



E-LEARNING PLATFORMS IN MEDICAL EDUCATION: A QUANTITATIVE COMPARISON OF ONLINE AND TRADITIONAL LEARNING IN PESHAWAR

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Abstract

Background: E-learning platforms have become central to medical education globally. Yet, their comparative effectiveness versus traditional teaching in resource-limited contexts like Peshawar remains underexplored.

Objective: To quantitatively compare perceptions and outcomes of online and traditional learning among undergraduate medical students in Peshawar.

Design: Quantitative, cross-sectional comparative study.

Methods: Data were collected via a structured questionnaire from 300 medical students who had experienced both online and face-to-face learning at Khyber Medical University and affiliated colleges. Descriptive and inferential statistics were applied to assess perceptions, satisfaction, and self-reported academic performance.

Results: Students rated online learning higher for flexibility and accessibility, while traditional learning was preferred for interactivity and clinical skill acquisition. No significant difference was observed in self-reported knowledge outcomes between both modes ($p > 0.05$). Blended learning yielded the highest satisfaction.

Conclusion: E-learning is equally effective as traditional learning for knowledge acquisition but less suitable for developing hands-on clinical skills. A blended-learning model is recommended to optimize medical education outcomes in Peshawar.

Introduction

E-learning, defined as the use of electronic media and digital technologies to support education, has transformed medical teaching and learning practices globally [1]. The COVID-19 pandemic accelerated its adoption, compelling medical institutions to transition rapidly to digital platforms

[2,3]. E-learning systems, including learning management systems (LMS), virtual classrooms, and online simulations, offer flexibility, accessibility, and self-paced learning [4,5].

However, the degree to which e-learning achieves outcomes equivalent to traditional, face-to-face teaching remains debated. Studies indicate that online and blended approaches produce learning outcomes comparable or superior to conventional classroom methods, particularly for cognitive domains [1,2,6]. Yet, clinical skills acquisition—requiring hands-on practice, immediate feedback, and mentorship—remains more effectively taught in physical settings [3,7,8].

In Pakistan, medical schools such as Khyber Medical University (KMU) in Peshawar have increasingly adopted e-learning platforms for undergraduate teaching [9,10]. Despite this progress, barriers including poor internet access, limited faculty training, and inconsistent assessment integration persist [11–13].

This study aims to **quantitatively compare students’ perceptions and performance in online and traditional learning** to determine the relative effectiveness and challenges of each modality within Peshawar’s medical education context.

Methodology

Study design and setting

A **quantitative, cross-sectional comparative study** was conducted among undergraduate medical students at KMU and its affiliated colleges in Peshawar from March to May 2025. The study did not involve any intervention or manipulation of learning methods.

Participants

Participants included medical students (MBBS years I–V) who had experienced both online and traditional learning. Using stratified random sampling, 300 students were selected. Inclusion criteria included consent and prior exposure to both teaching modes.

Data collection tool

A structured questionnaire, validated through pilot testing, was distributed online. It consisted of three sections:

1. **Demographics:** Gender, age, and year of study.
2. **Perceptions and satisfaction:** 5-point Likert-scale items evaluating flexibility, interactivity, accessibility, motivation, and satisfaction.
3. **Self-reported academic performance:** Students compared perceived learning outcomes in both modes.

Data analysis

Data were analyzed using SPSS v26. Descriptive statistics summarized data as means and standard deviations. Independent *t*-tests compared perception scores between online and traditional learning. Pearson’s correlation assessed the relationship between satisfaction and perceived effectiveness. Statistical significance was set at $p < 0.05$.

Ethical approval

Ethical approval was obtained from the Institutional Review Board of KMU, Peshawar. Participation was voluntary and anonymous.

