ABCS HEALTH SCIENCES

REVIEW ARTICLE

OPEN ACCESS

Medical education: the historical framing of the medical curriculum and the challenges of renewal in the 21st century

Iago Gonçalves Ferreira[1], Márcia Rosa da Costa[1], Silvio César Cazella[1]

[1]Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA) – Porto Alegre (RS), Brazil

ABSTRACT

The study proposes a critical and exploratory analysis of the historical formation of the medical curriculum, including the pedagogical models and contemporary challenges. Contemporary Medicine has faced challenging transformations in the 21st century, such as population aging, technological and scientific advances, epidemiological transition, wide access to informationby society. The knowledge society requires new generations of physicians to develop interdisciplinary professional skills and the technical-scientific domain. Given the ongoing transformations in contemporary medical practice, it is up to the academic community to deconstruct obsolete teaching paradigms, to foster the design of new pedagogical practices, congruent with the new medical profile desired in the 21st century.

Keywords: Education, medical; Education, Medical, Undergraduate; Faculty, Medical; Internship and residency; Medicine.

How to cite this article: Ferreira et al. Medical education: the historical framing of the medical curriculum and the challenges of renewal in the 21st century. ABCS Health Sci. 2022;47:e022304 https://doi.org/10.7322/abcshs.2020180.1626

Received: Oct 20, 2020
Revised: Mar 03, 2021
Approved: Mar 05, 2021

Corresponding author: Iago Gonçalves Ferreira - Universidade Federal de Ciências da Saúde de Porto Alegre - Rua Sarmento Leite, 245 - Centro Histórico - CEP: 90050-170 - Porto Alegre (RS), Brazil – E-mail: iago_goncalves14@hotmail.com

Declaration of interest: nothing to declare.

INTRODUCTION

Medicine represents an abstract social concept, of a scientific and humanitarian character, materialized through its concrete agents, the doctors, professionals responsible for the care, diagnosis, and treatment of human diseases. Thus, doctor and medicine represent inseparable concepts, in the sense that the doctor makes medicine and medicine makes the doctor[1].

The practice of medicine presupposes the overcoming of challenges beyond the diagnosis and treatment of diseases, encompassing ethical and humanistic competencies[1,2]. However, in addition to the intrinsic challenges of the professionMedicine has faced challenging transformations in the 21st century arising from changes in the epidemiological profile of diseases, population aging, technological and scientific advances with the discovery of new diagnostic methods, and treatments. Moreover, the easy access to technological resources and health information by individuals demands physicians a greater ability to establish relationships based on a broad and horizontal dialogue with patients[1,3,4].

Faced with the complexity of current medical practice, the process of professional training takes on substantial importance for health systems and society. Thus, medical schools are required to train physicians capable of dealing with this new reality with critical thinking, technical and scientific knowledge, interpersonal communication skills, and teamwork[3,4].

Medical education is the result of a historical process of construction that reflects the various socio-cultural and economic influences of society. In this sense, the analysis and reflection about pedagogical practices represent fundamental attributes to face the new challenges in medical education[2,5]. Thus, this study proposes a discussion about the historical trajectory of medical education, considering the challenges arising from the social and technological transformations of the 21st century.

The formation of Western medical schools: from the antagonism between physicists and surgeons to Flexner's standardization and the biomedical paradigm

From the Middle Ages until the 18th century, medical education expressed a climate of tension between theoretical and practical approaches. The medical activity was performed by two essentially distinct groups: physicists, university-trained doctors, considered "educated gentlemen"; and surgeons, professionals trained in the practice, equated to barbers and other liberal workers of modest trades and with less social recognition[1,5].

During the 19th and 20th centuries, European and North American medical schools presented heterogeneous curricula, which varied according to the local traditions of each country. While Dutch and German curricula attributed more importance to scientific research and academia, British, French, and American medical schools valued assistance and clinical practice[5].

Faced with this situation, in 1910, the American social researcher and educator Abraham Flexner published the book "Medical Education in the United States and Canada", based on the results of an evaluation program of medical schools in the United States and Canada. Known as the Flexner Report, this publication triggered a profound transformation in medical education in the United States throughout the 20th century, spreading throughout the Americas and Europe in the following decades[6-8].

