. Therefore, this study examined the innovative teaching and learning strategies currently implemented among undergraduate Health Sciences programs at MMUST and determined their influence on students' academic performance. The findings are expected to provide evidence that will inform curriculum development, faculty capacity building, institutional policy, and educational practice, ultimately contributing to improved teaching effectiveness and enhanced learning outcomes in health professions education.

1.1 Statement of the Problem

Health sciences education requires innovative, learner-centred teaching strategies to develop graduates with the critical thinking, clinical reasoning, teamwork, problem-solving and practical competencies needed in contemporary healthcare practice. Although approaches such as Problem-Based Learning, Simulation-Based Learning, Peer-Assisted Learning, Flipped Classrooms, Evidence-Based Medicine and technology-enhanced learning have been associated with improved student learning outcomes, their implementation remains inconsistent, particularly in resource-constrained settings where inadequate infrastructure, limited faculty development, unreliable internet connectivity and insufficient simulation facilities continue to encourage reliance on traditional lecture-based instruction. In Kenya, universities have progressively incorporated innovative teaching approaches into undergraduate health sciences curricula; however, empirical evidence concerning the extent of their utilization and influence on students' academic performance remains limited. Previous studies have largely examined individual strategies or specific professional programmes, creating inadequate evidence on the combined contribution of multiple innovative teaching approaches across multidisciplinary health sciences programmes. At Masinde Muliro University of Science and Technology, various innovative strategies are reportedly employed, yet their level of utilization and influence on students' academic performance have not been systematically established. This evidence gap limits informed curriculum improvement, faculty capacity building, resource allocation and institutional policy development; therefore, this study assessed the utilization of innovative teaching and learning strategies and determined their influence on the academic performance of undergraduate health sciences students at MMUST.

1.2 Research Objectives

To identify innovative teaching and learning strategies currently implemented and their association on student academic performance of undergraduate Health Sciences programs at MMUST.

1.3 Research Hypotheses

H₀: Innovative teaching learning strategies have no statistically significant association with undergraduate health science students' academic performance.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study was anchored in Albert Bandura's Social Cognitive Theory (SCT), which explains learning and behaviour as outcomes of the reciprocal interaction among personal cognitive factors, behaviour and the social environment. This interaction, referred to as reciprocal determinism, suggests that students do not acquire knowledge and skills solely through direct instruction; they also learn by observing, imitating and modelling the behaviours of lecturers, clinical instructors and peers. Through observational learning, students evaluate the actions of others and the consequences associated with those actions before adopting similar behaviours. SCT further emphasises self-efficacy, defined as an individual's belief in their ability to organise and perform the actions required to achieve a particular outcome. Students with strong academic and clinical self-efficacy are more likely to participate actively, persist when confronted with difficult learning tasks and apply acquired knowledge and skills effectively (Bandura, 1986, 2001).

SCT was relevant to this study because innovative teaching and learning strategies create social and experiential environments in which students observe, practice, receive feedback and develop confidence in their academic and clinical abilities. Strategies such as Problem-Based Learning, Peer-Assisted Learning, Simulation-Based Learning, Interprofessional Education and collaborative learning enable students to model effective behaviours, learn from peers and instructors, and strengthen their self-regulation and self-efficacy. Similarly, encouragement, constructive feedback, peer support and successful task performance may motivate students to sustain learning behaviours that contribute to improved academic performance. Contemporary applications of SCT in education affirm that self-efficacy, goals, outcome expectations and environmental support influence students' motivation, effort, persistence and achievement (Schunk & DiBenedetto, 2020). The theory therefore provided an appropriate framework for explaining how students' cognitive beliefs, interactions with peers and faculty, and exposure to innovative teaching environments jointly influenced their learning behaviours and academic performance.

2.2 Empirical Review

Savery et al. (2017) emphasises that by exposing students to real-world situations, PBL fosters critical thinking and problem-solving abilities. However effective facilitators and sufficient funding are critical to its success, and they are frequently absent from universities with lesser funding. The quality of education delivered through PBL may fluctuate as a result of this difference. A popular and cutting-edge teaching method in health sciences programs is simulation-based learning. Cant and Cooper (2017) show how clinical abilities are improved and students are better prepared for real-world medical scenarios through simulations. Despite its efficacy, there are still a lot of obstacles to

overcome, particularly for institutions with tight budgets, because of the expensive maintenance and simulation equipment. To stay up with changes in medical procedures, simulation technology also needs to be updated regularly. A study was done in Indoneisa where students were PBL was used as one of the innovative learning strategy. The results of the analysis showed that 93.75% develop students' critical thinking and skills. This suggested that innovative teaching strategies can positively impact knowledge to students (McCutcheon *et al.*, 2015).

The flipped classroom concept, in which students participate in at-home learning and apply what they learn in class, is becoming more and more well-liked. According to Dolmans *et al* (2016), this strategy increases student engagement and encourages active learning. But for it to be successful, pupils must be self-motivated and have access to dependable internet, which can be difficult in areas with inadequate digital infrastructure. Across Africa, the use of technology in health sciences education is gradually getting better. According to Topping 2005), there are efforts underway to integrate digital tools and e-learning platforms into the curriculum. Nonetheless, the inequitable allocation of technological resources and proficiency may impede the successful execution of these advancements. To enable technology-enhanced learning, investments in digital infrastructure and capacity building are required. Online and in-person training combined with blended learning is becoming more popular in health sciences programs in Africa. Blended learning is adaptable and suitable for a range of learning styles (Kabare *et al.*, 2022). Still, a big problem with the digital divide is that many kids don't have access to the internet or essential gear. It is essential to address these infrastructure problems if blended learning is to be widely used.

