

Research Article**The Impact of Hybrid Learning on Psychological Wellness, Academic Performance, and Health Behaviors Among Medical Students**

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Abstract

Hybrid learning, combining traditional face-to-face teaching with digital education platforms, has become a widely adopted instructional model in medical education. While it offers flexibility and improved access to learning resources, its impact on psychological wellness, academic performance, and health behaviors remains incompletely understood. This study aimed to evaluate the influence of hybrid learning on mental health outcomes, academic achievement, and lifestyle behaviors among medical students.

A cross-sectional analytical study was conducted among 540 undergraduate medical students across all academic years. Data were collected using validated instruments including the Depression Anxiety Stress Scale (DASS-21), Pittsburgh Sleep Quality Index (PSQI), and a structured questionnaire assessing academic performance, screen exposure, physical activity, dietary patterns, and engagement with hybrid learning modalities.

Moderate to severe stress, anxiety, and depressive symptoms were observed in 40.8%, 44.6%, and 36.9% of students, respectively. Poor sleep quality was reported

in 55.3% of participants. Students predominantly engaged in hybrid learning with excessive digital exposure (>6 hours/day) exhibited significantly higher psychological distress ($p<0.001$) and reduced academic satisfaction ($p=0.003$). Academic performance was moderately improved in students with balanced hybrid engagement, whereas over-reliance on digital components was associated with cognitive fatigue and reduced attention span. Physical inactivity and irregular dietary patterns were significantly correlated with psychological distress and poor academic outcomes.

These findings indicate that hybrid learning has a complex influence on medical students, offering academic benefits when balanced appropriately but contributing to psychological strain and unhealthy behaviors when poorly regulated. Structured curriculum design and wellness-focused educational policies are essential to optimize outcomes.

Keywords: Hybrid learning, medical students, psychological wellness, academic performance

Introduction

Medical education has undergone a rapid transformation in recent years, driven by technological advancement and evolving pedagogical frameworks. Among these,

hybrid learning has emerged as a dominant instructional model that integrates traditional classroom-based teaching with digital platforms, virtual lectures, and online assessment systems. This blended approach aims to enhance flexibility, accessibility, and student-centered learning experiences [1–3]. Hybrid learning is particularly relevant in medical education due to its ability to combine clinical exposure with theoretical digital instruction. It enables students to access recorded lectures, interactive modules, and virtual simulations while still participating in hands-on clinical training. This dual-mode structure is intended to optimize knowledge acquisition and skill development [2–4].

Despite its educational advantages, hybrid learning introduces new challenges related to cognitive load, time management, and self-regulation. Students are required to adapt to shifting learning environments, often alternating between digital and physical classrooms within short periods. This transition may contribute to mental fatigue and reduced concentration levels [3–5].

Psychological wellness among medical students has long been a concern, with high prevalence of stress, anxiety, and burnout reported globally. The introduction of hybrid learning has added new dimensions to these

challenges, including increased screen exposure, reduced peer interaction during virtual sessions, and difficulty maintaining structured study routines [4–6].

Sleep quality is another important factor influenced by hybrid learning systems. Increased use of digital devices for online lectures and study materials, particularly during late hours, has been associated with circadian rhythm disruption and poor sleep quality. Sleep disturbances, in turn, negatively affect cognitive performance, emotional regulation, and academic productivity [5–7].

Academic performance in hybrid learning environments is influenced by multiple factors, including student adaptability, digital literacy, engagement levels, and institutional support. While some students benefit from the flexibility and autonomy offered by hybrid systems, others experience difficulties in maintaining motivation and consistency, leading to variability in academic outcomes [6–8].

Health behaviors such as physical activity, dietary habits, and screen time management are also affected by hybrid learning. Increased sedentary behavior, irregular meal patterns, and prolonged screen exposure have been widely reported among students engaged in blended learning environments.

These behavioral changes may contribute to both physical and psychological health consequences [7–9].

The effectiveness of hybrid learning is therefore not uniform and depends on the balance between digital and in-person components. Excessive reliance on either mode may lead to suboptimal outcomes, whereas a well-structured integration of both modalities may enhance learning efficiency and well-being [8–10].

Recent studies have emphasized the need for evaluating the broader impact of hybrid learning beyond academic performance alone. Psychological and lifestyle dimensions are increasingly recognized as essential components of educational effectiveness, particularly in high-stress disciplines such as medicine [9–10].

However, there remains limited comprehensive evidence examining the simultaneous effects of hybrid learning on mental health, academic outcomes, and health behaviors in medical students. This study was therefore conducted to evaluate these interrelated domains and provide evidence-based insights into optimizing hybrid medical education systems.

Methodology

A cross-sectional analytical study was conducted from January 2024 to December

2025 at NUST School of Health Sciences, National University of Sciences and Technology, Islamabad. Ethical approval was obtained from the institutional ethics committee prior to study initiation.

Sample size was calculated using Epi Info version 7, assuming a 50% prevalence of psychological distress among medical students engaged in hybrid learning, with a 95% confidence interval, 5% margin of error, and 80% statistical power. The minimum required sample size was 384; however, 540 students were included to ensure adequate subgroup analysis and higher statistical reliability.

Medical students from first to final year MBBS programs were included. Students with pre-existing psychiatric disorders under active treatment or those not engaged in hybrid learning systems were excluded.

