ORIGINAL RESEARCH

Evaluating Blended Teaching Models in Medical Colleges: Preferences and Influential Factors for Teachers and Students

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Objective: This study evaluates the adoption of blended teaching models by faculty and students at Hubei University of Medicine. It aims to assess their willingness to adopt hybrid learning and identify the factors influencing their choices. The goal is to provide a theoretical foundation for reforming teaching models.

Methods: We distributed questionnaires to 235 faculty members and 1501 students at Hubei Medical College to assess their preferences for various teaching models. We analyzed the results using multiple logistic regression analysis.

Results: Among the participants, 34.5% of teachers and 33.7% of students preferred the hybrid teaching model. Influential factors for selecting this model included the quality of online teaching (OR=1.601, 95% CI: 1.221–2.100) and teacher-student interaction (OR=2.568, 95% CI: 1.230–5.361) for teachers. For students, significant factors included online learning tools (OR=1.894, 95% CI: 1.002–3.580), a single teaching method (OR=1.390, 95% CI: 1.042–1.856), low learning efficiency (OR=2.154, 95% CI: 1.673–2.774), and the effectiveness of online learning (OR=1.257, 95% CI: 1.181–1.339).

Conclusion: The blended teaching model has gained popularity among faculty and students in higher education. Universities should leverage advancements in information technology to address challenges in hybrid teaching. Maximizing students' sense of academic achievement and satisfaction is recommended to enhance and support the blended teaching approach.

Keywords: teaching modes, learning methods, willingness to adopt, influential factors

Introduction

The use of computer multimedia and network technology in education has become increasingly popular, especially during the COVID-19 pandemic.[1] This period witnessed rapid growth in massive open online courses and small-scale restricted online course platforms.[2] Online teaching modes have become essential for universities to maintain educational quality. Following the Ministry of Education's directive to "suspend classes without halting learning or teaching", universities have adopted online and blended teaching as key strategies for classroom reform.[3] These new teaching modes are transforming the teaching and learning processes. The choice between offline, online, and blended modes is fundamental to teaching reform efforts at universities.[4]

Offline education typically depends on face-to-face interactions between teachers and students, which helps keep students engaged in the classroom and enables teachers to provide immediate answers to questions. However, this form of communication is constrained by various factors such as class duration and venue; additionally, some teachers' rote teaching methods may hinder the development of students' independent thinking and creativity.[5] Online education utilizes the internet and information resources to present complex and often dry knowledge points through case studies, animated videos, and digital textbooks, thereby stimulating students' interest in learning.

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Modern students have increasingly diverse learning needs, with many preferring the flexibility to choose their study time and location. Online platforms provide personalized content and difficulty levels, allowing students to select resources for previewing and skill training, repeatedly review key and challenging concepts, and break free from the constraints of time and space. Teachers can also supply timely supplementary materials based on student feedback, thereby enhancing teaching quality and extending classroom learning indefinitely. Furthermore, online education enables students in remote and resource-limited areas to access quality educational resources, promoting educational equity. However, online education can be impacted by network and equipment issues, making it difficult to ensure consistent teaching quality for all students. Teachers may also find it challenging to monitor students' learning status in real-time. If students lack self-discipline, they may be easily distracted and unable to complete their learning tasks.[6]

Blended learning can stimulate students' interest and engagement by presenting knowledge in a more vivid manner and encouraging active participation, all while making full use of fragmented time. Online and offline teaching complement each other by combining virtual simulations with practical internships, enabling teachers to select quality resources that enhance the classroom experience. Simultaneously, blended learning emphasizes student initiative and creativity, allowing students to create their own learning paths and access online materials anytime and anywhere, thereby achieving a student-centered, personalized teaching approach.[7] In medical education, integrating theoretical learning with clinical practice is essential; however, the willingness of faculty and students in medical colleges to adopt blended learning models and the factors influencing this choice remain unclear. This study examines the preferences of Hubei University of Medicine's faculty and students regarding different teaching modes and analyzes the factors influencing these preferences. The findings will inform the development of post-pandemic educational reform strategies in medical schools.