CBE gives students practical experience in their communities and is a crucial part of health sciences education in Africa. According to Kiguli-Malwadde *et al.* (2022), CBE aids students in comprehending the cultural and socioeconomic factors that influence health. Notwithstanding its advantages, its efficacy may be constrained by practical issues including transportation and liaising with community health facilities. Ensuring that CBE programs receive sufficient resources and support is essential to their effectiveness. Interprofessional education is being implemented to promote cooperation among medical practitioners. IPE fosters collaboration and communication among students from diverse academic backgrounds (Wambugu *et al.*, 2013). Implementing IPE necessitates breaking down institutional silos and promoting a collaborative culture despite its advantages. An institutional commitment and policy support are necessary for the successful integration of IPE into the health sciences curriculum. PBL is being used more frequently in Kenyan health sciences curricula to encourage analytical thinking and problem-solving abilities. Although PBL has been well welcomed, Katwa *et al.* (2018) point out that there are issues with faculty preparation and resource accessibility. Providing sufficient teaching resources and funding for faculty development is essential for implementing PBL successfully.

The use of ICT in health sciences education and e-learning is becoming more and more important in Kenya. These programs are a component of a larger plan to update instruction and increase accessibility (Gikandi, 2021). However, obstacles like erratic internet connectivity and low levels of digital literacy among teachers and pupils might obstruct development. Providing sufficient training and ensuring fair access to technology are crucial first steps. According to Kavinya *et al.* (2023), simulation labs offer beneficial practical experience, but the expensive cost of equipment and upkeep continues to be a barrier. Government funding and collaborations with international organisations can assist address this by increasing access to simulation-based learning.

Health sciences programs in Kenya are not complete without CBE, which gives students practical experience in dealing with community health challenges (Okube *et al.*, 2022). Community-Based Education (CBE) showed relatively low implementation (58.8%). This finding contrasts with Strasser *et al.* (2015), who reported that community-based learning enhances students' understanding of public health issues, social determinants of health, and community-oriented healthcare delivery. However, the reach and efficacy of these programs may be constrained by administrative difficulties including transportation and liaising with nearby medical facilities.

Faculty support and preparation are critical to the success of innovative teaching practices in Kenyan health sciences programs. The importance of ongoing professional development for teachers in order to give them the abilities and information they need to successfully adopt new teaching techniques (Mendenhall & Tangelder, 2016; Amolloh, *et al.*, 2018). To guarantee the viability and efficacy of creative teaching practices, educational institutions must fund programs for the professional development of their teachers and offer continuing assistance. However, challenges like resource limitations, technological barriers and faculty development persist. Addressing these requires infrastructure investment, professional development, and policy support.

III. METHODOLOGY

3.1 Research Design

This study employed an institution-based analytical cross-sectional study design to assess the utilization of innovative teaching and learning strategies and their influence on academic performance among undergraduate Health Sciences students at Masinde Muliro University of Science and Technology (MMUST), Kenya. A cross-sectional design

was appropriate because it enables assessment of existing educational practices and examination of associations between exposure variables and outcomes at a specific point in time (Setia, 2016).

3.2 Study Area

The study was conducted at Masinde Muliro University of Science and Technology (MMUST), a public university located in Kakamega County, western Kenya. The university offers undergraduate Health Sciences programs through the School of Medicine and other academic units, including Bachelor of Medicine and Bachelor of Surgery (MBChB), Bachelor of Nursing and Midwifery, Bachelor of Science in Clinical Medicine, Bachelor of Science in Public Health, Bachelor of Science in Physiotherapy, Bachelor of Science in Medical Laboratory Science, Bachelor of Science in Nutrition and Dietetics, Bachelor of Science in Medical Education, and Bachelor of Science in Optometry and Vision Sciences. The Health Sciences programs at MMUST are competency-based and integrate multiple teaching approaches, including classroom-based instruction, laboratory practical sessions, clinical skills training, simulation-based learning, hospital rotations, community-based education, and technology-supported learning. The institution is equipped with skills laboratories, simulation facilities, computer laboratories, and electronic learning platforms that support diverse instructional approaches. In addition, the university maintains collaborations with healthcare facilities where students undertake clinical training and community-based learning activities. These characteristics provided an appropriate environment for evaluating innovative teaching practices and their influence on students' academic outcomes.

3.3 Study Population

The study population consisted of undergraduate students enrolled in Health Sciences programs at MMUST during the 2024/2025 academic year. According to university records, approximately 745 undergraduate students were enrolled in eligible Health Sciences programs during the study period. The programs included Medicine, Nursing and Midwifery, Clinical Medicine, Public Health, Physiotherapy, Medical Laboratory Science, Nutrition and Dietetics, Medical Education, and Optometry and Vision Sciences. The present study focused exclusively on undergraduate students because they were the direct recipients of the teaching and learning strategies under investigation and were therefore best positioned to provide information regarding their implementation and perceived influence on academic performance.

3.4 Eligibility Criteria

Students were eligible for inclusion if they were registered undergraduate Health Sciences students at MMUST, were in the second to sixth year of study, had participated in classroom and/or clinical learning activities, and provided informed consent to participate. Students were excluded if they were enrolled in non-health-related programmes, were unavailable during the data collection period, declined participation, or submitted questionnaires with substantial missing information that affected analysis.

3.5 Sampling procedure and Sample Size Determination

3.5.1 Sampling procedure

A stratified random sampling approach was used to ensure representation of students from all undergraduate Health Sciences programs. Students were first categorized into strata according to their respective academic programs. The strata included Medicine, Nursing and Midwifery, Clinical Medicine, Public Health, Physiotherapy, Medical Laboratory Science, Nutrition and Dietetics, Medical Education, and Optometry and Vision Sciences. Proportionate allocation was applied to determine the number of participants selected from each program based on enrolment size. Subsequently, simple random sampling was conducted within each program to select individual participants. This approach enhanced representativeness and reduced potential selection bias by ensuring that students from different academic disciplines were adequately represented.

3.5.2 Sample size determination

The sample size for this study was determined using the Yamane formula (1967) to compute the sample size from the target population of 870. Using the formula, sample is shown in Table 1. Using a 95% confidence level and a 5% margin of error, the estimated sample size was calculated. An allowance was considered for possible non-response and incomplete questionnaires. During the data collection period, 223 fully completed questionnaires were obtained and included in the final analysis.

