

Barriers and Solutions to Successful Problem-Based Learning Delivery in Developing Countries – A Literature Review

Review began 07/29/2023

Review ended 08/05/2023

Published 08/09/2023

© Copyright 2023

Solano et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Jhiamluka Solano ^{1, 2}, Melba Zuniga Gutierrez ³, Esther Pinel-Guzmán ⁴, Génesis Henriquez ^{5, 6}

1. Cardiology, Scunthorpe General Hospital, North Lincolnshire, GBR 2. Research and Development, Asociación de Educación Médica Hondureña, Tegucigalpa, HND 3. Research, Organization for Woman in Science for the Developing World, Tegucigalpa, HND 4. Medicine, Universidad Católica de Honduras, Tegucigalpa, HND 5. Medicine, Universidad Nacional Autónoma de Honduras, Tegucigalpa, HND 6. Medicine, Asociación de Educación Médica Hondureña, Tegucigalpa, HND

Corresponding author: Jhiamluka Solano, jhiamv@gmail.com

Abstract

Problem-based learning (PBL) was introduced in the 1960s as an alternative to traditional teacher-centered and discipline-based preclinical medical education. A literature review was conducted to explore the barriers and solutions to successful PBL uptake and delivery in developing countries. The review involved the search of articles and scientific studies on PubMed, The Lancet, and Scielo. The review focused on the medical education literature, using as a primary search criterion "problem-based learning" in combination with "developing countries" and "education". The search was limited to articles in Spanish and English published between 2011 and November 2021, except for three articles due to their relevance to the subject. Faculty development programs are the cornerstone when implementing a new methodology in developing countries. Early career development, PBL methodology, and the available assessment options should be the primary learning objectives of these programs. Stakeholders will need to plan using available resources following the experience of other countries and institutions encouraging collaborative development. Evaluation and assessment will be crucial to understand the impact of PBL, and considerations should be taken to implement an integrated curriculum. Medical Education Research should be encouraged, appraised, and disseminated to improve evidence-based decision-making, creating a constant development cycle. PBL is innovative and represents many unanswered questions that will develop in the following decade as more schools implement new methodologies and Research on PBL.

Categories: Medical Education, Medical Simulation

Keywords: teaching feedback, curriculum development and evaluation, medical education, developing countries, problem-based learning

Introduction And Background

Problem-Based Learning (PBL), introduced to preclinical medical education in 1969, was defined as "an instructional (and curricular) learner-centered approach that empowered learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" [1,2]. Extensive research has developed since the introduction of PBL, creating an abundant source of discussion in medical education [1].

Strong scientific evidence supports PBL as an exceptional tool for developing an efficient approach to clinical challenges. It encourages critical thinking skills rather than factual knowledge through Self-Directed Learning (SDL), reflective practice, and formative feedback [3,4]. Medical schools in developing countries have struggled to adopt new methodologies in their curriculum. The available literature regarding its implementation in settings with limited resources appears sparse [5].

The following literature review outlines the main challenges and potential solutions for successful PBL delivery to guide developing countries to transition successfully from the traditional teacher-centered approach exploring the basic concepts and the advantages and disadvantages of PBL.

Review

Methodology

The review focused on medical education literature primarily in PubMed; the search terms used were Medical Education, Problem-based Learning, and developing countries. We used AND and OR as our Boolean operators. We included literature reviews, Meta-analyses, Randomized Controlled Trials, and systematic reviews published in English between 2011 and 2021. However, articles published before 2011 were considered if they offered relevant data to improve the development of the research question. We excluded articles that were not original studies, book chapters, published in other languages, unrelated to medical

How to cite this article

Solano J, Zuniga Gutierrez M, Pinel-Guzmán E, et al. (August 09, 2023) Barriers and Solutions to Successful Problem-Based Learning Delivery in Developing Countries – A Literature Review. Cureus 15(8): e43187. DOI 10.7759/cureus.43187

education, and outside the year interval with the abovementioned exception.

During the first stage of the selection process, we found 873 articles related to the search terms used. We selected 523 based on the title, and a further 17 were found through other search engines. We identified 121 duplicate articles and appraised the remaining articles based on the abstract. We excluded 278 articles before the last stage of the selection process; the remaining 141 articles' full text was appraised to select a final sample of 85 articles. A PRISMA diagram shows the search, identification, screening, and review process (Figure 1).