The Flexner report recommended teaching centered in the hospital environment with curricular organization segmented in learning cycles, the valorization of scientific research, and the full dedication of the professors. Thus, the medical curriculum should be structured in two phases: preclinical phase, focusing on basic laboratory sciences; and clinical phase, focusing on applied clinical sciences[6-8].

Such characteristics were adapted to the medical advances of that time,when infectious diseases became identifiable and preventable, and pathological anatomy guided medical reasoning, favoring the predominance of the conception that without identifiable lesion and/or germ there is no disease[6-8]. Throughout the 20th century, the biomedical conception is consolidated, promoting important advances such as the control of infectious diseases and the increase in life expectancy[7,8].

Medical Education in Brazil: from real origins to national guidelines

Until the early nineteenth century, due to the Portuguese colonization rules that did not allow the establishment of higher education institutions in its colonies, Brazil had no universities, distinguishing itself from other colonies in America. This situation lasted until the arrival of the Portuguese Royal family in Brazil, which provided the creation of the first medical school in Brazil: the School of Surgery of Bahia, founded on February 18, 1808[9-11] (Figure 1).

Figure 1: Faculty of the Bahia School of Medicine at the Federal University of Bahia. Salvador, Brazil, 2020.

The first medical schools in Brazil adopted teaching models markedly influenced by two antagonistic European theoretical currents: the French school, with an intense clinical hospital focus; and the German school, with a greater focus on academia and laboratory research[6,12]. After the University Reform of 1968, the flexnerian model acquired predominance in Brazilian medical education, reorganizing the medical curriculum in cycles, focusing on the hospital scenario[7,9].

The political re-democratization and the 1988 Constitution initiated a process of reformulation of Brazilian higher education, which culminated, in medical schools, with the publication of the Brazilian curricular guidelines - Diretrizes Curriculares Nacionais (DCN) for Undergraduate Medical Courses, in 2001. The DCN established new pedagogical parameters, breaking with flexnerian precepts and stimulating the integration between humanities and biomedical contents[6,7,13].

Subsequently, in 2014, the reissue of the DCN recognized the importance of the social determinants involved in the health-disease process, reinforcing the need for critical and reflective thinking, autonomy, and active participation of students. The DCN has encouraged universities to rethink their teaching methodologies to meet the medical profile demanded by the contemporary health situation[11,14].

21st Century Medicine: the challenges of training doctors in a globalized world

The techno-scientific, socio-economic, and epidemiological transformations that have occurred in the 21st century have given rise to new challenges for medical education and universities[7,8]. Among the main transformations are the increase in the prevalence of chronic degenerative diseases - strongly associated with lifestyles and social determinants - that have led to changes in the understanding of the health-disease process and medical approaches[7,8], in addition to the expansion of scientific and technological knowledge that has provided a vast diversity of diagnostic and therapeutic procedures of increasing complexity[15].

In this scenario, universities have been demanded to promote curricular reforms that overcome old teaching models and adapt to the needs of contemporary society[15]. However, such reformulations presuppose the facing of several challenges of varying order and complexity, which the authors propose to delimit in three classifications: institutional challenges, related to the pedagogical policies and guidelines of universities, pedagogical challenges, related to the teaching and learning process, and the dynamics of relationships between professors and students, and conjunctural challenges, represented by the socioeconomic contexts of societies and the structure of health systems (Figure 2).

The curricular challenge: renewing pedagogical practices and giving new meaning to learning

The concept of curriculum presents diverse conceptions, being understood as the documentary record that represents the educational intentionality of an institution, or adopting a broader meaning, reaching the entire university context with its plurality of thoughts and attitudes[2].

From this perspective, the university curriculum is constituted by the conjunction of elements of the formal and informal (parallel) curricula, the first composed of the pedagogical guidelines, courses, and internships defined by the educational institutions, and the second formed by the free initiative activities of students, such as participation in academic interest groups, research groups, extension projects, among others[16].