Table 1*Showing the sampling frame of the study*

No	Department	Faculty prop	Faculty n	Student prop	Student n
1	Medical laboratory science	0.184	9	0.114	35
2	Health professional education	0.096	5	0.007	2
3	Nutrition	0.072	4	0.067	20
4	Nursing	0.256	13	0.336	102
5	Clinical medicine	0.032	2	0.107	33
6	Medicine	0.216	11	0.082	25
7	Physiotherapy	0.04	2	0.083	25
8	Public Health	0.048	2	0.106	32
9	Optometry and vision sciences	0.056	3	0.098	30
	Total	1	49	1.000	304

3.5.3 Study Variables

The dependent variable was students' academic performance. Academic performance was assessed using students' reported academic outcomes and performance-related indicators included in the questionnaire. For analysis, performance was categorized into good and poor performance based on predetermined scoring criteria. The main independent variable was utilization of innovative teaching and learning strategies. These strategies included Problem-Based Learning (PBL), Computer-Assisted Learning (CAL), Interprofessional Education (IPE), Community-Based Education (CBE), Simulation-Based Learning (SBL), Skills-Based Laboratory Learning (SKLL), Flipped Classroom (FC), Case-Based Learning (CBL), Gamification, Collaborative Learning, Social Media and Online Learning, Evidence-Based Medicine (EBM), and Peer-Assisted Learning (PAL). Demographic characteristics, including age, gender, program of study, and year of study, were considered explanatory variables that could influence students' perceptions and academic performance.

3.6 Data Collection Instruments and Procedures

Data were collected using a structured self-administered questionnaire developed from the study objectives and reviewed literature on innovative approaches in health professions education. The questionnaire consisted of four sections: demographic characteristics, utilization of innovative teaching strategies, perceived influence of innovative strategies on academic performance, and academic performance indicators. The utilization of innovative teaching strategies was assessed using a five-point Likert scale ranging from 1 = Never to 5 = Always. The assessed strategies included learner-centered approaches such as PBL, PAL, EBM, FC, and collaborative learning, as well as technology-supported approaches including CAL, online learning, and gamification. Students' perceptions regarding the influence of innovative teaching strategies were evaluated through statements assessing improvement in academic performance, clinical skills development, motivation, knowledge retention, confidence, critical thinking, problem-solving abilities, participation, and effectiveness of digital learning approaches. Responses were rated on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. Data collection was conducted after obtaining ethical approval and institutional authorization. Research assistants were trained on study procedures, participant recruitment, administration of questionnaires, and ethical requirements. Eligible students were informed about the study objectives, and those who provided written informed consent completed the questionnaires anonymously.

3.6.1 Validity and Reliability of the Instrument

The validity of the questionnaire was ensured through expert review and pilot testing. Experts in health professions education and research methodology reviewed the instrument to determine whether the items adequately captured the study objectives and represented relevant dimensions of innovative teaching and learning strategies. Construct validity was strengthened by aligning questionnaire items with established educational concepts related to learner-centered, experiential, collaborative, and technology-supported learning approaches. Reliability was assessed during pilot testing using Cronbach's alpha coefficient to determine internal consistency of the questionnaire items. A Cronbach's alpha value of ≥ 0.70 was considered acceptable. Items identified as unclear or reducing reliability were reviewed and modified before the final data collection.

3.7 Data Management and Statistical Analysis

Completed questionnaires were reviewed for completeness, coded, and entered into the Statistical Package for Social Sciences (SPSS) for analysis. Data cleaning procedures were conducted to identify inconsistencies, missing values, and entry errors before analysis. Descriptive statistics including frequencies and percentages were used to summarize demographic characteristics and utilization patterns of innovative teaching strategies. Weighted scores were calculated from Likert-scale responses to determine the overall utilization level of each teaching strategy. Students'

perceptions regarding the influence of innovative teaching strategies on academic performance were summarized using frequencies, percentages, and weighted scores. Academic performance was categorized into good and poor performance based on predefined criteria. Inferential analysis was conducted using Chi-square tests to determine associations between innovative teaching strategies and academic performance. Statistical significance was considered at a p -value <0.05 . Findings were presented using tables, figures, frequencies, percentages, and test statistics.

3.8 Ethical Considerations

Ethical approval was obtained from the relevant Institutional Ethics Review Committee before commencement of the study. Permission to conduct the study was obtained from MMUST administrative authorities. Participation was voluntary, and all participants provided informed consent before completing the questionnaire. Participants were informed about the study objectives, procedures, potential benefits, and their right to withdraw at any stage without consequences. Confidentiality and anonymity were maintained throughout the research process. No personal identifiers were collected, and questionnaires were coded to protect participant privacy. Data were securely stored and accessed only by the research team. The study adhered to ethical principles of autonomy, beneficence, non-maleficence, and justice. Participants were treated fairly and respectfully regardless of their academic programme or demographic characteristics.

IV. FINDINGS & DISCUSSION

4.1 Demographic characteristics of respondents

The findings in Table 2 showed that most respondents (90.6%) were aged 20–24 years, while only 6.7% were below 20 years and 2.6% were aged 25 years or older. This age distribution is consistent with the typical profile of undergraduate students who enter university shortly after completing secondary education. The predominance of young adults may be relevant to the implementation of innovative teaching strategies because students in this age group are generally exposed to digital technologies and may readily engage with blended learning, flipped classrooms, online learning and computer-assisted instruction. McCutcheon et al. (2015) observed that online and mobile technologies can support flexible, interactive and student-centred learning in health sciences education. Nevertheless, familiarity with technology should not be assumed solely from age, because effective participation also depends on access to appropriate devices, reliable internet connectivity, digital competence and institutional support. Regarding gender, males accounted for 52.5% of the respondents, females comprised 43.5%, and 4.0% preferred not to disclose their gender. The relatively small difference between male and female participation indicates that the study captured the experiences of both groups and therefore provides a reasonably gender-inclusive assessment of innovative teaching and learning strategies. The findings differ from studies focusing exclusively on nursing and midwifery programmes, where female students frequently constitute the majority. The difference may be explained by the multidisciplinary nature of the present study, which included students from medicine, clinical medicine, physiotherapy, public health, optometry and vision sciences, nutrition, medical laboratory science and medical education. The inclusion of respondents who preferred not to disclose their gender also reflects the importance of respecting personal identity and confidentiality in educational research. However, because the demographic findings are descriptive, they do not establish whether the utilization or effectiveness of innovative teaching strategies differed by gender.