Methods
Study Design and Population
The subjects of this study, conducted in August 2020, comprised medical teachers and students at Hubei University of Medicine. We employed an anonymous online survey conducted via the Questionnaire Star platform (http://www.wjx.com), supervised by uniformly trained class counselors. Stratified sampling was used to selected participants from the Department of Clinical Medicine and the School of Pharmacy and Nursing, with questionnaires tailored to profession and academic year. The platform ensured that only one response was allowed per IP address and excluded responses submitted in less than 60 seconds or more than 600 seconds.

Self-Designed Questionnaire as a Survey Tool (see supplementary materials for details). The content of the survey questionnaire was developed based on feedback from the Academic Committee and the Student Union of the school. The teacher's questionnaire included: 1) basic personal information (gender, age, teaching experience, academic rank); 2) online teaching evaluation, encompassing quality self-assessment and challenges (difficulty monitoring student progress, lack of interaction, absence of classroom atmosphere); 3) preferred teaching modes: offline, online, or hybrid. The student questionnaire included: 1) personal information (gender, age, department, major, academic year); 2) online learning assessment, addressing effectiveness and challenges (rigid content, limited teaching methods, restricted communication); 3) preferred learning modes: offline, online, or hybrid. Scores for online teaching quality and learning effectiveness were rated on a 10-point scale: 1 (very poor), 6 (pass), and 10 (excellent).

Statistical Analysis
We utilized SPSS version 21.0 for statistical analysis. Descriptive statistics, including frequency and proportion, were used to analyze basic subject information. Group comparisons were conducted using chi-square tests and one-way analysis of variance (ANOVA). Multinomial logistic regression was employed for multivariate analysis, with a P-value of < 0.05 indicating statistical significance.

Results

Statistical Material

We collected 250 teacher questionnaires; after excluding those with logical errors and duplicates, 235 valid responses remained, resulting in a 94% response rate. Similarly, of 1600 student questionnaires collected, 1501 were valid after exclusions, yielding a 93.8% response rate. Of the 235 teachers, 51 were male (21.7%) and 174 were female (78.3%). The age distribution included 166 under 40 years (70.6%), 36 between 40 and 50 years (15.3%), and 33 over 50 years (14.0%). Regarding academic titles, 26 were junior (11.1%), 136 were intermediate (57.9%), 57 were associate high (24.3%), and 16 were high (6.8%). Among the 1,501 students, 370 were male (24.7%) and 1,131 female (75.3%). The age distribution included 492 under 20 (32.8%), 838 aged 20 to 21 (55.8%), and 171 over 21 (11.4%). Yearly breakdown: 1,019 in years 1 to 3 (67.9%) and 482 in years 4 to 5 (32.1%).

Univariate Analysis

In this study, 14.0% of teachers expressed a willingness to adopt online teaching, while 34.5% preferred a hybrid online-offline approach. No statistically significant differences were observed in preference for offline or online teaching across variables such as gender, age, experience, education level, academic title, or online teaching duties ($P > 0.05$). Significant variations were noted in self-assessed online teaching quality, with the highest scores reported by those preferring hybrid teaching ($P < 0.001$), as detailed in Table 1. Challenges in online teaching, such as difficulty in monitoring student progress, limited interaction, a poor classroom atmosphere, and home distractions, significantly influenced teachers' mode preferences ($P < 0.05$), as outlined in Table 2.

Among medical students, 12.8% expressed a willingness to adopt online learning, while 33.7% preferred a hybrid approach. No significant differences in learning mode preferences were observed among students based on gender, age, major, or academic year ($P > 0.05$), as shown in Table 3. However, factors such as rigid course content, monotonous teaching methods, limited interaction, low learning efficiency, and susceptibility to distractions significantly influenced students' learning mode preferences ($P < 0.05$), as detailed in Table 3 and Table 4.