According to the guidelines of the World Federation for Medical Education (WFME) - published in 2020 in the document "Basic Medical Education WFME Global Standards for Quality Improvement" - the political-pedagogical projects of medical courses should include aspects such as planning and structure of disciplines, entry requirements, duration and organization of the program, evaluation system, teaching and learning methods, and desirable professional profile[17]. It is worth mentioning, however, that the elaboration of university curricula is an arduous challenge,

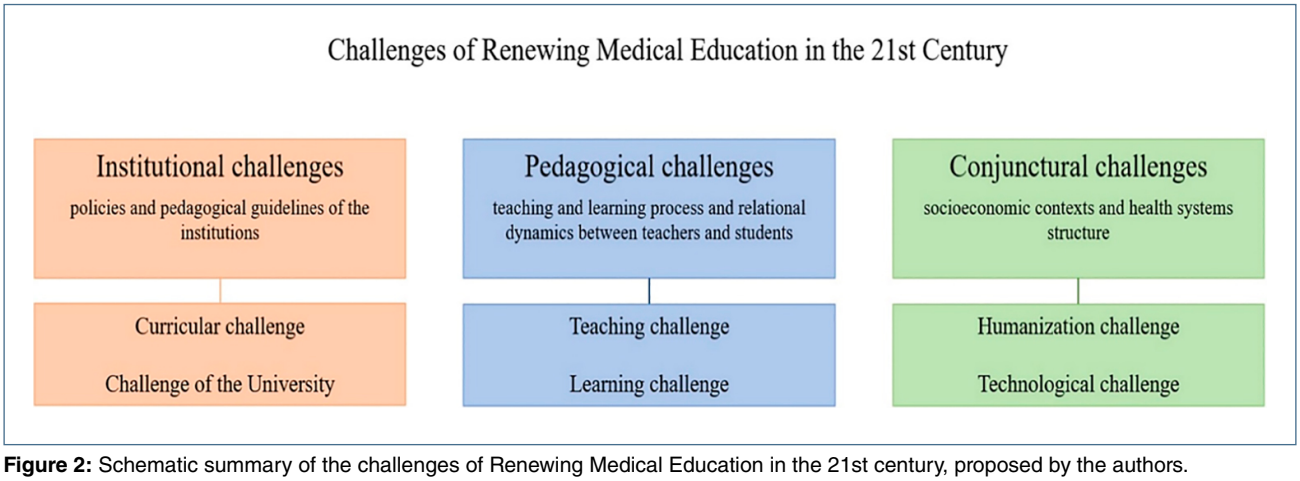

Figure 2: Schematic summary of the challenges of Renewing Medical Education in the 21st century, proposed by the authors.

as it must articulate the learning objectives and educational resources with the vocations and interests of the students[11,12].

The reformulation of medical education in Brazil gained greater momentum after the DCN for Undergraduate Medical Courses reinforced the importance of critical thinking and the principles of active learning in medical training[11]. Such conception, however, emerges still in the 1960s with the emergence of the first alternative medical education models to the flexnerian paradigm, proposing the teaching and learning process as a collaborative construction between educator and student, based on the relations between students' previous knowledge, their social environment, and new concepts learned[2,18].

In active methodologies, the construction of knowledge derives from critical analysis and constant search for information so that students develop their ability to 'learn how to learn', interacting among peers and improving their interpersonal and teamwork skills[18]. On the other hand, it should be noted that active methodologies cannot be understood as a unique solution or "magic" to face the current dilemmas of medical education, nor should they be implemented as a guide or recipe.

From another perspective, the process of renewal of medical education cannot disregard the contributions of the parallel curriculum for professional training. This curriculum is composed of the activities performed by the students apart from the institutional disciplinary structure, including student and sports associations, internships, scientific initiation programs, monitoring, language courses, among others[16,19].

Through these activities, the undergraduates have the opportunity to develop cognitive and practical skills, as well as interpersonal skills and humanitarianism, the latter two being essential attributes to the medical profile that is expected to emerge from the universities[16]. In academia, such educational practices are also known as 'hidden curriculum', which deserves due attention, since it can infer the inadequate valuation of knowledge, values, practices, and ideologies, implicitly and subjectively[20].

Considering these aspects, university education should not be restricted to the development of technical and academic attributes, to meet only the specific objectives of professional performance. On the contrary, it should allow the construction of professionals capable of dialoguing and reconciling scientific knowledge with social reality.

The challenge of humanization: the crisis of the biomedical model and the emergence of integrality

The changes in the patterns of diseases and population aging have attributed greater importance to the role of socioeconomic determinants in the health of individuals. At this conjuncture, the adherence of individuals to treatments and changes in lifestyles demands new forms of approach from physicians. Thus, the paradigm of integrality emerges as a new ideological conception that advocates for the humanistic character of Medicine, replacing the focus on the disease with an emphasis on health[7,8].