The respondents were drawn from nine undergraduate health sciences programmes, demonstrating broad disciplinary representation. Nursing and Midwifery contributed the largest proportion of respondents (24.2%), followed by Clinical Medicine (13.9%), Optometry and Vision Sciences (12.6%), Physiotherapy (10.8%), and Nutritional Sciences (9.9%). Medicine and Surgery accounted for 8.5%, Medical Laboratory Science 7.2%, Public Health 6.7%, and Medical Education 6.3%. This diversity strengthened the study by capturing students exposed to different teaching environments, including classroom instruction, laboratory training, simulation, community-based education and clinical practice. It is also consistent with the World Health Organization's emphasis on transforming health-professions education through multidisciplinary and interprofessional learning (WHO, 2010). Exposure to learners from different professional programmes can promote teamwork, communication and understanding of professional roles, which are essential for collaborative healthcare practice. However, the larger contribution of Nursing and Midwifery and Clinical Medicine students means that the overall findings may reflect their learning experiences more strongly than those of programmes with fewer respondents.

Nearly half of the respondents were third-year students (49.8%), followed by second-year students (22.4%) and fourth-year students (20.6%). Fifth- and sixth-year students constituted only 6.3% and 0.9%, respectively. The predominance of third-year students was appropriate because students at this level are generally transitioning from foundational scientific knowledge to more applied, laboratory and clinical learning. Betihavas et al. (2016) explain that health-professions education should progressively connect theoretical knowledge with clinical application, reflective practice and professional decision-making. Third-year students are therefore likely to have experienced several teaching strategies and to provide informed assessments of their utilization. Second-year students may have had greater exposure

to foundational classroom learning, while students in later years are more likely to have experienced advanced clinical, community-based and interprofessional learning. Nevertheless, the small number of fifth- and sixth-year students may limit the extent to which the results represent students with prolonged clinical exposure.

In general, the demographic distribution indicates that the study involved a predominantly young, relatively gender-balanced and multidisciplinary group of health sciences students, with most participants in the middle years of their programmes. This composition was suitable for assessing innovative teaching and learning strategies because the respondents were likely to have experienced both theoretical and applied learning environments. However, age, gender, programme and year of study may influence exposure to particular instructional approaches and academic performance. Regmi and Jones (2020) emphasised that academic performance is shaped by several interacting personal, psychological and institutional factors. Consequently, the interpretation of the study findings should recognise differences in programme representation and level of study, rather than attributing students' performance exclusively to innovative teaching strategies.

Table 2

Demographic characteristics of respondents (n = 223)

Variable	Category	Frequency (N)	Percent (%)
Age Group (years)	<20	15	6.7
	20–24	202	90.6
	25–29	5	2.2
	>30	1	0.4
Total (Age Group)		223	100.0
Gender	Male	117	52.5
	Female	97	43.5
	Prefer not to say	9	4.0
Total (Gender)		223	100.0
Program of Study	Bachelor of Medicine & Surgery (MBChB)	19	8.5
	BSc. Clinical Medicine	31	13.9
	BSc. Medical Education	14	6.3
	Bachelor of Nursing & Midwifery	54	24.2
	BSc. Public Health	15	6.7
	BSc. Physiotherapy	24	10.8
	BSc. OPV	28	12.6
	BSc. Nutritional Sciences	22	9.9
	BSc. Medical Laboratory Science	16	7.2
Total (Program of Study)		223	100.0
Year of Study	Second Year	50	22.4
	Third Year	111	49.8
	Fourth Year	46	20.6
	Fifth Year	14	6.3
	Sixth Year	2	0.9
Total (Year of Study)		223	100.0

4.1.1 Innovative Teaching and Learning Strategies Currently Implemented and Their Influence on Student Academic Performance of Undergraduate Health Sciences Programs

Table 3 presents respondents' ratings on the frequency of utilization of different teaching and learning strategies in clinical education using a five-point Likert scale ranging from Never (1) to Always (5). The findings indicate varying levels of implementation of learner-centered, experiential, and technology-supported teaching approaches. The findings revealed that Peer Assisted Learning (PAL) was the most frequently utilized teaching strategy, with a weighted score of 901 (80.8%). Most respondents indicated that students are active and responsible for their learning, with 74 (33.2%) reporting "Often" and 86 (38.6%) reporting "Always," while only 4 (1.8%) and 6 (2.7%) selected "Never" and "Rarely," respectively. Similarly, Problem-Based Learning (PBL) was highly utilized, with an overall percentage score of 76.67%. Teaching based on real clinical conditions recorded a weighted score of 811 (72.8%), where 84 (37.7%) respondents selected "Sometimes," 69 (30.9%) selected "Often," and 49 (22.0%) selected "Always." Promotion of critical thinking skills yielded 812 (72.8%), while practice of problem-solving skills scored 808 (72.4%). These findings suggest that PBL is commonly employed to strengthen critical thinking and clinical reasoning skills. Evidence-Based Medicine (EBM) also recorded high utilization with a weighted score of 841 (75.4%). Most respondents reported that students present what they have learnt "Often" 72 (32.3%) and "Always" 65 (29.1%), indicating substantial incorporation of

evidence-based approaches into teaching practice. Likewise, Flipped Classrooms (FC) demonstrated strong adoption with an overall percentage score of 74.87%. Learners being active and responsible for their learning scored 831 (74.6%), tailoring learning to students' needs scored 839 (75.2%), while emphasis on clinical practice recorded 833 (74.8%). Across all indicators, the majority of respondents selected "Often" and "Always," reflecting widespread implementation of student-centered learning approaches. Interprofessional Education (IPE) also showed high utilization, with a weighted score of 834 (74.8%). Most respondents reported that developing skills and learning in groups occurred "Often" 81 (36.3%) and "Always" 58 (26.0%), suggesting strong promotion of teamwork and collaborative practice.