Table 1 Univariate Analysis of Medical School Teachers' Preferences for Offline/Online Teaching Modes [n (%)]

Variable	Category	Teaching Mode			χ^2/ F	P
		Offline 121 (51.5)	Online 33 (14.0)	Hybrid Online-Offline 81 (34.5)		
Gender	Male	22(43.1)	11(21.6)	18(35.3)	3.523	0.172
	Female	99(53.8)	22(12.0)	63(34.2)		
Age (years)	<40	81(48.8)	24(14.5)	61(36.7)	1.790	0.774
	40–50	21(58.3)	5(13.9)	10(27.8)		
	≥50	19(57.6)	4(12.1)	10(30.3)		
Teaching Experience (years)	<5	62(48.8)	19(15.0)	46(36.2)	7.118	0.524
	5–10	31(50.0)	9(14.5)	22(35.5)		
	10–15	13(54.2)	1(4.2)	10(41.7)		
	15–20	6(75.0)	1(12.5)	1(12.5)		
	≥20	9(64.3)	3(21.4)	2(14.3)		
Education	Bachelor's and below	74(55.2)	14(10.4)	46(34.3)	5.732	0.220
	Master	28(51.9)	8(14.8)	18(33.3)		
	PhD	19(40.4)	11(23.4)	17(36.2)		

(Continued)

Table 1 (Continued).

Variable	Category	Teaching Mode			χ^2/ F	P
		Offline 121 (51.5)	Online 33 (14.0)	Hybrid Online-Offline 81 (34.5)		
Academic Title	Junior	14(53.8)	1(3.8)	11(42.3)	3.760	0.709
	Intermediate	72(52.9)	21(15.4)	43(31.6)		
	Associate Senior	27(47.4)	8(14.0)	22(38.6)		
	Senior	8(50.0)	3(18.8)	5(31.3)		
Self-Assessed Online Teaching Quality		7.12±1.235	7.73±1.153	7.84±1.260	9.107	<0.001

Table 2 Impact of Issues Encountered During Online Teaching on Preferences for Offline/Online Teaching Modes Among Medical School Teachers [n (%)]

Variable	Category	Teaching Mode			χ^2	P
		Offline	Online	Hybrid		
Inexperience with teaching software	Yes	48(50.5)	14(14.7)	33(34.7)	0.087	0.958
	No	73(52.1)	19(13.6)	48(34.3)		
Equipment issues	Yes	33(55.0)	9(15.0)	18(30.0)	0.712	0.700
	No	88(50.3)	24(13.7)	63(36.0)		
Internet issues	Yes	54(54.0)	11(11.0)	35(35.0)	1.375	0.503
	No	67(49.6)	22(16.3)	46(34.1)		
Inability to immediately grasp students' learning status	Yes	90(57.3)	18(11.5)	49(31.2)	6.823	0.033
	No	31(39.7)	15(19.2)	32(41.0)		
Inability to achieve real-time teacher-student interaction	Yes	89(63.1)	16(11.3)	36(25.5)	19.252	<0.001
	No	32(34.0)	17(18.1)	45(47.9)		
Poor classroom atmosphere	Yes	65(64.4)	10(9.9)	26(25.7)	11.771	0.003
	No	56(41.8)	23(17.2)	55(41.0)		
Many home distractions for students	Yes	48(66.7)	6(8.3)	18(25.0)	9.753	0.008
	No	73(44.8)	27(16.6)	63(38.7)		

Table 3 Univariate Analysis of Medical Students' Preferences for Offline/Online Learning Modes [n (%)]

Variable	Category	Learning Mode			χ^2/ F	P
		Offline 803 (53.5)	Online 192 (12.8)	Hybrid 506 (33.7)		
Gender	Male	216(58.4)	44(11.9)	110(29.7)	4.806	0.090
	Female	587(51.9)	148(13.1)	396(35.0)		
Age (years)	<20	254(51.6)	66(13.4)	172(35.0)	4.447	0.349
	20–21	445(53.1)	108(12.9)	285(34.0)		
	>21	104(60.8)	18(10.5)	49(28.7)		

(Continued)

Table 3 (Continued).