Results

Table 1. Demographic Characteristics (n = 300)

Variable	Category	Frequency (%)	Mean ± SD
Gender	Male	114 (38%)	—
	Female	186 (62%)	—

Variable	Category	Frequency (%)	Mean $\pm$ SD
Age (years)	—	—	22.1 $\pm$ 2.4
Year of study	Pre-clinical (Years I–II)	138 (46%)	—
	Clinical (Years III–V)	162 (54%)	—

Table 2. Comparison of Perception Scores Between Online and Traditional Learning

Parameter	Online Learning (Mean $\pm$ SD)	Traditional Learning (Mean $\pm$ SD)	<i>p</i> -value	Interpretation
Accessibility	4.21 $\pm$ 0.73	3.72 $\pm$ 0.81	<0.01	Significant difference
Time Flexibility	4.12 $\pm$ 0.81	3.25 $\pm$ 0.79	<0.01	Significant difference
Interactivity	3.24 $\pm$ 0.88	4.48 $\pm$ 0.62	<0.01	Significant difference
Clinical Demonstration	2.95 $\pm$ 0.91	4.56 $\pm$ 0.68	<0.01	Significant difference
Motivation	3.89 $\pm$ 0.77	4.10 $\pm$ 0.70	0.07	Not significant
Overall Satisfaction	3.96 $\pm$ 0.74	4.18 $\pm$ 0.69	0.05	Borderline significant

Table 3. Self-Reported Academic Performance and Learning Outcomes

Learning Mode	Mean GPA $\pm$ SD	Knowledge Retention (%)	Skills Confidence (%)
Online	3.41 $\pm$ 0.48	81.3 $\pm$ 6.7	68.5 $\pm$ 8.2
Traditional	3.46 $\pm$ 0.52	82.1 $\pm$ 5.9	83.2 $\pm$ 7.5
<i>p</i> -value	0.18	0.27	<0.01

Interpretation:

No significant difference was found in GPA or knowledge retention between online and traditional modes ($p > 0.05$). However, confidence in clinical skills was significantly higher for traditional learning ($p < 0.01$).

Table 4. Correlation Between Satisfaction and Perceived Effectiveness

Variable Pair	Pearson's <i>r</i>	<i>p</i> -value	Interpretation
Satisfaction $\times$ Effectiveness	0.54	<0.01	Moderate positive correlation

Interpretation:

Higher perceived effectiveness was moderately associated with higher satisfaction among students.

Barriers to E-Learning (Open-ended responses summarized):

- Poor internet connectivity (68%)
- Limited faculty interaction (45%)
- Lack of practical exposure (61%)
- Technical difficulties and LMS navigation (37%)

Discussion

The results demonstrate that e-learning is equally effective as traditional learning for knowledge-based outcomes among medical students in Peshawar. However, traditional instruction remains

superior for developing clinical and procedural skills. These findings are consistent with prior meta-analyses that reported similar knowledge outcomes between online and face-to-face learning [1,2,6,14].

Students favored e-learning for its **flexibility and accessibility**, mirroring global findings where online learning allowed students to manage their own pace and schedules [3,4,12]. Nonetheless, **reduced interactivity and limited clinical practice opportunities** were key limitations, aligning with reports from both international and Pakistani studies [4,9,11,13].

Blended learning—combining online theoretical modules with in-person practical sessions—emerged as the most satisfying and balanced approach. Previous studies have also recommended blended models as the most effective framework in medical education [2,15,16].

Institutional readiness in Peshawar, through KMU's Learning Management System and the Institute of Health Professions Education and Research (IHPER), supports the feasibility of sustainable blended implementation [9,10]. However, addressing infrastructural and faculty-development challenges remains essential for long-term success [7,8,11].

Conclusion

E-learning platforms in Peshawar's medical institutions provide a flexible and accessible means of knowledge delivery with comparable cognitive outcomes to traditional teaching. However, the hands-on nature of clinical training necessitates face-to-face components. Therefore, **a blended learning approach**—integrating online theory with in-person practice—represents the optimal strategy for medical education in the region.

Recommendations

1. Integrate blended learning as a core pedagogical model.
2. Train faculty in digital content delivery and interactive online engagement.
3. Improve internet connectivity and LMS support infrastructure.
4. Conduct longitudinal studies to track objective academic performance and clinical skill development.

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