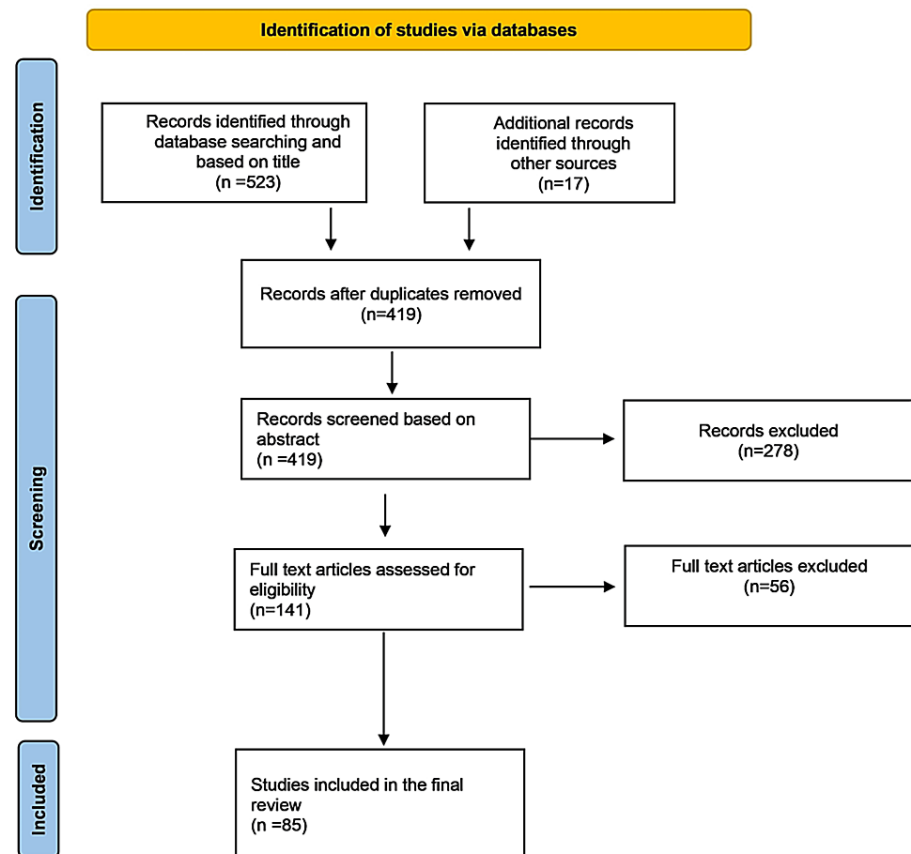


FIGURE 1: PRISMA flowchart.

Problem-Based Learning

PBL is an instructional method that involves presenting the problem, solving it using clinical reasoning skills, re-addressing the problem with gained knowledge, and concluding by summarising what has been learned [6,3]. PBL has evidence supporting its effectiveness compared to traditional teaching methods [7-11]. Assessments in PBL can vary depending on the learning objectives, including portfolios, objective structured clinical examinations (OSCE), written assessments, extended matching questions, and Progressive Disclosure Questions [3].

Advantages and Disadvantages of PBL

The benefits for learners include the development of critical thinking, knowledge acquisition, and teamwork skills; students also achieve better exam scores. As for tutors, the advantages encompass the standardized and communicative environment. The disadvantages include the narrow subjects it can be applied to in the curriculum, the need for more students than qualified teachers, and the challenging transition from traditional methods [8-23].

Medical Education Challenges in Developing Countries

Developing countries face challenges such as corruption, underfunding and bureaucratic barriers that harm healthcare and medical training [24-36]. Unfortunately, this leads to a brain drain where the best professionals leave and never return, leaving medical education to fail and perpetuating faults [37]. During

the pandemic, this was more evident as a pitfall due to the challenges of adapting to the new normal [38-43]. This leaves a significant gap in the development of future doctors as a poor understanding of medical education makes it challenging to implement new methodologies leaving a teacher-centered traditional curriculum [2,44,45].

Discussion

The need for an innovative curriculum has been continuously highlighted in many studies [15,46-48,9]. There are some recommended elements to accomplish the implementation in limited resources settings:

Faculty Development Programmes

The evidence suggests the role and importance of faculty development programs [49,4,50,42]. A sustainable program should aim to train their local Faculty and use funding only for external experts when needed. Peer mentoring programs can improve faculty training. The first generation becomes future generations' mentors, creating a long-term sustainable program. Furthermore, we should encourage medical schools to have medical education departments [44] that explore new methodologies and their impact on student learning [51].

Early Educators Career Development

The lack of medical education departments promotes isolated efforts for competent facilitators' development. The experience in medical education can be limited before becoming an educator [52]. Early career development in medical education will be essential to allow future educators to develop the required skills. Medical students and postgraduate trainees will represent the primary resource of mentees [53]. Overcoming the cultural barrier the medical hierarchy represents is vital. We can follow a faculty milestone form to guide faculty members' development by assessing six core competencies: patient care, medical knowledge, system-based practice, practice-based learning, improved professionalism, and communication [54]. Junior educators will represent the new generation to break the cycle and promote development.

