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Blended Learning in Health Professions Education: A Systematic Review of Pedagogical Approaches, Digital Innovations, Learning Outcomes, and Implementation Challenges

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Abstract: This study aims to examine the implementation patterns, technology integration, learning outcomes, student engagement, and sustainability factors of blended learning (BL) in health professions education (HPE) between 2020 and 2024 across diverse pedagogical and educational contexts. Despite the increasing adoption of BL in HPE, the existing literature lacks a comprehensive, theory-informed synthesis of implementation patterns, technology integration, the relationship between student engagement and learning outcomes, and sustainability factors across disciplines and educational settings. This study employed a Systematic Literature Review (SLR) following the PRISMA 2020 guidelines. The review was conducted using the Scopus database and included studies published between January 2020 and December 2024. A total of 41 peer-reviewed empirical studies were selected from an initial pool of 65 records through rigorous title and abstract screening, followed by full-text eligibility assessment. Data were synthesised narratively, and the findings were organised thematically according to five research questions using an integrated theoretical framework encompassing constructivism, cognitive load theory, multimedia learning theory, and self-regulated learning theory. The findings revealed that 58.5% of the included studies implemented general BL approaches, whereas 41.5% adopted established pedagogical frameworks. Technology integration primarily involved multimedia resources (53.7%), digital assessment platforms (43.9%), and video conferencing tools (43.9%). Overall, BL demonstrated high effectiveness, with 86% of the reported learning outcome measures indicating positive results. Structured active engagement exhibited the strongest positive association with learning outcomes ($r \approx 0.55–0.75$). The main challenges included substantial resource requirements and difficulties in student self-regulation, whereas instructional design support emerged as the most important facilitating factor. These findings suggest that although BL is highly effective in HPE, its long-term sustainability depends on transitioning from ad hoc implementation to institutionally supported, theory-driven instructional design. Accordingly, educators and higher education institutions should prioritise intentional pedagogical design and sustained institutional support to ensure the effective and sustainable implementation of blended learning in health professions education.

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Introduction

The integration of digital technologies into health professions education (HPE) has fundamentally altered instructional delivery. Blended learning (BL), defined as the deliberate combination of face-to-face instruction with online components, has become a prominent approach for addressing contemporary educational demands, including increasing student enrolments, distributed clinical placements, and the need to foster self-directed, lifelong learning (Garrison & Vaughan, 2008; Vallee et al., 2020). The COVID-19 pandemic accelerated this transition, compelling institutions worldwide to rapidly adopt technology-mediated instruction and generating a substantial body of post-pandemic evidence on what works, under what conditions, and for which learner populations (Wang et al., 2022; Wilcha, 2020). The 2020–2024 period is particularly critical: it represents the transition from emergency remote teaching toward intentional, institutionally embedded BL designs, a consolidation phase in which institutions could evaluate, refine, and permanently integrate new instructional approaches into their curricula (Dedeilia et al., 2020; Wang et al., 2022)).

Existing systematic reviews confirm the general effectiveness of BL in HPE. Liu et al. (2016) demonstrated positive effects on knowledge and skills across multiple health professions, while (Hew & Lo, 2018) confirmed the superiority of flipped classroom BL for student satisfaction and knowledge outcomes, and McCutcheon et al. (2018) showed BL equivalence or superiority for clinical skills in nursing. However, these reviews share critical limitations: they are predominantly single-discipline or single-framework in scope, were conducted before or during rather than after the pandemic transformation, and systematically neglect three analytically critical dimensions: how technology integration complexity relates to outcomes, which engagement dimensions most strongly predict achievement, and how BL influences psychomotor and affective clinical competency domains in authentic hospital and clinical settings,as distinct from cognitive knowledge acquisition in the classroom (Norcini et al., 2018; Park et al., 2022; Santos et al., 2022).