Data were collected using structured self-administered questionnaires covering demographic characteristics, academic performance indicators, hybrid learning

engagement patterns, lifestyle behaviors, and psychological health status. Validated tools including DASS-21 and PSQI were used to assess mental health and sleep quality.

Hybrid learning exposure was categorized based on the proportion of digital versus in-person learning: balanced hybrid (40–60% digital), digital-heavy (>60% digital), and traditional-leaning (<40% digital). Screen time, study hours, and physical activity levels were recorded.

Academic performance was assessed using self-reported grade point average trends and perceived academic satisfaction. Lifestyle variables included physical activity frequency, dietary habits, and sleep duration. Statistical analysis was performed using SPSS version 27. Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Chi-square test, ANOVA, and multivariate logistic regression were applied. A p-value <0.05 was considered statistically significant.

ResultsTable 1. Demographic and Academic Characteristics (n=540)

Variable	Value
Age (years)	21.6 $\pm$ 2.3
Female (%)	60.7
Average screen exposure (hours/day)	6.4 $\pm$ 2.2

Variable	Value
Balanced hybrid learners (%)	44.8
Digital-heavy learners (%)	38.5
Traditional-leaning learners (%)	16.7
Physical inactivity (%)	57.3

Most students were engaged in moderate-to-high digital exposure with a majority demonstrating sedentary lifestyle patterns.

Table 2. Psychological Outcomes Among Study Participants

Outcome	Prevalence (%)
Stress (moderate–severe)	40.8
Anxiety (moderate–severe)	44.6
Depression (moderate–severe)	36.9
Poor sleep quality	55.3

A high burden of psychological distress and sleep disturbance was observed among students engaged in hybrid learning.

Table 3. Hybrid Learning Type and Psychological Distress

Learning Type	Stress (%)	Anxiety (%)	Depression (%)	p-value
Balanced hybrid	28.7	31.5	24.9	<0.001
Digital-heavy	59.4	63.2	52.8	<0.001
Traditional-leaning	34.1	36.8	29.7	0.041

Digital-heavy hybrid learning was significantly associated with higher psychological distress compared to balanced hybrid learning.

Table 4. Association Between Lifestyle Behaviors and Outcomes

Factor	Psychological Distress OR	Poor Academic Performance OR	p-value
Physical inactivity	2.41	1.89	<0.001
Irregular diet	1.76	1.62	0.003
Sleep disturbance	3.52	2.94	<0.001
Excess screen time	3.18	2.47	<0.001

Unhealthy lifestyle behaviors significantly contributed to both psychological distress and reduced academic performance.

Table 5. Academic Performance and Satisfaction Outcomes

Outcome	Balanced Hybrid	Digital-Heavy	Traditional	p-value
High academic performance (%)	68.4	51.2	59.7	0.002
Academic satisfaction (%)	72.1	48.6	63.5	0.003
Cognitive fatigue (%)	34.8	62.9	41.3	<0.001

Balanced hybrid learning was associated with better academic satisfaction and lower cognitive fatigue compared to digital-heavy learning.

Discussion

The present study demonstrates that hybrid learning has a multifaceted impact on medical students, influencing psychological wellness, academic performance, and lifestyle behaviors in complex and

interrelated ways. While hybrid learning offers flexibility and improved access to educational resources, excessive reliance on digital components appears to contribute to psychological distress and behavioral imbalance [11–12].

A key finding was the significantly higher prevalence of stress, anxiety, and depression among students engaged in digital-heavy hybrid learning. This may be attributed to prolonged screen exposure, reduced social interaction, and increased cognitive load associated with online learning platforms. These findings align with emerging evidence highlighting the mental health challenges of digitally intensive education systems [12–13].

Balanced hybrid learning was associated with comparatively better psychological outcomes and academic satisfaction. This suggests that integration of in-person engagement with digital tools may provide optimal cognitive stimulation while reducing emotional exhaustion. Structured learning environments may therefore mitigate adverse psychological effects [13–14].

Sleep disturbances were highly prevalent and strongly associated with digital exposure. Screen use during late hours disrupts circadian rhythm regulation and melatonin secretion, leading to poor sleep quality. This in turn negatively affects attention, memory consolidation, and emotional regulation [14–15].

Lifestyle behaviors such as physical inactivity and irregular dietary patterns were significantly associated with poor mental

health and academic performance. Sedentary behavior and poor nutrition may alter neurochemical balance, increasing vulnerability to stress and reducing cognitive efficiency [15–16].

Academic performance analysis revealed that balanced hybrid learning was associated with higher performance and satisfaction, whereas digital-heavy learning contributed to cognitive fatigue. This highlights the importance of structured curriculum design that prevents excessive digital overload [16–17].

The findings also underscore the importance of institutional support systems, including mental health counseling, time management training, and structured digital learning schedules. Such interventions may help students adapt more effectively to hybrid learning environments [17–18].

Overall, hybrid learning represents a valuable but complex educational model that requires careful optimization to maximize benefits and minimize adverse psychological and behavioral outcomes [18–20].

Conclusion

Hybrid learning significantly influences psychological wellness, academic performance, and lifestyle behaviors among medical students. Balanced integration of digital and in-person learning is associated

with better outcomes, while excessive digital reliance increases psychological distress and cognitive fatigue. Structured educational strategies are essential to optimize hybrid learning effectiveness.

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