Overcoming Resource Limitations

Medical Education needs to evolve to meet the needs and requirements of students [55]. However, there is not much literature regarding the effective use of available resources in medical education to improve its quality. Most sectors have adequate resources to develop sustainable Programmes [56]. Limited funding accounts for understaffed departments, equipped facilities, lack of training courses, external evaluation, and scientific information [57]. However, there are mechanisms to achieve positive outcomes without funding through grants or free access from developed countries [58].

Moreover, there are different types of rationing in Medical Education [59]. Using a single tutor can be helpful when Faculty Development Programmes are created, and no local experts are available. Not an ideal solution, but it can help. The use of flipped classrooms can be helpful for students in understanding and learning at their own pace and revisiting after [51]. Furthermore, we can use an approach based on four economic principles: targeted talent approach, use of the internet as a network tool to broaden the scope, dissemination of knowledge of PBL, and extrapolation of the successful approaches efficiently [57].

Inter-Institutional Cooperation

Developed countries often collaborate with medical schools in underdeveloped countries. This is an opportunity to access resources and develop based on the experience of others [60]. Different institutions' frameworks can aid stakeholders in identifying objectives, deliverables, funding flow, management principles, promoting standards, developing medical educators constantly, and disbursement procedures that can be improved [61,62]. Finally, governments and universities are essential in designing training plans, ultimately impacting healthcare delivery in different stages [26].

Assessment

Traditional teaching methods have been distorted from the original principles by insufficient training for trainers in underdeveloped countries. Introducing PBL becomes a teaching and assessment challenge. Although most literature aims for formative assessment used in PBL, summative assessment can also be used when adequately designed. On the other hand, peer assessment of professional behaviors can provide a better understanding of the impact of PBL [63]. Peer assessment can be highly reliable for 'within group' comparison but poor for 'across group' comparison [64]. The self-assessment scale can also assess performance and improve SDL and critical thinking by promoting reflective practice [65]. Courses will be crucial to provide educators with different options and enable them to adopt the one they feel most comfortable with.

Evaluation

Evaluation is crucial in every learning process to ensure constant development and feedback. Evaluation requires design and a structured approach to ensure relevant and actionable results. In developing countries, effective evaluation processes are not standard, representing a common cultural and methodological challenge [66]. Pilot faculty development programs can represent a good starting point to understand and develop evaluation knowledge, which can be implemented for evaluation at a larger scale.

Quality in medical education has been categorized into four dimensions: structural and curricular level, procedural aspects of teaching, quality referring to teacher characteristics, and outcomes of teaching activities. Educational structure and processes can be assessed using student feedback questionnaires. There are many ways to evaluate the quality of teaching ("Medical Student Experience Questionnaire"; "Marburger Fragebogen zur Evaluation des Lehrangebots in der Medizin"; "Learning Environment Questionnaire"; and "Medical Instructional Quality"). On the other hand, when considering evaluating individual teachers and their characteristics, we can use the "Stanford Faculty Development Program survey" and the "Student Evaluation of Teaching in Outpatient Clinic". Although inaccurate, postgraduate entry exams can assess the last dimension [67].

Using an Integrated Approach

Liu et al. [11] contrasted Lecture-based Learning (LBL) with integrated curriculums and found that the latter student group had superior knowledge assessment scores. Integrated curriculums show improved comprehension [68,69]. Single-method curriculums should be avoided [15,67,46,47,48]. For this purpose, we encourage the aim of an integrated curriculum [70].

Identifying and understanding local needs through needs assessments is crucial [71,72]. Most studies support PBL over LBL [73,74]. However, Bergman et al. [75] found that PBL affects concept-based courses. LBL helped students retain non-clinical information long-term [76,77]. We should avoid using PBL in subjects like anatomy [78-80]. Gustin et al. [81] found that students' use of deep learning approaches was similar in both curriculums. New generations of medical students are more inclined to use technology when learning; thus, technology is a tool we need to explore further [51].

Medical Education Research

As part of implementing new methodologies, we need to address the impact caused by the learning process. Only research understands the true impact of benefits, challenges, and designs of implementing new strategies [82,83]. Developing countries struggle to produce research, and Medical Education research is a more significant challenge [84]. Once a new methodology is implemented with a following evaluation and research process, the initial outcomes should prompt follow-up studies to encourage development [85]. Most developing countries do not have adequate medical education publications, representing an exceptional opportunity to narrow the knowledge gap in this area [84]. Finally, once research in medical education is established, we must encourage researchers at all experience levels to publish their findings in high-impact journals [86].