Variable	Category	Learning Mode			χ^2/F	P
		Offline 803 (53.5)	Online 192 (12.8)	Hybrid 506 (33.7)		
Major	Clinical Medicine	323(55.4)	78(13.4)	182(31.2)	8.506	0.075
	Nursing	367(50.3)	94(12.9)	269(36.8)		
	Other	113(60.1)	20(10.6)	55(29.3)		
Academic Year	1–3 Years	535(52.5)	132(13.0)	352(34.5)	1.306	0.521
	4–5 Years	268(55.6)	60(12.4)	154(32.0)		
Primary Tool for Online Learning	Mobile Phone	507(56.5)	88(9.8)	303(33.7)	23.735	<0.001
	Computer	257(48.4)	88(16.6)	186(35.0)		
	Tablet	39(54.2)	16(22.2)	17(23.6)		
Self-assessed Online Learning Effectiveness Score		5.84±2.181	6.93±2.014	6.98±1.814	56.958	<0.001

Table 4 Impact of Issues Encountered During Online Lectures on Students' Preferences for Offline/Online Learning Modes [n (%)]

Variable	Category	Learning Mode			χ^2	P
		Offline	Online	Hybrid		
Rigid course content	Yes	296(62.1)	51(10.7)	130(27.3)	20.627	<0.001
	No	507(49.5)	141(13.8)	376(36.7)		
Monotonous teaching methods	Yes	357(64.6)	51(9.2)	145(26.2)	43.309	<0.001
	No	446(47.0)	141(14.9)	361(38.1)		
Limited teacher-student interaction	Yes	387(63.8)	46(7.6)	174(28.7)	49.396	<0.001
	No	416(46.5)	146(16.3)	332(37.1)		
Lower learning efficiency than offline classes	Yes	545(67.1)	50(6.2)	217(26.7)	147.818	<0.001
	No	258(37.4)	142(20.6)	289(41.9)		
Susceptibility to external distractions	Yes	517(60.8)	65(7.6)	268(31.5)	62.975	<0.001
	No	286(43.9)	127(19.5)	238(36.6)		
Tendency to get distracted	Yes	516(60.9)	68(8.0)	263(31.1)	58.583	<0.001
	No	287(43.9)	124(19.0)	243(37.2)		

Multivariate Logistic Regression Analysis

Variables that were significant in the univariate analysis were included in the regression model. The results indicated that online teaching quality and teacher-student interaction significantly influenced teachers' preferences for hybrid teaching (P < 0.05). For students, factors such as limited interaction, low learning efficiency, and susceptibility to distractions significantly affected their decision to adopt online learning (P < 0.05). Students' choice of hybrid learning was significantly influenced by online learning tools, the singularity of teaching methods, low learning efficiency, and online learning effectiveness (P < 0.05), as shown in Table 5. Therefore, enhancing the quality of online teaching and fostering communication between teachers and students are essential for improving students' learning efficiency and attracting more participants to blended teaching models.

Table 5 Multivariable Logistic Regression Analysis of Factors Influencing Teaching Mode Preferences Among Medical School Faculty and Students

Subject		Variable	Category	P value	OR (95% CI)
Faculty	Online Teaching Quality[a]	Online Teaching Quality		0.029	1.478 (1.040~2.100)*
		Online Teaching Quality		0.001	1.601 (1.221~2.100)*
	Hybrid Online-Offline Teaching[a]	Real-time Teacher-Student Interaction	No	0.012	2.568 (1.230~5.361)*
			Yes		
Students	Online Lecture[a]	Limited Teacher-Student Interaction	No	0.001	1.958 (1.326~2.889)*
			Yes		
		Learning Efficiency Lower Than Offline	No Yes	<0.001	3.594 (2.458~5.257)*
		Susceptible to External Distractions	No	0.021	1.577 (1.073~2.319)*
			Yes		
		Prone to Distraction	No Yes	0.010	1.630 (1.116~2.380)*
		Online Learning Effectiveness		<0.001	1.172 (1.077~1.276)*
	Hybrid Online-Offline Lecture[a]	Online Learning Tools	Mobile Phone Computer Tablet	0.168 0.049	1.551 (0.831~2.894) 1.894 (1.002~3.58)* 1
		Monotonous Teaching Method	No Yes	0.025	1.390 (1.042~1.856)*
		Learning Efficiency Lower Than Offline	No	<0.001	2.154 (1.673~2.774)*
			Yes		
		Online Learning Effectiveness		<0.001	1.257 (1.181~1.339)*

Note: [a]The reference group is the offline teaching mode; *in the table indicate a statistically significant difference, with a p-value less than 0.05.