The novelty of this review lies in its simultaneous cross-disciplinary, multi-framework, theory-informed synthesis across the full spectrum of HPE disciplines during 2020–2024. Modern HPE increasingly demands interprofessional competencies that require evidence across medicine, nursing, pharmacy, dental, and allied health disciplines simultaneously (Frenk et al., 2010)—a cross-disciplinary synthesis that prior single-discipline reviews cannot provide. Critically, this is the first systematic review to explicitly interrogate why Workplace-Based Assessment (WBA) remains chronically underimplemented in BL formats, despite its established role as the gold standard for authentic clinical competency assessment (Miller, 1990; Norcini et al., 2018)

This study aims to examine the implementation of blended learning in Health Professions Education (HPE) during 2020–2024 by exploring pedagogical approaches, technological integration, learning outcomes, student engagement, and sustainability factors. Specifically, this study aims to identify the frameworks and digital platforms used, analyse the effectiveness and engagement patterns across different educational contexts, and synthesise the challenges and facilitating factors that influence the successful implementation of blended learning in post-pandemic HPE.

Research Method

This study employed a Systematic Literature Review (SLR) approach to examine and synthesise empirical research on blended learning in health professions education. The SLR method was selected for its structured, transparent, and replicable procedures, which

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minimise bias and enhance the credibility of synthesised findings (Snyder, 2019). The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework (Page et al., 2021), which organises the process into four stages: identification, screening, eligibility, and inclusion.

The identification stage involved a targeted literature search in the Scopus database, selected for its extensive coverage of peer-reviewed journals in medicine, nursing, and health sciences. The search was conducted in September 2025, restricted to publications between January 2020 and December 2024. The Boolean search string applied to titles, abstracts, and keywords was: "blended learning" AND "problem-based learning". The search was further restricted to the subject areas of Medicine, Nursing, and Health Professions, and to English-language journal articles only. Conference papers, editorials, book chapters, and these were excluded at the database level. All retrieved records were exported to Microsoft Excel for organization and duplicate removal, yielding an initial dataset of 65 articles.

Studies were included if they were empirical, peer-reviewed journal articles available in full text, focused on blended learning implementation within HPE (medicine, nursing, pharmacy, dentistry, allied health), published in English between 2020 and 2024. Blended learning was defined broadly to encompass both general BL implementations and those aligned with named frameworks such as problem-based learning, flipped classroom, team-based learning, case-based learning, or challenge-based learning. Studies were excluded if they lacked empirical data (conceptual papers, theses, book chapters, conference abstracts), were not peer-reviewed, were unrelated to blended learning in HPE, or were unavailable in full text. Table 1 presents the full inclusion and exclusion criteria applied during screening.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Studies examining blended learning in educational settings with or without explicit reference to specific pedagogical frameworks (PBL, flipped classroom, TBL, CBL, challenge-based learning)	Articles that do not involve or discuss blended learning approaches
Research conducted within health professions education (medicine, nursing, pharmacy, dentistry, allied health)	Studies not related to health professions education or focusing on general/non-health education
Empirical studies employing qualitative, quantitative, or mixed-method research designs	Theoretical or conceptual papers lacking empirical data
Peer-reviewed journal articles published in English	Review articles (systematic reviews, meta-analyses, scoping reviews, or narrative reviews)
Full-text articles accessible for comprehensive data extraction and analysis	Conference abstracts, reports, theses, or non-peer-reviewed documents; publications in languages other than English; articles unavailable in full text
Studies focusing on implementation, effectiveness, outcomes, or experiences related to BL in HPE (2020–2024)	Studies published before January 2020 or after December 2024

During the screening phase, titles and abstracts of the 65 retrieved articles were reviewed against the inclusion and exclusion criteria. Studies were retained if they explicitly

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indicated the use of blended learning within an HPE context regardless of the specific framework label. Articles outside HPE, lacking a blended component, or clearly non-empirical were excluded at this stage, reducing the dataset to 41 articles. In the eligibility phase, full-text versions of these 41 articles were obtained and assessed in detail to confirm all inclusion criteria. No additional exclusions were required at this stage; all 41 articles satisfied the eligibility criteria and were included in the final synthesis.