Conclusions

Successful PBL delivery can represent a significant challenge for developing countries. Patient quality of care can improve significantly with better-trained doctors; thus, developing medical education should be an ethical obligation. Implementing PBL will require more than training educators but a cultural and administrative effort from medical schools. Overcoming resource limitations and promoting interinstitutional cooperation are vital steps.

The first and most crucial step in implementing any change to a curriculum is training the educators. Although Medical Education Departments should be the long-term goal, programs can help improve medical education. Additionally, early career development, assessment, and research should be the primary learning objectives of the program to improve evidence-based decision-making. Either members or externals need to design the evaluation process for a later stage in the implementation. Because of the evidence supporting this, we should consider implementing an integrated rather than a PBL-based curriculum.

To our knowledge, this is the first review that addresses all the possible barriers and solutions to successful PBL delivery by exploring the documented experiences in developing countries. After carefully considering the available evidence, we outlined 8 recommended fundamental areas of development to implement PBL. These recommendations will help develop medical education further. The available evidence provides enough knowledge to guide medical schools to successful PBL delivery in developing countries. If medical schools in developing countries do not evolve, they risk becoming obsolete, negatively impacting patient care and professional development outside their frontiers for their students.

Additional Information

Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Al-Azri H, Ratnapalan S: Problem-based learning in continuing medical education: review of randomized controlled trials. *Can Fam Physician*. 2014, 60:157-165.
2. Lim WK: Dysfunctional problem-based learning curricula: resolving the problem. *BMC Med Educ*. 2012, 12:89. [10.1186/1472-6920-12-89](https://doi.org/10.1186/1472-6920-12-89)
3. Albanese MA, Dast LC: Problem-based learning. *Understanding Medical Education*. Tim Swanwick (ed): John Wiley & Sons, West Sussex; 2018. 2:63-79. [10.1002/9781119373780](https://doi.org/10.1002/9781119373780)
4. Joseph N, Rai S, Madi D, Bhat K, Kotian SM, Kantharaju S: Problem-based learning as an effective learning tool in community medicine: initiative in a private medical college of a developing country. *Indian J Community Med*. 2016, 41:133-40.
5. Amoako-Sakyi D, Amonoo-Kuofi H: Problem-based learning in resource-poor settings: lessons from a medical school in Ghana. *BMC Med Educ*. 2015, 15:221. [10.1186/s12909-015-0501-4](https://doi.org/10.1186/s12909-015-0501-4)
6. Azer SA: Problem-based learning: where are we now? guide supplement 36.1 - viewpoint. *Med Teach*. 2011, 33:e121-2. [10.3109/0142159X.2010.540595](https://doi.org/10.3109/0142159X.2010.540595)
7. Zhao W, He L, Deng W, Zhu J, Su A, Zhang Y: The effectiveness of the combined problem-based learning (PBL) and case-based learning (CBL) teaching method in the clinical practical teaching of thyroid disease. *BMC Med Educ*. 2020, 20:381. [10.1186/s12909-020-02306-y](https://doi.org/10.1186/s12909-020-02306-y)
8. Yang LH, Jiang LY, Xu B, Liu SQ, Liang YR, Ye JH, Tao EX: Evaluating team-based, lecture-based, and hybrid learning methods for neurology clerkship in China: a method-comparison study. *BMC Med Educ*. 2014, 14:98. [10.1186/1472-6920-14-98](https://doi.org/10.1186/1472-6920-14-98)
9. Faisal R, Bahadur S, Shinwari L: Problem-based learning in comparison with lecture-based learning among medical students. *J Pak Med Assoc*. 2016, 66:650-653.
10. Gao J, Yang L, Zhao J, Wang L, Zou J, Wang C, Fan X: Comparison of problem-based learning and traditional teaching methods in medical psychology education in China: a systematic review and meta-analysis. *PLoS One*. 2020, 15:e0243897. [10.1371/journal.pone.0243897](https://doi.org/10.1371/journal.pone.0243897)