The integrality model, or biopsychosocial model, provides a broad view of the disease process, considering the social, cultural, and psychological aspects of the sickperson. In medical education, integrality requires that students develop relational competencies and critical analysis of reality, becoming committed to the transformation of the complex social contexts in which they will be immersed[7,21].

In the transition between the 20th and 21st centuries, this new conception of health has stimulated the renewal of political-pedagogical projects of medical schools, through the incorporation of the concept of Medical Humanities, which consists of an interdisciplinary set of contents whose purpose is to develop attributes such as engagement, integrity, respect, empathy and critical thinking among medical students, essential attributes for medical practice[2,21].

The technological challenge: incorporating new tools and resources into teaching practice and medical care

Information and Communication Technologies (ICTs) have revolutionized the way individuals interact, search and exchange information, thus fostering new ways of acting, thinking, and learning - a cultural context known as the Knowledge Society[22,23]. Information resources have revealed the enormous potential for addressing health dilemmas, as well as for revitalizing teaching-learning models[24].

In the educational field, distance education - through digital technologies and virtual environments - has enabled the interaction between educator and learner even when separated in space and time[23,25]. In addition, the use of digital media has strongly impacted the quality of teaching and health care, through the sharing of scientific productions, clinical protocols, and knowledge that encouraged the exchange between students, professor, and health care teams[4,26].

In the healthcare field, telemedicine has emerged, a technology that allows the sharing of medical information for diagnostic, therapeutic, scientific research, and continuing education purposes[27,28]. Another innovative resource is artificial intelligence, a technology that seeks to simulate the human capacity to solve problems based on medical data, to avoid diagnostic errors and iatrogenic procedures[29,30]. However, it should be noted that, despite its great potential, the use of artificial intelligence disseminated by health systems still lacks structural and logistical resources, as well as the solution of ethical-professional dilemmas.

Despite scientific and technical advances, the role of the physician should not be relegated to a mere technology provider, since technological resources can never replace the bond and trust established by the doctor-patient relationship[29]. On the contrary,

by expanding the diagnostic capacity and providing greater medical knowledge, the ICTs can favor human contact, requiring greater emotional intelligence on the part of future physicians[30]. Given this, medical training must respond to the new paradigms of the Information Age, incorporating new technologies without neglecting, however, communication and humanistic skills.

The teaching challenge: professor training as a strategy for educational transformation

In contrast with the recognition of the importance of good physicians by the academic-scientific community, the need for good medical professors is still quite neglected. The teaching staff in Brazilian universities is characterized by the presence of professionals with notable knowledge and who stand out in their field of training, either for their scientific production or their quality of care[12,18,31].

However, pedagogical skills are attested by the institutions only by proof of a strict sense postgraduate degree - Masters and Doctorate[12,18,31]. However, historically, the graduate programs have privileged the development of research and the scientific production in detriment to the didactic-pedagogical formation, thus prioritizing the formation of excellent researchers, but without the adequate skills for teaching[32]. This vision is based on the premise that specialists with deep knowledge in their area of training would also be good educators with guaranteed pedagogical competence. However, many of these professionals enter the academic environment with limited didactic and pedagogical knowledge and skills[12,31].

In medical schools, this scenario is even more prominent, with professionals being admitted with minimum requirements, such as a medical degree and a residency title[12,31]. Thus, due to the circumstantial access to university, many medical professors tend to consider teaching as a secondary activity, showing little interest in pedagogical discussions and paying more attention to research and assistance activities. Consequently, they tend to be more resistant to new teaching paradigms and often reproduce traditional pedagogical visions[18,31,33].

On the other hand, teaching in higher education also requires the mastery of specific areas of knowledge, as well as constant updating through periodicals and scientific events, which, however, does not exempt medical specialists from the commitment of "teaching professionalization" based on the recognition of the main epistemological and pedagogical currents and the improvement of their educational practice[18,31,33].

In this conception, it is also up to the universities to recognize the importance of the pedagogical training of their professors as part of the curricular renewal process, developing initiatives that promote the "professionalization of teaching", either indirectly, through selection criteria that value pedagogical training and degrees in graduate programs in the areas of education, or directly, through incentives and pedagogical training provided by the institutions. However, it is worth pointing out that pedagogical practices must be understood in a real and contextualized perspective, not as mere theoretical and normative constructs.