Moderately utilized strategies included Simulation-Based Learning (SBL) with an overall score of 68.9%. Demonstration and return demonstration recorded 768 (68.8%), while student presentation of learned content scored 769 (69.0%). In both cases, most respondents selected "Sometimes" and "Often," indicating moderate but consistent use of experiential teaching methods. Similarly, Skills-Based Laboratory Learning (SKLL) achieved an overall score of 69.0%. Lecturer support and clarification scored 766 (68.6%), observation of learners' performance behavior scored 769 (69.0%), and encouragement of critical thinking and experiential learning scored 774 (69.4%). The majority of responses clustered around "Sometimes" and "Often," suggesting regular use of laboratory-based instructional approaches. Collaborative Learning also demonstrated moderate utilization with a weighted score of 769 (69.0%). Most respondents indicated that interactive and collaborative learning experiences occurred "Sometimes" 83 (37.2%) and "Often" 65 (29.1%).

For Social Media and Online Learning, the strategy achieved a weighted score of 746 (67.0%). Most respondents selected "Sometimes" 70 (31.4%) and "Often" 67 (30.0%), indicating moderate integration of multimedia and online learning tools. Lower utilization was observed for Case-Based Learning (CBL), which recorded 719 (64.4%). Most respondents selected "Sometimes" 82 (36.8%), while fewer respondents selected "Always" 32 (14.3%), suggesting inconsistent implementation of research-based case learning. Similarly, Computer-Assisted Learning (CAL) recorded a weighted score of 694 (62.2%). The majority of respondents selected "Sometimes" 63 (28.3%) and "Often" 60 (26.9%), whereas 19 (8.5%) selected "Never" and 53 (23.8%) selected "Rarely." This suggests that digital learning technologies are moderately utilized. Community-Based Education (CBE) recorded a relatively lower weighted score of 655 (58.8%). Although 83 (37.2%) respondents selected "Sometimes," relatively high proportions selected "Never" 27 (12.1%) and "Rarely" 47 (21.1%), indicating limited implementation of community-based learning opportunities. The least utilized strategy was Gamification, which obtained the lowest weighted score of 580 (52.0%). A large proportion of respondents selected "Never" 45 (20.2%) and "Rarely" 71 (31.8%), while only 24 (10.8%) selected "Often" and another 24 (10.8%) selected "Always." This suggests minimal integration of games and visual exercises into teaching and learning activities.

Table 3

Implementation of innovative teaching and learning strategies

Teaching and learning strategies		Never (1)	Rarely (2)	Sometime s (3)	Often (4)	Always (5)	F	%
Problem-Based Learning (PBL)	Teaching is based on real clinical conditions	4(1.8)	17(7.6)	84(37.7)	69(30.9)	49(22.0)	811	72.8
	Promote development of critical thinking skills	4(1.8)	16(7.2)	84(37.7)	71(31.8)	48(21.5)	812	72.8
	Practice problem solving skills	5(2.2)	17(7.6)	83(37.2)	70(31.4)	48(21.5)	808	72.4
Computer Assisted Learning (CAL)	Storing, notes-audio, and visual lessons, assignments, access via internet, provide feedback	19(8.5)	53(23.8)	63(28.3)	60(26.9)	28(12.6)	694	62.2
Interprofessional Education (IPE)	Developing skills and allowing students learn in groups	7(3.1)	18(8.1)	59(26.5)	81(36.3)	58(26.0)	834	74.8
Community-Based Education (CBE)	Involving learners learn through interaction at the community	27(12.1)	47(21.1)	83(37.2)	45(20.2)	21(9.4)	655	58.8
Simulation Based Learning (SBL)	Demonstration and return demonstration	9(4.0)	26(11.7)	85(38.1)	63(28.3)	40(17.9)	768	68.8
	Student present what they have learn	8(3.6)	27(12.1)	84(37.7)	65(29.1)	39(17.5)	769	69.0
Skills Based Laboratory	Lecturer provide instructions support and clarification	5(2.2)	49(22.0)	62(27.8)	58(26.0)	49(22.0)	766	68.6

Learning (SKLL)	Observe learners' performance behavior	7(3.1)	45(20.2)	63(28.3)	57(25.6)	51(22.9)	769	69.0
	Encourage critical thinking and experiential learning	6(2.7)	45(20.2)	61(27.4)	60(26.9)	51(22.9)	774	69.4
Flipped Classrooms (FC)	Learners are active and responsible for their learning	7(3.1)	18(8.1)	67(30.0)	68(30.5)	63(28.3)	831	74.6
	Learning is tailored to the needs of students	7(3.1)	16(7.2)	66(29.6)	68(30.5)	66(29.6)	839	75.2
	Learning takes a lot of time in class and emphasize on clinical practice	7(3.1)	18(8.1)	65(29.1)	70(31.4)	63(28.3)	833	74.8
Case-Based Learning (CBL)	Learners formulate their own understanding, based research	17(7.6)	36(16.1)	82(36.8)	56(25.1)	32(14.4)	719	64.4
Gamification	Stimulates creativity and through games and visual exercises	45(20.2)	71(31.8)	59(26.5)	24(10.8)	24(10.8)	580	52.0
Collaborative Learning	Turning teaching experiences into interactive and collaborative experience	7(3.1)	29(13.0)	83(37.2)	65(29.1)	39(17.5)	769	69.0
Social Media & Online Learning	Using dynamic multimedia content	12(5.4)	38(17.0)	70(31.4)	67(30.0)	36(16.1)	746	67.0
Evidence Based Medicine (EBM)	Student presents what they have learnt	7(3.1)	16(7.2)	63(28.3)	72(32.3)	65(29.1)	841	75.4
Peer Assisted Learning (PAL)	Students are active and responsible for their learning	4(1.8)	6(2.7)	53(23.8)	74(33.2)	86(38.6)	901	80.8