11. Liu CX, Ouyang WW, Wang XW, Chen D, Jiang ZL: Comparing hybrid problem-based and lecture learning (PBL + LBL) with LBL pedagogy on clinical curriculum learning for medical students in China: a meta-analysis of randomized controlled trials. *Medicine (Baltimore)*. 2020, 99:e19687. [10.1097/MD.00000000000019687](https://doi.org/10.1097/MD.00000000000019687)
12. Hamdy H, Agamy E: Is running a problem-based learning curriculum more expensive than a traditional subject-based curriculum? *Med Teach*. 2011, 33:e509-14. [10.3109/0142159X.2011.599451](https://doi.org/10.3109/0142159X.2011.599451)
13. Harasym PH, Tsai TC, Munshi FM: Is problem-based learning an ideal format for developing ethical decision skills? *Kaohsiung J Med Sci*. 2013, 29:523-9. [10.1016/j.kjms.2013.05.005](https://doi.org/10.1016/j.kjms.2013.05.005)
14. Meo SA: Evaluating learning among undergraduate medical students in schools with traditional and problem-based curricula. *Adv Physiol Educ*. 2013, 37:249-53. [10.1152/advan.00031.2013](https://doi.org/10.1152/advan.00031.2013)
15. Al-Gindan YM, Al-Sulaiman AA, Al-Faraidy A: Undergraduate curriculum reform in Saudi medical schools. which direction to go? *Saudi Med J*. 2000, 21:324-6.
16. Bokey L, Chapuis PH, Dent OF: Problem-based learning in medical education: one of many learning paradigms. *Med J Aust*. 2014, 201:134-6. [10.5694/mja13.00060](https://doi.org/10.5694/mja13.00060)
17. Abdelkarim A, Schween D, Ford T: Implementation of problem-based learning by faculty members at 12 U.S. medical and dental schools. *J Dent Educ*. 2016, 80:1301-7.
18. Leatemia LD, Susilo AP, van Berkel H: Self-directed learning readiness of Asian students: students perspective on a hybrid problem based learning curriculum. *Int J Med Educ*. 2016, 7:385-92. [10.5116/ijme.582e.021b](https://doi.org/10.5116/ijme.582e.021b)
19. Qin Y, Wang Y, Floden RE: The effect of problem-based learning on improvement of the medical educational environment: a systematic review and meta-analysis. *Med Princ Pract*. 2016, 25:525-32. [10.1159/000449036](https://doi.org/10.1159/000449036)
20. Reddy S, McKenna S: The Guinea pigs of a problem-based learning curriculum. *Innov Educ Teach Int*. 2016, 53:16-24. [10.1080/14703297.2014.959542](https://doi.org/10.1080/14703297.2014.959542)
21. Fan C, Jiang B, Shi X, Wang E, Li Q: Update on research and application of problem-based learning in medical science education. *Biochem Mol Biol Educ*. 2018, 46:186-94. [10.1002/bmb.21105](https://doi.org/10.1002/bmb.21105)
22. O Doherty D, Mc Keague H, Harney S, Browne G, McGrath D: What can we learn from problem-based learning tutors at a graduate entry medical school? a mixed method approach. *BMC Med Educ*. 2018, 18:96. [10.1186/s12909-018-1214-2](https://doi.org/10.1186/s12909-018-1214-2)
23. Chang Chan AY, Cate OT, Custers EJ, Leeuwen MS, Bleys RL: Approaches of anatomy teaching for seriously resource-deprived countries: a literature review. *Educ Health (Abingdon)*. 2019, 32:62-74. [10.4103/efh.Efh_272_17](https://doi.org/10.4103/efh.Efh_272_17)
24. Avorn J, Choudhry NK: Funding for medical education: maintaining a healthy separation from industry. *Circulation*. 2010, 121:2228-34. [10.1161/CIRCULATIONAHA.109.869636](https://doi.org/10.1161/CIRCULATIONAHA.109.869636)
25. Chouchane L, Mamtani R, Al-Thani MH, Al-Thani AA, Ameduri M, Sheikh JI: Medical education and research environment in Qatar: a new epoch for translational research in the Middle East. *J Transl Med*. 2011, 9:16. [10.1186/1479-5876-9-16](https://doi.org/10.1186/1479-5876-9-16)
26. Murray J, Wenger F, Downes E, Terrazas SB: *Educating Health Professionals in Low-Resource Countries: A Global Approach*. Springer Publishing Company, New York; 2010. <https://books.google.co.in/books?hl=en&lr=&id=uTwbRCMuDhcC&oi=fnd&pg=PP2&dq=Educating+Health+Professionals+in+Low-Res....>
27. Ganapathi L, Martins Y, Schumann D, Russ C: Overcoming challenges to develop pediatric postgraduate