The learning challenge: motivating and engaging students to actively participate in the construction of knowledge

The choice of a medical career and the admission into a medical course can be motivated by numerous aspirations, the humanitarian interest in contributing to the health of other people, the curiosity about the human organism, the intellectual challenge, among others[34]. However, as important as the initial motivations are the circumstances that maintain the engagement and enthusiasm of students with the chosen profession.

Students' perceptions of themselves and their reality strongly influence their motivation to engage in educational activities. This represents one of the main determinants of the teaching-learning process, being shaped by intrinsic factors, related to the individual, and extrinsic factors, related to the teaching environment[19,35].

Among the intrinsic motivational aspects, the initial interests in the medical field, expectations regarding the job market and career, and identification with the content, teaching strategies, and disciplines of the medical curriculum stand out. As for the extrinsic aspects, they are related to the educational resources offered by the university, the professors' commitment and engagement, and the wealth of experiences provided by the university context[16,19].

Given this complex motivational arrangement, universities and educators must recognize the importance of knowing and instigating the interests of their students, promoting meaningful learning experiences. Moreover, they must consider the accommodation of their guidelines to the characteristics of the current students generation, immersed in a technological and interconnected world in which the sharing of ideas occurs through collaborative relationships[4,18,19,36].

The university challenge: professor training and curricular interdisciplinarity

The transformations in the sociocultural context of health have demanded that universities change their educational paradigms, adopting critical reflection and active participation as teaching-learning strategies. Despite the essential role of professors, attributing to them the total responsibility for such changes, disregarding the political-institutional framework in which they are immersed, would be a reductionist and unmeasured understanding[37].

In this sense, we highlight the responsibility of medical schools in the process of institutionalizing faculty development through training activities and spaces for discussion among peers. The exchange of experiences among professors represents an opportunity to expose ideas, recognize weaknesses and difficulties, as well

as to deconstruct entrenched concepts[38,39]. Moreover, the educational institutions must integrate the professionals' permanent and continued education to the political- pedagogical projects of the courses, providing the availability of time, regularity, and adequate planning of the training activities. Another relevant aspect consists of the continuous evaluation of the professionals and the formative actions, diagnosing weaknesses and potentialities, to encourage initiatives for change[38].

In recent decades, the literature and the academic community have widely debated the need for the renewal of traditional teaching-learning models in medical education. Active methodologies and interdisciplinary curricula have been disseminated as widely as superficially, in many cases. This paradox arises from the idea that the reformulation of pedagogical projects *per se* would be able to break with archaic paradigms rooted in university structures[37-39].

Sometimes, the idea of interdisciplinarity in medical schools is understood from initiatives such as the fusion of basic and clinical disciplines, the intercalation between theoretical classes and internship fields, or even, the creation of "introductory" and "integrated" modules[40].

These initiatives reinforce the mistaken stigma that educational transformations can be implemented vertically and bureaucratically by institutions[40]. However, effective educational renewal presumes the abandonment of fragmented and compartmentalized knowledge under the Cartesian aegis, giving way to multisystemic, interdependent, meaningful knowledge - interdisciplinary knowledge[38,39] (Table 1).

