Integrating Research and Teaching in Medical Education: Challenges, Strategies, and Implications for Healthcare

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Abstract

Introduction: The integration of research and teaching in medical education offers numerous benefits, fostering critical thinking and analytical skills in students. Institutions worldwide have recognized the significance of this nexus and have implemented initiatives to link teaching with discipline-based research, promoting interdisciplinary collaboration. This article aims to explore the challenges and recommendations for integrating research and teaching in medical schools and provide recommendations to overcome these challenges.

Methods: We conducted a comprehensive review of the literature to identify the common challenges faced by medical institutions in integrating research and teaching. PubMed, Scopus, Web of Science, ERIC, and Google Scholar databases were searched to assess the literature that met the study objectives with explicit inclusion and exclusion criteria. We also examined successful strategies employed by some institutions to promote research-teaching integration.

Results: The challenges identified include limited resources, the need to balance research and curriculum requirements, and the importance of cultivating a research-oriented institutional culture. Successful strategies involve curriculum updates, faculty motivation, and cross-disciplinary collaboration. Implementing strategies involve vertically and horizontally integrating research methodology throughout the undergraduate curriculum and cross-integrating traditional medical courses with other disciplines. Collaboration between universities, enterprises, and schools can enhance comprehensive cooperation.

Conclusion: To create a research-oriented learning environment, medical institutions should address these challenges and implement effective strategies. This approach will not only nurture research-oriented healthcare professionals but also advance medical knowledge for the benefit of patient care. By addressing these challenges and implementing appropriate strategies, medical institutions can create a research-oriented learning environment, nurturing research-oriented healthcare professionals and advancing medical knowledge to improve patient care.

Keywords: Integration, Research, Medical, Education, Teaching

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Introduction

The integration of research and teaching in medical education is a crucial aspect of modern medical education. Medical school is undergoing a transformation, moving away from traditional academic roots to a more professional landscape. This shift calls for the implementation of non-traditional methods in curriculum development to meet the ever-growing societal needs. While certain countries may differentiate between specialized research-focused institutions and those primarily focused on academic education, it is less common to encounter universities where education and research are tightly integrated as an indispensable requirement for graduating professionals capable of addressing the ever-growing societal needs. The integration of research and teaching is not only beneficial due to its positive impact on research-based learning, but it also holds transformative potential when education and research become inseparable partners, working in unison to shape a new generation of professionals (1).

Balancing research and teaching demands requires adequate resources and faculty expertise.

To overcome the time-intensive nature of research, medical schools should update their curricula to include research representation. Institutional culture plays a crucial role, necessitating the cultivation of research-friendly environments.

Faculty buy-in is essential for driving research teaching integration, and medical schools should motivate faculty members to engage in research activities. Careful curriculum design is necessary to integrate research effectively, and students' perspectives should be considered to enhance interest and engagement. Evaluating the impact of research-teaching integration is vital for improvement (2).

This review article explores the significance of aligning research and teaching methodologies to enhance the learning experience for medical students and foster a culture of inquiry, critical thinking, and evidence-based practice.

Methods

High-quality data that fulfilled the study objectives were included. Furthermore, exhaustive research on articles available in gateways and reputable databases such as PubMed, Scopus, Web of Science, ERIC, and Google Scholar were considered for literature review. Articles published in English from 2001 to 2023 were selected.

Gray literature, theses, abstracts, short correspondence, opinion papers, letter to the editor, commentary articles, non–English-language articles and literature dated before 2019, were excluded from the study.

We conducted a comprehensive review of the literature to identify the common challenges faced by medical institutions in integrating research and teaching. We also examined successful strategies employed by some institutions to promote research-teaching integration.

Results

The Research/Teaching Nexus

The integration of research and teaching in medical schools has several benefits. Engaging students in research activities helps develop critical thinking and analytical skills (1). The core of higher education lies in the relationship between academic education and research. The intellectual development of students and the synthesis of competencies among professors should be demonstrated within academic departments with a focus on the relationship between education and research (2). Effective integration should consider the different possible variants existing in disciplines related to the subject of study.