- training programs in low- and middle-income countries. *Educ Health* (Abingdon). 2014, 27:277-82. [10.4103/1357-6283.152189](#)
28. Aburahma MH: Do not lose your students in large lectures: a five-step paper-based model to foster students' participation. *Pharmacy* (Basel). 2015, 3:89-100. [10.3390/pharmacy3030089](#)
29. Archer J, McManus C, Woolf K, Monrouxe L, Illing J, Bullock A, Roberts T: Without proper research funding, how can medical education be evidence based?. *BMJ*. 2015, 350:h3445. [10.1136/bmj.h3445](#)
30. Colon-Gonzalez MC, El Rayess F, Guevara S, Anandarajah G: Successes, challenges and needs regarding rural health medical education in continental Central America: a literature review and narrative synthesis. *Rural Remote Health*. 2015, 15:3361.
31. Sohail AH, Maan MH, Sachal M, Soban M: Challenges of training and delivery of pediatric surgical services in developing economies: a perspective from Pakistan. *BMC Pediatr*. 2019, 19:152. [10.1186/s12887-019-1512-9](#)
32. Talib Z, Narayan L, Harrod T: Postgraduate medical education in sub-Saharan Africa: a scoping review spanning 26 years and lessons learned. *J Grad Med Educ*. 2019, 11:34-46. [10.4300/JGME-D-19-00170](#)
33. Velasquez JZS: Percepción de factores modificables que afectan la educación médica en Honduras [Spanish] . *Rev Med Hondur*. 2019, 87:55-62. [10.5377/rmh.v87i2.11902](#)
34. Langlois EV, McKenzie A, Schneider H, Mecaskey JW: Measures to strengthen primary health-care systems in low- and middle-income countries. *Bull World Health Organ*. 2020, 98:781-91. [10.2471/BLT.20.252742](#)
35. Kato Y, Liew BS, Sufianov AA, et al.: Review of global neurosurgery education: horizon of neurosurgery in the developing countries. *Chin Neurosurg J*. 2020, 6:19. [10.1186/s41016-020-00194-1](#)
36. Rafi A, Anwar MI: Challenges for implementing WFME standards for accreditation in health professions education in low and middle-income countries: a scoping review. *J Pak Med Assoc*. 2021, 71:966-76. [10.47391/JPMA.795](#)
37. Michalski K, Farhan N, Motschall E, Vach W, Boeker M: Dealing with foreign cultural paradigms: a systematic review on intercultural challenges of international medical graduates. *PLoS One*. 2017, 12:e0181330. [10.1371/journal.pone.0181330](#)
38. Enam SF, Hashmi S: The importance of evolutionary medicine in developing countries: a case for Pakistan's medical schools. *Evol Med Public Health*. 2018, 2018:26-33. [10.1093/emph/eoy004](#)
39. Ashry AH, Soffar HM, Alsawy MF: Neurosurgical education during COVID-19: challenges and lessons learned in Egypt. *Egypt J Neurol Psychiatr Neurosurg*. 2020, 56:110. [10.1186/s41983-020-00242-8](#)
40. Wu H, Sun W, Huang X, et al.: Online antenatal care during the COVID-19 pandemic: opportunities and challenges. *J Med Internet Res*. 2020, 22:e19916. [10.2196/19916](#)
41. Dhandapani M, Dhandapani S: Challenges posed by COVID-19 and neurosurgical nursing strategies in developing countries. *Surg Neurol Int*. 2020, 11:441. [10.25259/SNI_677_2020](#)
42. Hosny S, Ghaly M, Hmoud AlSheikh M, Shehata MH, Salem AH, Atwa H: Developing, validating, and implementing a tool for measuring the readiness of medical teachers for online teaching post-COVID-19: a multicenter study. *Adv Med Educ Pract*. 2021, 12:755-68. [10.2147/AMEP.S317029](#)
