Review article

Integration of Teaching in Medical Education Towards Holistic Learning with Clinical Relevance

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ABSTRACT

Integration of teaching in medical education is increasingly used to reduce isolation of disciplines and make learning more clinically meaningful across the entire medical program. Integration refers to program-level design of curriculum that purposefully connects basic sciences, clinical sciences, population health, ethics and professionalism across the spectrum of teaching and assessment. Two core approaches of integrations are horizontal integration which links disciplines within the same phase and vertical integration which links foundational and clinical learning across the course. Potential benefits include stronger perceived relevance, improved coherence of learning, earlier development of clinical reasoning, and better preparedness for clinical work when integration is aligned with active learning and assessment strategies. Implementation requires careful curriculum mapping with blueprinting, faculty development, interdepartmental coordination, and assessment redesigned to avoid overload and unintended stressors.

Keywords

Integrated teaching; medical curriculum; horizontal integration; vertical integration; early clinical exposure; clinical relevance

INTRODUCTION

Medical education has experienced remarkable transformations over the past few decades, shifting from traditional knowledge-focused curricula to outcome-focused models that emphasizes on competency development and technology-enhanced educational development[1]. Within this shift, integration of medical education has emerged as a program-level approach that connects what students learn, when they learn, and how they apply it in the clinical context[2,3]. Knowledge acquired through traditional discipline-based teaching for example, anatomy, physiology, pathology, community medicine is often delivered in isolation. As a result, students tend to forget most of their basic science or foundational knowledge even before they enter their clinical training which limits their ability to develop a holistic understanding of medicine as a profession. This emphasizes the need to shift from isolated, discipline-specific instruction toward an integrated approach of instruction connecting related disciplines in order to bridge the gap between theory and practice[4].

Integration in medical teaching is a major feature of the educational reforms of the Edinburgh Declaration as proposed by World

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Federation of Medical Education[5]. Integrated teaching emphasized on bringing different disciplines together; when this approach is structured around systems or organs (e.g., cardiovascular, respiratory), it is called an Organ-System-Based Curriculum or systems-based approach and covers all its aspects concurrently, rather than teaching subjects in isolation[6,7,8]. Integration involves a curriculum that purposefully connects basic sciences, clinical sciences, population health, ethics and professionalism across time, teaching methodology and assessment procedures. Essentially, integration is not a single fixed model. It may range from linking teaching-content within a session to redesigning an entire curriculum across disciplines, years, assessment and clinical responsibility[2,9]. This educational reform allows students to apply theoretical knowledge to real-world clinical problems, early in their medical training with relevance[1]. Integration of teaching in medical education is typically divided into horizontal and vertical approaches. However, despite the widespread support for these approaches, their theoretical basis, practical implementation, and assessment of learning outcomes remain challenging. Therefore, this review aims to provide an overview of current perspectives on integrated medical teaching, its educational foundations, and its utility in promoting a comprehensive or holistic learning outcomes.

Approaches to Integration

Horizontal Integration

Horizontal integration is the integration across parallel disciplines such as anatomy, physiology, and biochemistry or medicine, surgery, and therapeutics that are taught traditionally in the same phase of the curriculum. Its implementation emphasizes within a body-system block, for example; cardiovascular, respiratory, renal, nervous, gastrointestinal system and others, where foundational concepts from multiple disciplines such as anatomy, physiology, pathology and medicine, are taught together and related to shared learning outcomes[10,11]. At program level, horizontal integration reduces unnecessary duplication and helps students to understand how different disciplinary perspectives contribute to a single clinical domain[2,10].

Vertical Integration

Vertical integration connects foundational and clinical learning across larger timeframes, bridging the traditional separation between "pre-clinical" and "clinical" years[10,11,12]. It integrates basic science and clinical science around problem-based clinical scenarios. In practice, this often involves early and repeated clinical experiences, case discussions, and skills teaching that run alongside foundational learning, with progressively increasing responsibility in later years[9,12]. It encourages the students to have a holistic view of patients' problems and arouses students' curiosity and increases the effectiveness (achieving a desired effect) and efficacy (achieving the same but with minimum effort) of the teaching learning process[6].