1-1- Institutionalization, Initiatives, and Support

Various institutions of excellence worldwide, such as the University of Manchester, University of Oxford, and University of Warwick, have recognized the importance of integrating education and research. They foster effective links between teaching and discipline-based research, promoting interdisciplinary collaboration and preparing students for the evolving healthcare landscape. Examples include the Centre for Excellence in Enquiry-Based Learning (CEEBL) in the University of Manchester, the Centre of Teaching and Learning in the University of Oxford and the Centre for Teacher Education in the University of Warwick, which serve as centres for student research "reinvention" (3).

Integration enhances interdisciplinary collaboration and prepares students for the evolving healthcare landscape. By integrating medical courses with other disciplines, such as medical engineering, students gain a broader perspective and are better prepared to work in interdisciplinary teams (1). Healey and Jenkins (4) refer to geographically active areas on the research-teaching integration, such as renowned centres of study in Europe, Australia, New Zealand, the United States, and Canada. They advocate for the establishment of strong connections between teaching and discipline-specific research within academic communities and departments. Some

researchers, support their proposals based on the criterion that research improves the effectiveness of teaching when treated as a cross-cutting axis of the latter. However, others, recommend caution in these processes as they have found elements that do not always allow for an effective evaluation of the integration in the contexts studied (5).

1-2- Research-Based Learning

Research-based learning enables students to understand the scientific method, evaluate evidence, and apply research findings to clinical practice (6). However, there is still a debate on how to integrate education and research effectively, as it requires careful attention to training tutors in the process. Siddaiah- and Singh (7) point out that research and education are still often established and evaluated separately, and this separation may adversely affect learning and the development of competencies. They define that the integration of education and research has sparked a continuous debate, especially given its complexity, which requires careful and intelligent attention to ensure, among other aspects, the successful training of tutors in the process.

The inclusion of undergraduate research in the curriculum of a Brazilian medical school could facilitate the development of research activities and create a closer relationship between teaching and research, according to a survey of 415 students (8). Incorporating hands-on, patient-focused research early in the medical school curriculum provides a valuable educational experience for students and can potentially influence their eventual choice to pursue careers in academic research (9).

1-3- Humboldtian Model of education and research integration

Annala and Mäkinen (10) embark on their exploration of necessary changes in modern universities by referencing the model of Wilhelm von Humboldt (1767-1835), where advanced research was seen as an integral and indistinguishable component of teaching and learning. However, they observe that despite significant references from the 19th century, the nexus between research and professional education, while impacting the current academic landscape, has not led to the emergence of a coherent model or its widespread application. Hence, there is a need to reconsider the balance between research and teaching in the context of 21st-century university education. An important aspect of this argument lies in the urgent need to value and develop a new teaching culture and emphasize that there is still no consensus on what it truly means to integrate research and teaching, a proposition built upon the

curriculum as the core of this union (11).

1-4- Features of student education in research-focused universities

Researchers from University College London, University of Freiburg and Utrecht University (12), in their examination of university excellence, evaluate the unique characteristics of 23 universities from the League of European Research Universities (LERU), which are highly research-focused, and the relationships involved in integrating education and research. They note that in these institutions, students not only learn to conduct research but also engage in research activities through active commitment to their social contribution. This commitment is fostered through the development of creative thinking, the capacity to solve complex problems, and an ethical awareness in their performance (13).

The integration of education and research requires adaptive strategies based on the experience of educators, primarily taking into account the characteristics present in the various contexts of study (5, 14). Achieving effective connections is not an automatic process; rather, it must be deliberately cultivated within teaching areas focused on this nexus.

Marsh and Hattie (11) reported a meta-analysis of the relation between teaching and research among university academics. They highlight the lack of correlation between teaching effectiveness and research productivity, stemming from a clear separation between teachers and researchers concerning the competencies that each professional group should possess in these categories (teaching and research). They assert that both groups need to acquire pedagogical and research competencies to facilitate the connection between education and research.

The strategies for integration

The pillars of lifelong education are learning to know (conceptual), learning to do (procedural), learning to live together, and learning to be (axiological). This analysis prompts consideration of integrating scientific research into the teaching-learning process. However, despite extensive citations of various researchers, this integration remains a somewhat unclear area with insufficient propositions for curriculum planning (15).

There are various barriers, particularly within internal university structures and processes, as well as in the organizational culture of institutions. In many cases, there is a traditional overemphasis on considering research at levels beyond what students should undertake. Consequently, students end up engaging in superficial research

practices disconnected from the social context, without the use of didactic strategies for research-based education. Thus, there is a need to develop strategies that enhance synergies between research and education (16).