Table 1: Summary of the challenges of medical education in the 21st century

Challenges of medical education in the 21st century		
	Features/Obstacles	**Solutions/Proposals**
Curriculum Challenge	The predominance of traditional curricula with a hospital-centric focus, favoring reductionist, fragmenting, and biologistic views of the health- disease process. Education focused on the professor and the transmission of knowledge, without stimulating students' critical and reflective thinking.	Curricular reform with an interdisciplinary focus, valuing disciplines of medical humanities, as well as evidence-based medicine. Adoption of active methodologies that allow the active participation of students as protagonists in the construction of their knowledge.
Challenge of Humanization	The predominance of the biological vision, understanding the health-disease process as restricted to the organic and pathological aspects. The preponderance of the premise: "Without lesion or identifiable microorganism/infection there is no disease". Focus on diagnostic methods and drug treatments, to the detriment of the doctor-patient relationship and psychosocial aspects related to diseases.	Appreciation of the social, cultural, environmental, and ethical determinants in the health-disease process. Improved communication skills and recognition of the person-centered approach as a guiding strategy for medical care.
Technology Challenge	Difficulty in incorporating Information and Communication Technologies (ICTs) in pedagogical practice. A new generation of medical students, "digital natives", who show full abilities in the use of ICTs and demand from the university and professors the use of new teaching methodologies, more participative and stimulating.	Assimilation of technological resources in medical education, adopting the use of distance education, instant communication applications, videoconferences, among other ICTs in the teaching-learning process.
Teaching Challenge	Medical professors, often start their teaching careers without adequate pedagogical and didactic training. Higher education institutions prioritize academic productivity and assistance training as criteria for selecting professors, to the detriment of teaching degrees/training. Overvaluation of research and assistance, lack of exclusive dedication of professors to universities, and lack of interest in participating in discussion forums on medical education. Professors´difficulty in incorporating new teaching and learning methodologies into pedagogical practice.	"Professionalization" of professors through selection criteria that valorize pedagogical training or through incentives provided by the institutions themselves Recognition by educational institutions that curricular reforms and adherence to new pedagogical models must start with the training of professors who are engaged and aware of the importance of pedagogical discussions in medical education. Adoption of innovative teaching methodologies, valuing the active construction of knowledge, and stimulating the development of students' interpersonal and professional skills.
Learning Challenge	Student motivation manifests itself as one of the main determinants of the teaching-learning process. The current generation of medical students, immersed in an interconnected world with collaborative and horizontal relationships, contrasts with previous generations - from which most of the current faculty members come - in which strongly vertical and hierarchical relationships predominated.	Educational institutions and professors should pay attention to the importance of knowing and instigating their students' motivation, promoting meaningful learning experiences. Adoption of more flexible, collaborative, and horizontal relational models in academia.
University Challenge	Professors have an essential role in the educational transformation demanded of universities, however, institutions must assume their part in the process of renewing teaching-learning practices and perspectives. Political-pedagogical projects focused on the conjunction of disciplines and "blending" of basic and clinical cycles, limiting educational transformation to mere curricular reformulation.	Institutionalization of professor training, through the incorporation of permanent and continued education in the institutional political- pedagogical projects, ensuring the availability of workload, regularity, and adequate planning for training activities. Abandonment of fragmented and compartmentalized knowledge, under the Cartesian aegis, fosters the development of interdisciplinary knowledge among professors, students, and the entire academic community.

Final considerations

Socio-cultural and technological transformations in the 21st century have revealed a challenging conjuncture for medical practice. Changes in disease patterns, in the lifestyles of populations, and the emergence of information technologies have broken paradigms and dogmas considered untouchable within medicine.

The democratization of knowledge has established new patterns of doctor-patient relationships; previously paternalistic and verticalized, these relationships now occur in a more horizontal and accessible way. Social skills have acquired greater significance since patients' adherence to medical recommendations presupposes dialogue, cultural competence, and ethical attitudes.

The implementation of technological innovations in health systems, especially in supplementary care, has required more effective and collaborative learning and work processes from physicians. The increase in demand and the pressure to reduce costs have imposed on professionals the need of improvement of procedures and the reduction of waste and unnecessary conduct, favoring professional practice based on continuous updates, information management, and Evidence-Based Medicine.

Faced with this challenging scenario, medical schools, and the academic community should engage in a broad debate of ideas and thoughts, deconstructing obsolete paradigms and proposing new teaching-learning strategies. Thus, this narrative review aimed to discuss the views surrounding the challenges of renewal of medical education in the 21st century from the perspective of six different domains: curricular challenges, humanization challenges, technological challenges, teaching challenges, learning challenges, and university challenges, summarized in Table 1.

The globalized world and the Knowledge Society impose on new generations of physicians the development of more interdisciplinary and integrative professional competencies, which go beyond the technical-scientific domain once required.