Evidence suggests that vertically integrated curricula can be associated with improved perceived preparedness for work and for postgraduate training, and may support earlier career decision-making, although effects depend on the context and components which drive the change[12]. Vertical integration is commonly carried out through early clinical exposure and workplace-based learning experiences which provide a clinical context for foundational knowledge[13,14,15]. Community-oriented experiences can also contribute to vertical integration by linking clinical learning with population needs and interdisciplinary practice[16].

Though integrated teaching in medical education is commonly discussed using "horizontal" and "vertical" dimensions, contemporary models using additional dimensions such as sequencing, alignment of instruction with assessment, competency progression and graded clinical responsibility have also been described[9,10]. The key defining feature at program level is intentional linkage of learning outcomes, teaching activities and assessments designed such that students can connect concepts across disciplines and over time, rather than encountering them as isolated blocks[2,9]. Thus an integrated curricula should extend beyond the basic and clinical sciences to include humanistic and population perspectives, and embedding professionalism and ethics as longitudinal elements rather than stand-alone topics[3,9].

Spiral Curriculum approach that supports both Horizontal and Vertical Integrations

A spiral curriculum revisits key topics or themes repeatedly across the program, each time at a deeper level and with new clinical and contextual applications[17]. This approach supports both vertical and horizontal integration in a way that early foundational learning becomes a prerequisite for later clinical reasoning, while each revisit can reconnect disciplines within a

shared clinical theme[2,17].

At program level, spiral design can help manage complexity by sequential learning so that students move from foundational understanding (for example, basic anatomy and physiology) to clinical pathophysiology and, later, to diagnostic reasoning and management decisions within the same thematic thread[17]. Conceptually, this design aligns with integrated curricula that emphasize coherent progression rather than one-time exposure to the content[2,9].

Teaching-Learning Methods used in Integrated Curriculum

An integrated curriculum is strengthened when teaching methods actively require students to connect concepts and apply knowledge. Reviews describe a range of approaches used in modern medical education, including problem-based learning, case-based learning, team-based learning, simulation-based learning, e-learning and flipped classroom models[18,19,20].

Early clinical exposure can be supported through structured clinical encounters, simulation, and integrated skills modules[14,21] For example, integrated simulation-based early exposure has been described in cardiovascular physiology teaching, illustrating how foundational concepts can be linked to clinical skills and patient-focused scenarios early in training[21]. Workplace-based clinical placements represent another key setting where experiential learning can reinforce integration by encouraging learning in an authentic clinical context[15]. Although bedside teaching is commonly perceived as an authentic clinical context or applicable only to the hospital setting, its principles extend to any setting in which instruction occurs in the presence of a patient. This includes outpatient offices and long-term care facilities[22,23,24,25].

Potential Benefits of an Integrated Curriculum

***Improved coherence and clinical relevance*:** Integrated programs aim to make learning more meaningful by connecting foundational knowledge to clinical reasoning and practice across the curriculum[2,3].

***Stronger preparedness for clinical work*:** Vertically integrated curricula have been associated with graduates reporting greater preparedness for work and postgraduate training in some contexts[12].

***Earlier development of clinical reasoning*:** Early exposure to clinical problems can prompt students to synthesize information, generate hypotheses and practice structured thinking, especially when learning activities require application rather than recall[14,18].

***Support for active learning and engagement*:** When integration is paired with active learning approaches (for example, case-based sessions and simulation), students may experience clearer purpose and engagement because learning is anchored to clinical problems[18,21].

***Assessment and performance signals (context-dependent)*:** Some educational evaluations report improved examination performance and learner preference with integrated teaching approaches, but results are context-sensitive and depend on alignment between teaching, assessment and curriculum design[26].