Data were extracted systematically from each included study using a standardised extraction form covering: author(s) and year, country, health professions discipline, participant type and sample size, pedagogical approach, technologies used, research design and methods, learning outcome measures, key findings, and reported challenges or facilitating factors. The methodological quality of all 41 included studies was assessed independently by two reviewers using the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018), which provides standardised quality criteria for quantitative, qualitative, and mixed-methods empirical studies. The MMAT assesses studies across five screening questions relevant to the research design category: clarity of research question, appropriateness of design, representativeness of the sample, measurement validity, and completeness of outcome reporting. Disagreements between reviewers were resolved through discussion and consensus. No study was excluded solely on the basis of quality assessment; instead, quality ratings were used to contextualise the weight of evidence during narrative synthesis.

Narrative synthesis was employed to integrate findings across studies, given the heterogeneity of study designs and outcome measures that precluded meta-analytic pooling. The synthesis was organised around the five research questions and interpreted through the integrated theoretical framework of constructivism, cognitive load theory, multimedia learning theory, and self-regulated learning theory.

Results and Discussion

Implementation Patterns and Pedagogical Approaches

Across the 41 included studies, BL implementations were markedly heterogeneous. General BL approaches, flexibly combining online and face-to-face components without a named framework, predominated (n = 24, 58.5%). Named frameworks included Problem-Based Learning (n = 6, 14.6%), Flipped Classroom (n = 5, 12.2%), case-based learning (n = 4, 9.8%), and team-based and challenge-based learning (n = 2 each, 4.9%). This confirms that 'blended learning' functions as an umbrella term covering diverse designs with varying degrees of theoretical grounding and instructional sophistication.

Health professions disciplines were unevenly represented. Medical education dominated (n = 16, 39.0%), followed by nursing and continuing professional development (n = 6 each, 15.0%), allied health (n = 4, 10.0%), pharmacy (n = 3, 7.3%), and dental education (n = 2, 4.9%). Geographically, studies originated from Asia (34.1%), North America (26.8%), and Europe (22.0%). The low frequency of blended PBL (14.6%), despite its gold-standard status for clinical reasoning (Woltering et al., 2009), reflects the logistical complexity of designing authentic online case resources alongside effective in-person collaborative sessions. Through a CLT lens, the dominance of general BL suggests HPE educators intuitively avoid extraneous cognitive load from complex framework-specific designs (Sweller, 2020).

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Technologies and Digital Platforms

Technology use concentrated on foundational rather than advanced tools (Table 2). Multimedia resources (n = 22, 53.7%), digital assessment platforms (n = 18, 43.9%), and video conferencing (n = 18, 43.9%) dominated. Learning Management Systems (n = 15, 36.6%) functioned as near-universal organization hubs. Moderate integration of 2–4 tools (n = 19, 46.3%) was most prevalent, outperforming both simple (n = 12, 29.3%) and complex configurations (n = 10, 24.4%). This pattern aligns with MLT and CLT principles: coherent combinations of a small number of established tools support meaningful processing without imposing unsustainable resource demands (Mayer, 2021; Sweller, 2020).

Table 2. Technology Adoption Frequencies Across Studies

Technology Category	n	% of Studies
Multimedia Resources (videos, animations, presentations)	22	53.7
Digital Assessment Platforms (quizzes, assignments, exams)	18	43.9
Video Conferencing Systems (Zoom, Teams, etc.)	18	43.9
Learning Management Systems (Moodle, Blackboard, Canvas)	15	36.6
Mobile Learning Applications	12	29.3
Collaborative Tools (forums, wikis, shared documents)	9	22.0
Specialised Health Education Tools (clinical simulation)	8	19.5
Virtual Simulation Environments (virtual patients)	7	17.1
Custom Educational Platforms (institution-specific)	6	14.6
Social Media Platforms (educational use)	3	7.3

Note. Studies typically employed multiple technologies; percentages reflect proportion of 41 studies utilising each category.

Learning Outcomes, Clinical Competency Domains, and WBA

Overall effectiveness was high: of 97 outcome assessments, 86% showed positive results, 11% were neutral, and 3% mixed. Positive patterns were robust across student satisfaction (18/18, 100%), knowledge acquisition (24/28, 86%), skills development (16/18, 89%), and clinical competency (7/8, 88%). Of 28 studies directly comparing BL with traditional face-to-face instruction, 71% found BL superior. Assessment practices relied predominantly on knowledge tests (n = 28, 68%) and satisfaction surveys (n = 18, 44%), with skills assessments in 44% of studies and Workplace-Based Assessment (WBA) in only 8 studies (20%). This concentration of evidence at Kirkpatrick Levels 1–2 (reaction and learning) rather than Levels 3–4 (behaviour and results) represents a critical ceiling that limits what can be concluded about BL's impact on authentic clinical practice (Kirkpatrick & Kirkpatrick, 2006; Yardley & Dornan, 2012).