43. Shambour MK, Abu-Hashem MA: Analysing lecturers' perceptions on traditional vs. distance learning: a conceptual study of emergency transferring to distance learning during COVID-19 pandemic. *Educ Inf Technol (Dordr)*. 2022, 27:3225-45. [10.1007/s10639-021-10719-5](#)
44. Tsinel G, Tsedeke A, Matthias S, et al.: Establishing medical schools in limited resource settings . *Ethiop J Health Sci*. 2016, 26:277-84. [10.4314/ejhs.v26i3.10](#)
45. Tumlinson K, Jaff D, Stilwell B, Onyango DO, Leonard KL: Reforming medical education admission and training in low- and middle-income countries: who gets admitted and why it matters. *Hum Resour Health*. 2019, 17:91. [10.1186/s12960-019-0426-9](#)
46. Alzahrani HA, Alzahrani OH: Learning strategies of medical students in the surgery department, Jeddah, Saudi Arabia. *Adv Med Educ Pract*. 2012, 3:79-87. [10.2147/AMEP.S34780](#)
47. Dable RA, Pawar BR, Gade JR, Anandan PM, Nazirkar GS, Karani JT: Student apathy for classroom learning and need of repositioning in present andragogy in Indian dental schools. *BMC Med Educ*. 2012, 12:118. [10.1186/1472-6920-12-118](#)
48. Papanna KM, Kulkarni V, Tanvi D, et al.: Perceptions and preferences of medical students regarding teaching methods in a Medical College, Mangalore India. *Afr Health Sci*. 2013, 13:808-13. [10.4314/ahs.v13i3.41](#)
49. Ali SK, Baig LA: Problems and issues in implementing innovative curriculum in the developing countries: the Pakistani experience. *BMC Med Educ*. 2012, 12:31. [10.1186/1472-6920-12-31](#)
50. Abdelkarim A, Schween D, Ford T: Attitudes towards problem-based learning of faculty members at 12 U.S. medical and dental schools: a comparative study. *J Dent Educ*. 2018, 82:144-51. [10.21815/JDE.018.019](#)
51. Hew KF, Lo CK: Flipped classroom improves student learning in health professions education: a meta-analysis. *BMC Med Educ*. 2018, 18:38. [10.1186/s12909-018-1144-z](#)
52. MacDougall J, Drummond MJ: The development of medical teachers: an enquiry into the learning histories of 10 experienced medical teachers. *Med Educ*. 2005, 39:1213-20. [10.1111/j.1365-2929.2005.02335.x](#)
53. Burgess A, Matar E, Neuen B, Fox GJ: A longitudinal faculty development program: supporting a culture of teaching. *BMC Med Educ*. 2019, 19:400. [10.1186/s12909-019-1832-3](#)
54. Blake GH, Kemmet RK, Jenkins J, Heidel RE, Wilson GA: Milestones as a guide for academic career development. *Fam Med*. 2019, 51:760-5. [10.22454/FamMed.2019.109290](#)
55. Jebraelily M, Pirnejad H, Feizi A, Niazkhani Z: Evaluation of blended medical education from lecturers' and students' viewpoint: a qualitative study in a developing country. *BMC Med Educ*. 2020, 20:482. [10.1186/s12909-020-02388-8](#)
56. Latif MZ, Wajid G: Reforming medical education in Pakistan through strengthening departments of medical education. *Pak J Med Sci*. 2018, 34:1439-44. [10.12669/pjms.346.15942](#)
57. Kaplovitch E, Otremba M, Morgan M, Devine LA: Cost-efficient medical education: an innovative approach to creating educational products. *J Grad Med Educ*. 2019, 11:713-6. [10.4300/JGME-D-19-00155.1](#)
58. Van Essen C, Cartledge P, Kyamanywa P, Manirakiza A: Is HINARI appropriate for medical students in the developing world?. *Trop Med Int Health*. 2012, 17:406-8. [10.1111/j.1365-3156.2011.02938.x](#)