***Professional and interdisciplinary perspectives*:** Whole-curriculum integration can also support the inclusion of humanism, population health and professionalism as longitudinal components rather than isolated units, reinforcing a broader view of clinical practice[3].

Challenges in Implementing Integrated Curriculum

***Faculty development and coordination*:** Program-level integration requires sustained collaboration across departments, shared ownership of outcomes, and staff development to support new teaching and assessment roles[13,27]. Without adequate support, educators may experience uncertainty about expectations and content boundaries[13].

***Curriculum overload and unintended stressors*:** Implementation can introduce risks such as perceived stress, tightly packed sequences of courses and increased assessment burden if integration is not carefully managed[27]. Content mapping and prioritization are necessary to prevent overload and to maintain depth where needed[2,27].

***Blueprinting of assessment alignment*:** If assessment continues to reward isolated recall rather than application, it can undermine integrated teaching by signaling that integration is not valued[2,9,13]. Integrated curricula therefore require blueprinting and assessment strategies that evaluate application, reasoning and competence progression across domains[2,9,13,28].

***Resources and organizational readiness*:** Integrated curricula often need investment in learning spaces, simulation capacity, technology infrastructure and administrative systems for scheduling and governance[13,27,29].

Recommendations for Successful Whole Curriculum Integration

1. ***Establish clear governance and shared outcomes***: Program leaders should define integration goals, map learning outcomes across years and disciplines, and use curriculum mapping to identify duplication and gaps[2,9,13].
2. ***Invest in faculty development***: Teacher training is the basis of any education system[30,31]. Staff development should address integrated session design, facilitation, assessment writing and collaborative teaching across disciplines[13,27].
3. ***Align assessment with integration***: Blueprint assessment to program outcomes and ensure evaluation emphasizes application, reasoning and longitudinal competence progression, not only discipline-specific recall[2,9].
4. ***Use spiral sequencing where appropriate***: Revisit core themes with increasing complexity and clinical application to support progressive learning and retention across years[2,17].
5. ***Monitor workload and learner experience***: Actively evaluate stressors, assessment burden and pacing, and adjust sequencing to avoid overload and to preserve learning quality[27].

Successful integration of medical teaching throughout the whole curriculum, with strong clinical relevance, is essential for holistic learning. The 21st century is marked by rapid advances in science and technology, driving individuals to continuously improve themselves and acquire new knowledge and skills[32,33]. Teaching and learning are human transactions involving the teacher, learner, and learning group in a dynamic relationship that creates opportunities for learning[34]. Moreover, teaching and assessment are inseparable -two sides of the same coin[35]. Educating an effective medical educator requires significant effort, and such educators must be able to relate to others not only as patients but as human beings in their entirety[33]. Therefore, policymakers and educational managers should invest extensively in developing educators' skills in integrated teaching across the whole curriculum[33]. This approach ensures that learning remains holistic and clinically relevant, preparing future professionals to meet the evolving demands of healthcare.

CONCLUSION

Integration of teaching in medical education has become a cornerstone of modern educational reforms. In practice integration of courses often incorporate both horizontal and vertical integration and it reduces the fragmentation of medical courses. Integrated curriculum helps to solve the problems of much of the irrelevance of the knowledge that students have to acquire through overcrowded, information-gathering traditional curriculum. Study of basic medical science subjects by integrating with early clinical contact as in vertical integration student see it as the relevance, shape attitudes, value of what they are learning. However, integration cannot be achieved by structural redesign alone. Successful implementation depends on curriculum mapping with blueprinting, faculty development, coordinated delivery, appropriate resourcing and careful attention to assessment and workload. When these conditions are met, an integrated curriculum can support learners in connecting foundational knowledge to clinical reasoning, professionalism and population perspectives across the full medical program.

Conflict of interest

The authors have no conflict of interest to declare.

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