REFERENCES

1. Miranda-Sá Júnior LS. Uma introdução à medicina: o médico. Vol. 1. Brasília: Conselho Federal de Medicina, 2013.
2. Boas LMV, Daltro MR, Garcia CP, Menezes MS. Educação médica: desafio da humanização na formação. Saude Redes. 2017;3(2):172-82. http://dx.doi.org/10.18310/2446- 4813.v3n2p172-182
3. Khay-Guan Y. The future of medical education. Singapore Med J. 2019;60(1):3-8. http://doi.org/10.11622/smedj.2019003
4. Jason H. Future medical education: Preparing, priorities, possibilities. Med Teach. 2018;40(10):996-1003. https://doi.org/10.1080/0142159X.2018.1503412
5. Custers EJFM, Cate OT. The History of Medical Education in Europe and the United States, Concerning Time and Proficiency. Acad Med. 2018;93(3S): S49-54. https://doi.org/10.1097/ACM.0000000000002079
6. Almeida Filho N. Reconhecer flexner: inquérito sobre produção de mitos na educação médica no Brasil contemporâneo. Cad Saude Publica. 2010;26(12):2234-49. https://doi.org/10.1590/S0102-311X2010001200003
7. Nogueira MI. As mudanças na educação médica brasileira em perspectiva: reflexões sobre a emergência de um novo estilo de pensamento. Rev Bras Educ Med. 2009;33(2):262-70. https://doi.org/10.1590/S0100-55022009000200014
8. Emanuel EJ. Reforming American Medical Education. Milbank Q. 2017;95(4):692-7. https://doi.org/10.1111/1468-0009.12291
9. Neves NMBC, Neves FBCS, Bitencourt AGV. O ensino médico no Brasil: origens e transformações. Gaz Med Bahia. 2005;75(2):162-8.
10. Fávero MLA. A Universidade no Brasil: das origens à Reforma Universitária de 1968. Educ Rev. 2006;28(1976):17-36. https://doi.org/10.1590/S0104-40602006000200003
11. Machado CDB, Wuo A, Heinzle M. Educação Médica no Brasil: uma análise histórica sobre a formação acadêmica e pedagógica. Rev Bras Educ Med. 2018;42(4):66-73. https://doi.org/10.1590/1981-52712015v42n4rb20180065
12. Costa NMSC. Docência no ensino médico: por que é tão difícil mudar? Rev Bras Educ Med. 2007;31(1):21-30. https://doi.org/10.1590/S0100-55022007000100004
13. Brasil. Ministério da Educação. Conselho Nacional de Educação. Câmara de Educação Superior. Resolução CNE/CES nº4 de 7 de novembro de 2001. Institui diretrizes curriculares nacionais do curso de graduação em Medicina. Available from: http://portal.mec.gov.br/cne/arquivos/pdf/CES04.pdf.
14. Brasil. Ministério da Educação. Conselho Nacional de Educação. Câmara de Educação Superior. Resolução CNE/CES nº 3 de 20 de junho de 2014. Institui as Diretrizes Curriculares Nacionais do Curso de Graduação em Medicina. Available from: http://portal.mec.gov.br/conaes-comissao-nacional-de-avaliacao-da-educacao-superior/323-secretarias-112877938/orgaos-vinculados-82187207/20138-ces-2014.
15. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet. 2010;376(9756):1923-58. https://doi.org/10.1016/S0140-6736(10)61854-5
16. Ferreira IG, Carreira LB, Botelho NM, Souza LEA de. Atividades extracurriculares e formação médica: diversidade e flexibilidade curricular. Interdiscip J Health Educ. 2016;1(2):114-24. http://doi.editoracubo.com.br/10.4322/ijhe.2016.022
17. World Federation for Medical Education (WFME). Basic Medical Education WFME Global Standards for Quality Improvement: the 2020 revision [Internet]. 2020. Available from: https://wfme.org/wp-content/uploads/2020/12/WFME-BME-Standards-2020-1.pdf
18. Carabetta Jr V. Metodologia ativa na educação médica. Rev Med. 2016;95(3):113-21. https://doi.org/10.11606/issn.1679-9836.v95i3p113-121

19. Ferreira IG, Carreira LB, Murphy N, Soares ACB, Fonseca PCC, Sousa LEA. Extracurricular activities: a comparative perspective among health colleges in Brazil and Ireland. ABCS Health Sci. 2018;43(2):97-103. http://dx.doi.org/10.7322/abcshs.v43i2.1080

20. Silva TT. Documentos de identidade: uma introdução às teorias do currículo. 3.ed. Belo Horizonte: Autêntica, 2010.

21. Aguilar-da-Silva RH, Perim GL, Abdalla IG, Costa NMSC, Lampert JB, Stella RCR. Abordagens pedagógicas e tendências de mudanças nas escolas médicas. Rev Bras Educ Med. 2009;33(suppl 1):53-62. https://doi.org/10.1590/S0100-55022009000500006