Effective coordination is essential to overcome fragmentation within the medical education system, ensuring appropriate recognition for teaching and research across all clinical settings.

To enhance the careers of clinician-educators, it is crucial to develop valid and reliable measures of teaching excellence. Combined medicine-education degree programs may prove beneficial, and medical education research should be integrated into the mainstream of medical research, ultimately leading to better-educated doctors and improved patient care (17).

The distinction and promotion of excellent university teachers and leaders focused on the integration of research and teaching, fostering a culture of quality and improvement, and encouraging students to become leaders and change agents constitute essential elements in modern universities. Integrating education and research lies at the core of the relevance of higher education. It is an intentional process that requires indispensable management and is expressed through a nexus that defines the development of a contextually constructed process. This process is coordinated by formalized structures that enable the formation of scientific thinking through dialectical relationships that integrate the creative logic of knowledge construction and the hermeneutic logic of investigative formation for professionals.

Studies on curricular models highlights key elements that are still under development today, such as the need for innovative and contextualized curricular models and the trend towards seeking models with a focus on practical application, particularly for social contribution (15).

Similar considerations are echoed by Meza (18), who advocates for a competency-based curriculum supported by different types of knowledge.

Structuring the curriculum through modular organization aims to integrate teaching, research, and services in addressing social problems closely related to professional practice as an epistemological postulate. Each module is designed in a way that allows students to act upon problems for their transformation (19).

There are substantive elements that should be considered in the curriculum, where research is specified as a creative process through the establishment of what is termed thematic and problematic cores. These cores should not be considered in isolation but rather materialized in investigative projects that constitute support for sociocultural mediation (20).

Researchers advocate a shift from content distribution to a pedagogy of knowledge construction integrated into social practice. In the context of medical education, Karina D Torralba et al., address curricular formation and propose strategies employing a hermeneutic perspective with methodologies such as problem-based learning and emphasize project-oriented learning (21). However, such elements should also consider possible transformations in the curriculum. These transformations could involve the integration of central cross-cutting axes or themes, where research tools play a substantive role in the education process (22).

One of the limitations in the study plans of medicine programs is the lack of specification of investigative skills to be acquired within each discipline, hindering the systematic organization of these contents. To address this, curriculum subjects, disciplines, tutors, and student organizations must intensify their efforts to increase motivation and participation of students in student scientific forums, thereby contributing to the further development of research skills (23).

In Latin America, Pulido-Medinal highlights a common issue of perceived limitations on scientific research training in Mexican undergraduates, mainly due the weak emphasis on research training compared to clinical training and medical assistance. This observation significantly impacts the comprehensiveness of professional training, especially in institutions where many faculty members lack research experience (24). These observations align with the findings of Bayarre et al., who emphasize the need for greater integration of research-related topics into the curriculum and the development of workplace-based education as a fundamental element in training. This integration is crucial to produce well-rounded professionals capable of addressing health-related issues (25).

These perspectives are further supported by systematic literature reviews, which highlight that merely including research methodology as a subject in the curriculum is insufficient. True integration demands the harmonious inclusion of these methodologies to facilitate a holistic education for students pursuing medical careers (26, 27).

To address the issue of research-teaching integration, there is a need to explore new approaches that may require functional changes beyond what can be directly implemented by the teaching staff. Decisions from university

stakeholders are essential in this regard. However, intentions alone will not suffice to overcome this challenge. It calls for a response regarding the role high-level educational institutions should play. Strong strategic university leadership must be guaranteed, and an appropriate balance in the integration process cannot be achieved through isolated and discontinuous actions. Instead, it requires the institutionalization of these processes (1, 20, 28).

Challenges and Recommendations

The challenges in integrating research and teaching in medical education are multifaceted, but not insurmountable. By understanding and addressing these challenges, medical institutions can create an environment that nurtures research-oriented healthcare professionals and advances medical knowledge to improve patient care.

Balancing Research and Teaching Demands

Limited resources, including funding, infrastructure, and faculty time, pose significant challenges in integrating research and teaching in medical education (5, 7, 8). One challenge is the lack of adequate teaching time and resources dedicated to research. To overcome this, medical schools should ensure the provision of sufficient teaching time and resources, including the presence of senior academics with expertise research.