Discussion

In this survey, 34.5% of medical school teachers and 33.7% of students preferred a hybrid online-offline teaching model. Dika notes that individuals generally have more positive attitudes toward familiar activities.[8] Nemalynne et al found that teachers with online teaching experience were more likely to embrace hybrid teaching post-pandemic, indicating that such experience during the pandemic helped establish a foundation for teaching model reform in medical schools.[9] However, the preference for hybrid teaching among medical school teachers, at only 34.5%, is low compared to other universities, where over three-quarters favor a blended approach.

Medical students' preferences for learning modes—53.5% prefer offline, 12.8% prefer online, and 33.7% prefer hybrid—reflect patterns observed in previous studies.[10] This similarity may arise from the specific demands of medical education, which includes practical skills, lab work, and clinical internships—areas where current teaching models struggle to blend online and offline methods effectively.

Two approaches may address these challenges: model exploration and technology empowerment. Adapting teaching modes to meet medical education needs involves implementing self-regulated flipped classroom models,[11] WeChat-based flipped classrooms,[12] and integrating humanities and social sciences into course instruction.[13] These methods have shown promising results. The rise of smart education, driven by advancements in technology and big data, leverages recent 5G

innovations to significantly decrease latency. This facilitates real-time interactions and immersive experiences through extended reality, providing students and teachers with virtually simulated, lifelike educational environments.

Furthermore, teachers who rate their online teaching quality higher and students who perceive their online learning as effective are more likely to favor hybrid teaching in the post-pandemic context. Research by Meyer JH and Jong indicates a significant correlation between teachers' educational experiences and their selected teaching methods.[14,15] Teachers who focus on effectiveness are likely to invest more effort and maintain their engagement, leading to better outcomes and sustained innovation in education. Similarly, medical students who are dissatisfied with online teaching or who experience poor learning outcomes tend to prefer offline teaching.[15] This underscores the need for an effective feedback evaluation system in online teaching to improve ongoing assessments and keep teachers informed about student learning outcomes and feedback. Such a system would not only improve the teaching experience and enhance assessment quality but also enrich students' learning experiences. Establishing this dynamic feedback system requires administrative guidance and technical support from universities.

Challenges in teacher-student interaction during online sessions have caused some medical teachers to prefer traditional offline methods over hybrid teaching. Numerous studies indicate that faculty struggled with interaction and adapting to external environments during online teaching driven by the pandemic.[16] The initial extensive phase of online teaching during the pandemic posed significant challenges for college faculty, who often lacked experience and training in online teaching.[1,17] Teaching remained teacher-centric, simply shifting offline content online without effectively integrating student participation or interaction. In the post-pandemic era, university teachers should reevaluate the teaching-learning relationship, transitioning from regulatory to more collaborative, interactive, and feedback-oriented methods.[18]

A limitation of our study is that it only included data from the faculty and students of one medical school. To enhance the representativeness of the research, we recommend collecting data from multiple medical schools in various regions. Additionally, the data were collected using a questionnaire, which is a relatively singular approach. Future research should consider combining field surveys with questionnaires to create a more comprehensive approach. Lastly, the questionnaire only addressed common factors influencing the willingness of faculty and students to choose their teaching modes, omitting some important influencing factors. Previous studies have indicated that combining Transactional Distance Theory and Bloom's Taxonomy Theory and online learning platforms can enhance students' academic achievements and satisfaction.[19] We look forward to conducting similar multi-center studies in the future that involve large sample sizes and yield more comprehensive data.

Conclusion

In summary, the hybrid online-offline teaching model is gaining acceptance among university faculty and students. Key factors influencing new teaching models include teacher-student interaction, the learning environment, and overall efficiency. Maximizing students' sense of academic achievement and satisfaction is essential for enhancing blended teaching models. With advancements in information technology and big data, post-pandemic medical education should treat the crisis as an opportunity. It should leverage the experiences gained from online teaching during the pandemic, focus on enhancing teacher-student interaction, and adopt collaborative, interactive, and feedback-oriented methods. Fully leveraging the advantages of the hybrid model can guide the exploration of diverse teaching mode reforms in the post-pandemic era.

Data Sharing Statement

The data supporting the conclusions of this manuscript will be made available by the corresponding author.

Ethics Approval

This study was approved by the Ethics and Scientific Committee of Hubei University of Medicine with approval number XYYYE20240074. All participants provided informed consent to participate in this study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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