22. Garcia MBO, Oliveira MM, Plantier AP. Interatividade e mediação na prática de metodologia ativa: o uso da instrução por colegas e da tecnologia na educação médica. Rev Bras Educ Med. 2019;43(1):87-96. https://doi.org/10.1590/1981-52712015v43n1rb20180154

23. Behar PA. Competências em educação a distância. Porto Alegre: Penso, 2013.

24. Behar PA, Silva KKA. Mapeamento de competências: um foco no aluno da educação a distância. Rev Renote. 2012;10(3). https://doi.org/10.22456/1679-1916.36395

25. Litto FM, Guibert AAP, Fernandez CT, Palange I, Depresbiteris L. Competências para educação a distância: Matrizes e referenciais teóricos. São Paulo: ABED, 2012.

26. Paulino DB, Martins CCA, Raimondi GA, Hattori WT. WhatsApp® como recurso para a educação em saúde: contextualizando teoria e prática em um novo cenário de ensino-aprendizagem. Rev Bras Educ Med. 2018;42(1):171-80. https://doi.org/10.1590/1981-52712018v42n1rb20170061

27. World Health Organization (WHO). Telemedicine: opportunities and developments in the Member States: report on the second global survey on eHealth. Genebra: WHO, 2010.

28. Ferreira IG, Godoi DF, Perugini ER, Lancini AB, Zonta R. Teledermatologia: uma interface entre a atenção primária e atenção especializada em Florianópolis. Rev Bras Med Fam Comunidade. 2019;14(41):e2003. https://doi.org/10.5712/rbmfc14(41)2003

29. Lobo LC. Inteligência artificial, o Futuro da Medicina e a Educação Médica. Rev Bras Educ Med. 2018;42(3):3-8. https://doi.org/10.1590/1981-52712015v42n3rb20180115editorial1

30. Topol E. Deep Medicine: how artificial intelligence can make healthcare human again. New York: Basic Books, 2019.

31. Barreto NAP, Xavier AREO, Sonzogno MC. Percepção de tutores quanto a sua avaliação pelos discentes de um curso médico. Rev Bras Educ Med. 2018;42(1):57-66. https://doi.org/10.1590/1981-52712015v42n1rb20160026

32. Alves LR, Giacomini MA, Teixeira VM, Henriques SH, Chaves LDP. Reflexões sobre a formação docente na pós-graduação. Esc Anna Nery. 2019;23(3):e20180366. https://doi.org/10.1590/2177-9465-ean-2018-0366

33. Perim GL, Abdala IG, Aguilar-da- Silva RH, Lampert JB, Stella RCR, Costa NMSC. Desenvolvimento Docente e a Formação de Médicos. Rev Bras Educ Med. 2009;33(Suppl 1):70-82. https://doi.org/10.1590/S0100-55022009000500008

34. Scheffer M, Cassenote A, Guilloux AGA, Biancarelli A, Miotto BA, Mainardi GM. Demografia médica no Brasil 2018. São Paulo: Conselho Federal de Medicina, 2018.

35. Pelaccia T, Viau R. Motivation in medical education. Med Teach. 2017;39(2):136-40. https://doi.org/10.1080/0142159X.2016.1248924

36. Buja LM. Medical education today: All that glitters is not gold. BMC Med Educ. 2019;19(110). https://doi.org/10.1186/s12909-019-1535-9

37. Batista NA. Desenvolvimento docente na area de saúde: uma análise. Trab Educ Saude. 2005;3(2):283-94. https://doi.org/10.1590/S1981-77462005000200003

38. Almeida EG, Batista NA. Desempenho docente no contexto PBL: essência para aprendizagem e formação médica. Rev Bras Educ Med. 2013;37(2):192-201.

39. Almeida MTC, Batista NA. Ser docente em métodos ativos de ensino-aprendizagem na formação do médico. Rev Bras Educ Med. 2011;35(4):468-76. https://doi.org/10.1590/S0100-55022011000400005

40. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide no. 96. Med Teach. 2015;37(4):312-22. https://doi.org/10.3109/0142159X.2014.970998