Balancing Research and Curriculum Requirements

The time-intensive nature of research can impede its integration into a packed medical curriculum. Another challenge is the status, content, delivery, and assessment of research teaching in medical schools. To address this, medical schools should regularly review and update their curricula, consult with stakeholders, and ensure that research adequately represented in the curriculum (1, 29).

Institutional Culture

Nurturing a research-oriented environment is a pivotal for successful research-teaching integration. In the realm of research productivity, research environments or cultures are considered to be the primary determinants with the most influential predictors (30). Research environments play a crucial role in determining research productivity and should be carefully cultivated within medical institutions. While some narrative and systematic reviews have attempted to pinpoint the attributes of research-favourable environments, these evaluations have overlooked the intricate contextual nuances and the diverse array of environmental factors at play (31).

Faculty Buy-In

Encouraging faculty involvement in research is instrumental in driving research-teaching integration. However, resistance or lack of faculty buy-in can hinder progress (32). The observation of diminishing numbers of physician-scientists, coupled with shortages, prompted the implementation of measures aimed at mitigating or halting this decline. Medical schools should implement measures to motivate and engage faculty members in research activities.

Curriculum Design

Curriculums frequently suffered from an excess of basic and clinical science subjects, leaving limited space for research instruction and learning. Typically, research participation was relegated to an extracurricular activity, with students lacking adequate preparation in fundamental concepts of epidemiology, statistics, and scientific investigation (27, 29).

Integrating research into the medical curriculum requires careful planning and curriculum design. The significance and establishment of human medical research in the realm of medical education is well-recognized. However, the subtleties concerning instructional methods and pertinent results for undergraduate medical students require further analysis (29). Strategic planning and consideration of various integration strategies are essential to ensure a holistic education for medical students.

Student Perspectives

Enhancing student interest, engagement and motivation in research are critical in fostering a research-oriented learning environment. Despite the increasing focus on student engagement within medical education, research on this topic remains disjoint. While cognitive engagement is often seen as a beneficial factor for academic success, its association with other facets of engagement remains a subject of debate (32). Measures to increase student engagement and cognitive involvement should be explored.

Evaluation and Assessment

Measuring the impact of research-teaching integration is essential to assess its effectiveness and make evidence-based improvements. The development of appropriate assessment tools, measuring complex learning outcomes, capturing the long-term impact, and defining meaningful metrics for success, are definite genuine challenges.

Implementation Strategies

Implementing the integration of research and teaching in medical schools requires careful planning and execution. One strategy is to vertically and horizontally integrate research methodology throughout the undergraduate curriculum (33, 34). This means incorporating the principles and practice of research from the early stages of medical education and reinforcing them throughout the course (34). Additionally, integration can be achieved by cross-integrating traditional medical courses with other disciplines and specialties (28). For example, integrating medical engineering courses with clinical medicine can provide students with a comprehensive understanding of the application of technology in healthcare (28, 33, 34). Moreover, fostering collaboration between universities, enterprises, and other schools can foster all-around and in-depth cooperation. This may involve establishing integrated medicine academic organizations, publishing integrated medicine series, and setting up integrated medicine institutes (34). The successful implementation of these new approaches to integrate training and research in the medical sciences depends on the dedication, responsibility, commitment, and teamwork of the current instructors and administrators who are facing this challenge (35). Nevertheless, it is undeniable that the assurance of progress and continuity significantly depends on the quality of the dynamics involved in the development of curricula by professors and students across diverse educational, clinical, and research settings within the healthcare system. Additionally, the sustainability and oversight provided by the institution's leadership play a vital role in ensuring the success of these integration efforts.

Conclusion

The integration of research and teaching is at the core of the professional training and medical education. This integration is expressed in a connection that requires the development of a contextualized constructive process under the coordination of formalized structures that enable the formation of scientific thinking through dialectical relationships. These relationships, integrated into the curriculum, encompass both the logical creativity of knowledge construction and the hermeneutical logic of research training for professionals. To create a research-oriented learning environment, medical institutions should address these challenges and implement effective strategies. This approach will not only nurture research-oriented healthcare professionals but

also advance medical knowledge for the benefit of patient care.

Authors' Contribution

All authors contributed to the discussion, read and approved the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated resolved.

Conflicts of Interest

The authors declare no conflicts of interest.

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