A fundamental limitation of current BL evidence is its disproportionate focus on cognitive knowledge acquisition at the expense of the psychomotor and affective domains that define clinical competence in real hospital and clinical settings. Using Miller (1990) pyramid, the reviewed evidence predominantly addresses 'knows' and 'knows how', while 'shows how' and ' authentic does' in real clinical contexts remain largely unmeasured. In the psychomotor domain, skills assessments in the reviewed literature predominantly captured laboratory or simulation performance rather than authentic procedural competence in wards,

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operating theatres, or outpatient settings, environments where learners must adapt to unpredictable patient presentations and integrate manual skill with real-time clinical reasoning (McGaghie et al., 2010). In the affective domain, professional identity, clinical empathy, and interprofessional communication were rarely measured objectively; where assessed, self-report scales predominated over direct behavioural observation. The risk is that BL programmes optimised for digital content delivery may inadvertently displace the sustained bedside contact through which professional identity forms and affective competencies develop (Frenk et al., 2010). Effective BL must deliberately engineer complementarity between online preparation and in-person clinical application, ensuring digital components prepare, scaffold, and debrief clinical experiences rather than replacing them (Woltering et al., 2009; Yardley & Dornan, 2012)

The chronic underimplementation of WBA in BL environments, appearing in only 20% of studies, eflects four compounding institutional barriers. Structurally, WBA tools such as Mini-CEX, DOPS, and Case-Based Discussion require direct, in-person clinical observation that is fundamentally mismatched with asynchronous online delivery (Norcini et al., 2018). Pedagogically, most BL programmes retain course-based assessment architectures rather than adopting the competency-based education (CBE) frameworks, including Entrustable Professional Activities (EPAs) and competency milestones, that WBA requires (ten Cate, 2017). Culturally, faculty assessors frequently lack WBA calibration training and students approach WBA as summative threat rather than a formative developmental tool (Holmboe et al., 2021). Resource barriers are decisive: integrating WBA requires digital portfolio infrastructure, protected supervisor time, and programme-level governance, investments that exceed what institutions typically frame as the cost of adopting BL. Addressing this requires reconceptualising BL in HPE as three integrated environments, online preparation, face-to-face active learning, and supervised clinical practice, with assessment modalities aligned to each domain: online tests for cognitive knowledge, simulations for applied reasoning, and WBA in real clinical settings for authentic competence.

The high rate of effectiveness (86%) during 2020–2024 marks a substantive shift from pre-pandemic reviews, which typically reported equivalent or marginally superior effectiveness compared with traditional teaching (Liu et al., 2016; Vallee et al., 2020). This improvement plausibly reflects that forced pandemic technology adoption was followed by deliberate pedagogical refinement, enhanced faculty digital literacy, and greater institutional acceptance of blended designs (Chen et al., 2021; McCutcheon et al., 2018).

Student Engagement–Outcome Relationships

Thirteen studies explicitly examined engagement–outcome associations, revealing clear variation by engagement type. Structured active engagement, assignment completion ($r \approx 0.60–0.75$) and preparatory tasks ($r \approx 0.64–0.72$), showed the strongest positive correlations, followed by discussion participation ($r \approx 0.43–0.65$), collaborative work ($r \approx 0.40–0.58$), and passive resource access ($r \approx 0.25–0.45$). These findings align with SRL theory(Panadero, 2017) : structured production activities support all three SRL phases, forethought, performance monitoring, and self-reflection, while passive content access bypasses the metacognitive regulation driving sustained competence development.

Seven longitudinal studies documented a consistent mid-course engagement dip that was significantly smaller in courses with regular deadlines, milestones, and formative feedback. Engagement–outcome relationships were slightly stronger in medical education but

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showed greater variability in continuing professional development contexts, reflecting heterogeneous motivations and competing work demands among professional learners.