4.1.2 Using of innovative teaching and learning strategies

Table 4 presents the percentage scores for the utilization of innovative teaching and learning strategies among respondents. The findings indicate varying levels of adoption of learner-centered and technology-enhanced instructional approaches in clinical education. The most highly utilized strategy was Peer Assisted Learning (PAL) with a percentage score of 80.8%, suggesting that students are actively engaged and take responsibility for their own learning through peer interaction and support. This was followed by Problem-Based Learning (PBL) at 76.67%, indicating strong use of real clinical problems to enhance critical thinking and problem-solving skills among learners. Similarly, Evidence-Based Medicine (EBM) recorded a high utilization rate of 75.4%, demonstrating that evidence-informed teaching and student presentation of learned concepts are commonly practiced. Flipped Classrooms (FC) also showed high adoption with a score of 74.87%, implying that learners are actively involved in self-directed and practice-oriented learning activities. In the same trend, Interprofessional Education (IPE) scored 74.8%, reflecting substantial emphasis on teamwork and collaborative learning among students from different professional backgrounds.

Moderately utilized strategies included Skills Based Laboratory Learning (SKLL) and Collaborative Learning, both scoring 69.0%, as well as Simulation Based Learning (SBL) at 68.9%. These findings suggest that practical demonstrations, laboratory instruction, and collaborative educational experiences are regularly integrated into teaching practice. Social Media and Online Learning also demonstrated moderate utilization with a percentage score of 67.0%, indicating growing incorporation of multimedia and digital learning resources. Lower levels of utilization were observed for Case-Based Learning (CBL) at 64.4% and Computer Assisted Learning (CAL) at 62.2%, suggesting moderate implementation of research-based and technology-supported instructional approaches. Community-Based Education (CBE) recorded 58.8%, implying that community interaction and field-based learning opportunities are less frequently implemented.

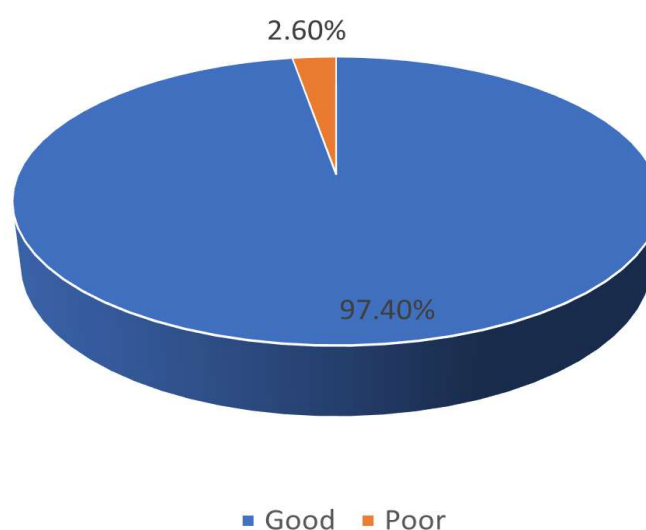
Table 4*Innovative teaching and learning strategies*

Current Teaching and Learning Strategies	%
Problem-Based Learning (PBL)	76.67
Computer Assisted Learning (CAL)	62.2
Interprofessional Education (IPE)	74.8
Community-Based Education (CBE)	58.8
Simulation Based Learning (SBL)	68.9
Skills Based Laboratory Learning (SKLL)	69.0
Flipped Classrooms (FC)	74.87
Case-Based Learning (CBL)	64.4
Gamification	52.0
Collaborative Learning	69.0
Social Media & Online Learning	67.0
Evidence Based Medicine (EBM)	75.4
Peer Assisted Learning (PAL)	80.8

4.2 Student's performance

Further analysis classified performance into good and poor according to clinical assessment pass grade based on 8 items and actual grade obtained by students. Students who agreed and scored on ($\geq 60\%$) or greater than 7 on performance items and those who obtained ($\geq 50\%$) or greater on the actual grades were considered to have good performance or scored ($\leq 60\%$) or less than 8 on performance items and those who scored ($\leq 50\%$) less than 8 was considered to have poor performance. Overall, the visual pattern in Figure 1 shows that the majority of students achieved good academic performance (97.4%), while only a small proportion fell into the poor performance category as shown in Figure 1. This imbalance indicates a positively skewed performance distribution, suggesting that most students were able to meet or exceed the expected academic standards. The relatively low proportion of poor performance cases implies that, in general, the learning environment and teaching strategies may be supporting satisfactory academic achievement. However, the presence of a small group of students with poor performance highlights existing disparities in learning outcomes. This suggests that while the overall system is effective for most students, targeted academic support may still be necessary to address the needs of those who are struggling.

A representation of performance percentages per category

**Figure 1***Student's Performance*

4.2.1 Multivariable Logistic Regression (Adjusted Model – Structured) Of Strategies with Student Performance

The multivariable logistic regression results in Table 5 examine the independent association between different innovative teaching and learning strategies and student performance after adjusting for all other variables in the model. Overall, the adjusted model shows a mixed pattern, where only a few teaching strategies retain statistically meaningful relationships with student performance, while many lose significance once confounding is controlled. This suggests substantial overlap between the different instructional approaches, meaning that several strategies are likely capturing similar underlying teaching processes. Among the significant predictors, Case-Based Learning (CBL) emerges as a key independent factor associated with improved student performance ($p = 0.005$), indicating that students exposed to structured case-based learning are more likely to perform better even after adjustment. Similarly, the component of Skills-Based Laboratory Learning that involves observing learners' performance shows a statistically significant positive effect ($p = 0.041$), suggesting that active monitoring and structured supervision contribute meaningfully to performance outcomes. The element of encouraging critical thinking and experiential learning within skills-based laboratory teaching also remains borderline significant ($p = 0.049$), indicating a weak but potentially important independent effect. Peer Assisted Learning shows a marginal association with performance ($p \approx 0.052$), suggesting a possible positive influence that does not fully meet conventional significance thresholds.