Challenges and Facilitating Factors

Implementation challenges clustered across four domains: institutional (high resource demands for course design, n = 14, 34%; faculty workload, n = 10), pedagogical (assessment integrity concerns, n = 13, 32%; maintaining interactivity, n = 10), technological (infrastructure limitations, n = 12, 29%; faculty technology skill gaps, n = 11), and student-related (self-regulation difficulties, n = 12, 29%; technology access disparities, n = 9).

Facilitating factors mirrored these challenges (Table 3). Instructional design assistance (n = 16, 39%) was the most consistently cited enabler, consistent with findings by Dedeilia et al. (2020) and McCutcheon et al. (2018)who identify pedagogical design quality as the primary differentiator between successful and challenged HPE BL implementations. Professional development, including technology training (n = 14, 34%) and technical support services (n = 13, 32%) followed as key institutional enablers.

These findings collectively confirm that BL has transitioned from an emergency response into an effective, institutionalized instructional strategy within HPE. The high overall effectiveness rate, the strong association of structured engagement with outcomes, and the clear identification of design and support factors that differentiate successful from challenged implementations all point to an evidence-based imperative: intentional pedagogical architecture, rather than technology presence alone, determines BL outcomes (Garrison & Vaughan, 2008; Woltering et al., 2009).

Table 3. Facilitating Factors by Category (Frequency Across Studies)

Facilitating Factor	n	%
INSTITUTIONAL SUPPORT		
Instructional Design Assistance	16	39
Professional Development Opportunities	14	34
Technical Support Services	13	32
Leadership Support & Resources	12	29
PEDAGOGICAL DESIGN QUALITY		
Active Learning Integration	13	32
Clear Objectives & Alignment	12	29
Scaffolding & Structure	11	27
Timely Formative Feedback	10	24
STUDENT SUPPORT		
Online Orientation to BL	8	20
Peer Support Networks	7	17

Note. Percentages reflect proportion of 41 studies. Studies typically reported multiple facilitating factors.

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Conclusion

This systematic review of 41 empirical studies (2020–2024) conclusively affirms that BL is a feasible, highly effective (86% positive outcomes), and institutionalised instructional strategy in HPE. Effectiveness depends fundamentally on deliberate, theory-informed instructional architecture rather than technology adoption alone. The review makes several distinctive contributions: it provides the first cross-disciplinary, post-pandemic synthesis covering multiple pedagogical frameworks, technology integration levels, engagement dimensions, and clinical competency domains simultaneously. A critical finding is the persistent gap between what BL currently measures and what clinical practice demands: BL evidence overrepresents cognitive outcomes while psychomotor skill development in authentic clinical contexts and affective competencies remain systematically underassessed. WBA is chronically underimplemented due to structural mismatches between asynchronous BL delivery and direct clinical observation requirements, pedagogical inertia in course-based assessment, cultural resistance, and resource barriers. These findings suggest BL's sustainability requires a fundamental reconceptualisation toward deliberately sequenced integration of online preparation, face-to-face active learning, and supervised clinical practice, each with competency-aligned assessment modalities. This review is limited by methodological heterogeneity across included studies, concentration of evidence in medical education and high-income contexts, and potential sampling bias from the PBL-anchored search string.

Recommendation

For educators, priority should be given to structured active learning over passive digital resources, moderate technology integration (2–4 tools), explicit SRL scaffolding through milestones and formative feedback, and deliberate design of online components as preparation and debriefing for, not substitutes for, authentic clinical experiences. For institutional administrators and policy makers, strategic investment should shift from software licensing toward instructional design expertise, faculty WBA training, digital portfolio infrastructure, and programme-level governance frameworks aligning BL with CBE milestone systems. For future researchers, experimental comparative designs (RCTs comparing blended PBL versus blended flipped classroom), longitudinal studies examining BL's impact on WBA outcomes and sustained clinical competencies, and broader search strategies capturing all BL frameworks across underrepresented disciplines, allied health, pharmacy, dental, and low-resource international contexts are strongly recommended

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