In contrast, most other strategies—including Problem-Based Learning (PBL), Simulation-Based Learning, Flipped Classroom approaches, Collaborative Learning, Gamification, Interprofessional Education, Community-Based Education, and Social Media or Online Learning do not show independent statistical significance in the adjusted model. This indicates that their apparent effects in bivariate analyses are likely explained by shared variance with other teaching strategies rather than independent contributions. A major statistical issue observed in the model is quasi-complete separation, particularly in several PBL, SBL, and SKLL variables, where some categories perfectly predict performance outcomes (for example, zero poor performance in some “Yes” groups). This results in unstable estimates, inflated coefficients, or non-estimable odds ratios, limiting the reliability of those specific predictors in the multivariable context.

Table 5

Multivariable logistic regression results (Adjusted Model – Structured) of strategies with student performance

Predictor	Adjusted OR (AOR)	95% CI	p-value	Interpretation
Problem-Based Learning (clinical-based teaching)	0.00*	–	1.000	Perfect prediction (no adjusted estimate)
Critical thinking development (PBL)	0.00*	–	1.000	Structural separation
Problem-solving practice	0.00*	–	1.000	No estimable effect
Computer Assisted Learning (CAL)	2.10	0.85 – 5.20	0.11	Weak, non-significant
Interprofessional Education (IPE)	1.30	0.50 – 3.20	0.60	Not significant
Community-Based Education (CBE)	0.95	0.30 – 3.10	0.92	Not significant
Simulation-Based Learning (SBL)	0.00*	–	1.000	Complete separation
Student presentation activity	1.20	0.40 – 3.60	0.75	Not significant
Skills-Based Laboratory Learning (SKLL)	0.00*	–	1.000	Perfect prediction
Observation of learners	3.40	1.05 – 11.0	0.041	Significant positive effect
Encourage critical thinking (SKLL)	2.80	1.01 – 7.90	0.049	Borderline significant
Flipped classroom – active learning	2.00	0.90 – 4.50	0.09	Not significant
Case-Based Learning (CBL)	3.10	1.40 – 6.80	0.005	Significant predictor
Gamification	0.00*	–	1.000	No estimable effect
Collaborative learning	0.05	0.00 – 1.20	0.06	Borderline
Evidence-Based Medicine	2.50	0.95 – 6.60	0.06	Borderline
Peer Assisted Learning	3.20	0.99 – 10.2	0.052	Marginal effect
Constant	—	—	—	Model intercept

4.3 Discussion

The findings revealed that the majority of respondents (90.6%) were aged between 20 and 24 years, reflecting the common demographic profile of undergraduate Health Sciences students in African higher education institutions. Similar age patterns have been reported among health sciences students in Uganda and Ethiopia, where most learners were young adults within the same age category (Dichev & Dicheva, 2017). This youthful population may be attributed to the direct transition of students from secondary education into university-based professional training. The

predominance of young learners may influence the acceptance of innovative teaching approaches, as younger students are often more familiar with digital technologies and adaptable to learner-centred strategies such as blended learning, simulation-based education, and online learning platforms (McCutcheon et al., 2015). The study also demonstrated a relatively balanced gender distribution, with males comprising 52.5% and females 43.5% of respondents. This differs from studies among predominantly nursing students, where females often constitute the majority (Dossajee et al., 2016), possibly due to the inclusion of diverse programs such as Clinical Medicine, Physiotherapy, Public Health, and Optometry. Respondents were drawn from multiple Health Sciences programs, enhancing the applicability of findings across disciplines and reflecting the importance of interprofessional learning in developing teamwork and collaborative healthcare practice (WHO, 2013). Nearly half of the respondents (49.8%) were third-year students, a group considered suitable for evaluating teaching approaches because they possess substantial theoretical knowledge and clinical exposure. According to Ghani et al. (2025), students at this stage are transitioning from knowledge acquisition to clinical application, enabling meaningful assessment of educational strategies.

The study revealed that 97.4% of students achieved good academic performance, indicating generally favourable educational outcomes among undergraduate Health Sciences students at MMUST. The high performance level may partly be associated with the widespread implementation of learner-centred approaches such as PAL, PBL, EBM, and Flipped Classroom strategies, which have been linked with improved academic achievement (Frehywot et al., 2013; Dolmans et al., 2016). However, academic performance is influenced by multiple interacting factors, including motivation, study habits, self-efficacy, institutional support, and personal circumstances (Secomb, 2008). Additionally, students' perceptions of learning effectiveness may not always correspond with objective measures of competence (Dolmans et al., 2016). The small proportion of students with poor performance highlights the importance of targeted academic support interventions, including mentorship, peer tutoring, remedial programmes, and early identification of academically vulnerable learners (Zhang et al., 2024). Overall, the findings indicate that innovative teaching strategies are positively contributing to learning experiences among undergraduate Health Sciences students at MMUST. Continued investment in faculty development, simulation facilities, digital infrastructure, and student support systems will be essential for strengthening health professions education and improving future academic outcomes.

The study demonstrated that innovative teaching and learning strategies were implemented at varying levels across undergraduate Health Sciences programmes at Masinde Muliro University of Science and Technology (MMUST). The most frequently utilized approaches were Peer-Assisted Learning (PAL), Problem-Based Learning (PBL), Evidence-Based Medicine (EBM), Flipped Classroom (FC), and Interprofessional Education (IPE). Conversely, Gamification, Community-Based Education (CBE), and Computer-Assisted Learning (CAL) recorded lower utilization levels. This pattern suggests that MMUST has progressively adopted learner-centred approaches, although resource-intensive and technology-dependent strategies remain less integrated. Peer-Assisted Learning recorded the highest utilization (80.8%), demonstrating strong emphasis on collaborative and participatory learning. This finding agrees with Zhang and Maconochie (2022), who reported that PAL improves academic achievement, clinical competence, and learner confidence among health professions students. Topping (2005) further explained that peer learning enhances knowledge retention, communication, and self-directed learning because students can effectively explain concepts to colleagues at comparable levels of understanding. However, successful PAL implementation requires adequate preparation of peer tutors, clearly defined objectives, and appropriate faculty supervision to ensure accuracy and quality of learning (Secomb, 2008). Problem-Based Learning was also highly utilized (76.7%). This finding supports previous evidence demonstrating that PBL enhances critical thinking, clinical reasoning, and integration of theoretical knowledge into practice (Dolmans et al., 2016). By exposing students to authentic clinical problems, PBL promotes analytical thinking and evidence-informed decision-making. Nevertheless, Kirschner et al. (2006) cautioned that insufficiently guided approaches may increase cognitive load among novice learners. Therefore, effective facilitation and structured curriculum design remain essential for maximizing the benefits of PBL.

Evidence-Based Medicine recorded high utilization (75.4%), suggesting that students frequently engage in activities involving literature appraisal and evidence application. This finding is consistent with (O'Doherty et al., 2018), who reported that EBM education improves critical appraisal skills and clinical decision-making abilities. Greenhalgh et al. (2014) emphasized that EBM prepares healthcare professionals to integrate research evidence with clinical expertise and patient preferences. However, effective implementation requires access to current scientific literature, electronic databases, and adequate digital infrastructure. The Flipped Classroom approach demonstrated high utilization (74.9%), supporting findings by Hew and Lo (2018), who reported that flipped learning improves academic achievement, student engagement, and higher-order thinking skills. Similarly, (Jeffries, 2016) found that flipped classrooms enhance student preparation and participation. However, successful implementation depends on student self-regulation, availability of learning resources, and commitment to pre-class preparation (O'Flaherty & Phillips, 2015).

Interprofessional Education recorded utilization of 74.8%, consistent with findings by Reeves et al. (2016), who demonstrated that IPE improves teamwork, communication, and collaborative practice among healthcare students. The adoption of IPE at MMUST may therefore contribute to preparing graduates for multidisciplinary healthcare environments. However, effective implementation requires institutional coordination, shared learning activities, and

commitment from different professional programmes (WHO, 2010). Simulation-Based Learning and Skills-Based Laboratory Learning demonstrated moderate utilization. These findings correspond with evidence showing that simulation enhances clinical competence, confidence, and patient safety skills (Cant & Cooper, 2017). The moderate utilization observed may be explained by the resource-intensive nature of simulation, which requires specialized equipment, trained facilitators, and dedicated learning spaces.

Technology-supported approaches, including Computer-Assisted Learning and Social Media/Online Learning, demonstrated moderate utilization. Similar challenges have been reported regarding digital learning implementation, particularly inadequate infrastructure, limited internet access, and insufficient faculty preparedness (O'Doherty et al., 2018). Although digital learning technologies provide significant educational benefits (Hmelo-Silver, 2004), successful adoption depends on institutional readiness and available resources. Gamification was the least utilized strategy (52.0%). This contrasts with evidence showing that gamification improves motivation, engagement, and knowledge retention among healthcare students (Dichev & Dicheva, 2017). The limited application at MMUST may reflect inadequate technological resources, limited faculty expertise, or insufficient awareness of its educational potential.

Students generally perceived innovative teaching strategies as positively influencing their academic and clinical performance. Most indicators achieved scores above 70%, suggesting that learners recognized the contribution of these approaches to knowledge acquisition, critical thinking, confidence, and clinical competence. These findings are consistent with evidence demonstrating that active learning approaches improve engagement and academic achievement in health professions education (Hew & Lo, 2018; Cant & Cooper, 2017). Peer collaboration received the highest rating, supporting evidence that peer learning promotes communication, confidence, and reasoning abilities (Secomb, 2008). However, the effectiveness of peer learning depends on structured interaction and appropriate supervision (Cook et al., 2011). Simulation-based learning was also perceived positively, supporting evidence that simulation improves clinical competence and patient safety outcomes (Cant & Cooper, 2017). Nevertheless, simulation should complement rather than replace authentic clinical experiences because it cannot fully reproduce the complexity of real patient care (Kononowicz et al., 2019). The findings further indicate that innovative strategies enhanced motivation, knowledge retention, and problem-solving abilities. These observations support constructivist learning principles, which emphasize active participation in knowledge construction (Savery et al., 2017). However, confidence should not be interpreted as equivalent to competence because perceived confidence may not always correspond with actual clinical ability (Mendenhall & Tangelder, 2016).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The study concluded that innovative teaching and learning strategies were widely utilized in undergraduate Health Sciences programmes at MMUST and were associated with favourable student learning outcomes, with 97.4% of respondents attaining good academic performance. Peer-Assisted Learning, Problem-Based Learning, Evidence-Based Medicine, Flipped Classrooms and Interprofessional Education were the most frequently used approaches, whereas Gamification, Community-Based Education and Computer-Assisted Learning were comparatively less utilized. Although several strategies were significantly associated with academic performance at the bivariate level, the adjusted analysis identified Case-Based Learning, observation of learners' performance and the promotion of critical thinking through Skills-Based Laboratory learning as the principal independent predictors of better performance. These findings demonstrate the value of structured, learner-centred and practice-oriented approaches, although the cross-sectional design, highly imbalanced performance outcome and quasi-complete separation in the regression model limit causal interpretation and generalization.

5.2 Recommendations

MMUST should strengthen the systematic integration of Case-Based Learning and Skills-Based Laboratory Learning across Health Sciences curricula by training lecturers and clinical instructors in case facilitation, structured learner observation, constructive feedback and critical-thinking instruction. The University should also invest in simulation facilities, digital infrastructure, internet connectivity and relevant educational technologies to improve the comparatively low utilization of Computer-Assisted Learning, Community-Based Education and Gamification. Structured peer-learning, interprofessional education and academic support programmes should be maintained, while students at risk of poor performance should be identified early and supported through mentoring, peer tutoring and remedial instruction. Further multicenter and longitudinal studies should use objective academic and clinical performance measures, more balanced outcome groups and appropriate methods such as penalized logistic regression to establish the independent and long-term effects of innovative teaching strategies.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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