59. Walsh K: Rationing medical education. *Afr Health Sci*. 2016, 16:325-8. [10.4314/ahs.v16i1.43](#)
60. Truong HA, Gorman MJ, East M, et al.: The eastern shore Collaborative for Interprofessional Education's implementation and impact over five years. *Am J Pharm Educ*. 2018, 82:6522. [10.5688/ajpe6522](#)
61. Golden DW, Braunstein S, Jimenez RB, Mohindra P, Spektor A, Ye JC: Multi-institutional implementation and evaluation of a curriculum for the medical student clerkship in Radiation Oncology. *J Am Coll Radiol*. 2016, 13:203-9. [10.1016/j.jacr.2015.06.036](#)
62. Hillman E, Paul J, Neustadt M, Reddy M, Wooldridge D, Dall L, Drees B: Establishing a multi-institutional quality and patient safety Consortium: collaboration across affiliates in a community-based medical school. *Acad Med*. 2020, 95:1864-73. [10.1097/ACM.0000000000003552](#)
63. Roberts C, Jorm C, Gentilcore S, Crossley J: Peer assessment of professional behaviours in problem-based learning groups. *Med Educ*. 2017, 51:390-400. [10.1111/medu.13151](#)
64. Kritikos VS, Woulfe J, Sukkar MB, Saini B: Intergroup peer assessment in problem-based learning tutorials for undergraduate pharmacy students. *Am J Pharm Educ*. 2011, 75:73. [10.5688/ajpe75473](#)
65. Khoiriyah U, Roberts C, Jorm C, Van der Vleuten CP: Enhancing students' learning in problem based learning: validation of a self-assessment scale for active learning and critical thinking. *BMC Med Educ*. 2015, 15:140. [10.1186/s12909-015-0422-2](#)
66. Dupas P: Health Behavior in Developing Countries. *Annu Rev Econom*. 2011, 3:425-449. [10.1146/annurev-economics-111809-125029](#)
67. Raupach T, Münscher C, Beissbarth T, Burckhardt G, Pukrop T: Towards outcome-based programme evaluation: using student comparative self-assessments to determine teaching effectiveness. *Med Teach*. 2011, 33:e446-53. [10.3109/0142159X.2011.586751](#)
68. Salari M, Roozbeh A, Zarifi A, Tarmizi RA: Pure PBL, hybrid PBL and lecturing: which one is more effective in developing cognitive skills of undergraduate students in pediatric nursing course?. *BMC Med Educ*. 2018, 18:195. [10.1186/s12909-018-1305-0](#)
69. McGaghie WC, Issenberg SB, Cohen ER, Barsuk JH, Wayne DB: Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? a meta-analytic comparative review of the evidence. *Acad Med*. 2011, 86:706-11. [10.1097/ACM.0b013e318217e119](#)
70. Lian J, He F: Improved performance of students instructed in a hybrid PBL format. *Biochem Mol Biol Educ*. 2013, 41:5-10. [10.1002/bmb.20666](#)
71. LaGrone LN, Sadasivam V, Kushner AL, Groen RS: A review of training opportunities for ultrasonography in low and middle income countries. *Trop Med Int Health*. 2012, 17:808-19. [10.1111/j.1365-3156.2012.03014.x](#)
72. Campbell N, Wozniak H, Philip RL, Damarell RA: Peer-supported faculty development and workplace teaching: an integrative review. *Med Educ*. 2019, 53:978-88. [10.1111/medu.13896](#)
73. Nanda B, Manjunatha S: Indian medical students' perspectives on problem-based learning experiences in the undergraduate curriculum: one size does not fit all. *J Educ Eval Health Prof*. 2013, 10:11. [10.3352/jeehp.2013.10.11](#)
74. Carrió M, Agell L, Baños JE, Moyano E, Larramona P, Pérez J: Benefits of using a hybrid problem-based learning curriculum to improve long-term learning acquisition in undergraduate biology education. *FEMS Microbiol Lett*. 2016, 363:10. [10.1093/femsle/fnw159](#)
75. Bergman EM, de Bruin AB, Herrler A, Verheijen IW, Scherpbier AJ, van der Vleuten CP: Students' perceptions of anatomy across the undergraduate problem-based learning medical curriculum: a phenomenographical study. *BMC Med Educ*. 2013, 13:152. [10.1186/1472-6920-13-152](#)
76. McBride JM, Drake RL: Longitudinal cohort study on medical student retention of anatomical knowledge in an integrated problem-based learning curriculum. *Med Teach*. 2016, 38:1209-13. [10.1080/0142159X.2016.1210113](#)
77. Alhassan A, Majeed S: Perception of Ghanaian medical students of cadaveric dissection in a problem-based learning curriculum. *Anat Res Int*. 2018, 2018:3868204. [10.1155/2018/3868204](#)
78. Dolmans DH, De Grave W, Wolfhagen IH, van der Vleuten CP: Problem-based learning: future challenges for educational practice and research. *Med Educ*. 2005, 39:732-41. [10.1111/j.1365-2929.2005.02205.x](#)
79. Gorgon EJ, Basco MD, Manuel AT: Teaching evidence based practice in physical therapy in a developing country: a national survey of Philippine schools. *BMC Med Educ*. 2013, 13:154. [10.1186/1472-6920-13-154](#)
80. Zhang S, Xu J, Wang H, Zhang D, Zhang Q, Zou L: Effects of problem-based learning in Chinese radiology education: a systematic review and meta-analysis. *Medicine (Baltimore)*. 2018, 97:e0069. [10.1097/MD.00000000000010069](#)
81. Gustin MP, Abbiati M, Bonvin R, Gerbase MW, Baroffio A: Integrated problem-based learning versus lectures: a path analysis modelling of the relationships between educational context and learning approaches. *Med Educ Online*. 2018, 23:1489690. [10.1080/10872981.2018.1489690](#)
82. White JD, O'Keefe BR, Sharma J, et al.: India-United States dialogue on traditional medicine: toward collaborative research and generation of an evidence base. *J Glob Oncol*. 2018, 4:1-10. [10.1200/JGO.17.00099](#)
83. Akdemir N, Peterson LN, Campbell CM, Scheele F: Evaluation of continuous quality improvement in accreditation for medical education. *BMC Med Educ*. 2020, 20:308. [10.1186/s12909-020-02124-2](#)
84. Mugabo L, Rouleau D, Odhiambo J, et al.: Approaches and impact of non-academic research capacity strengthening training models in sub-Saharan Africa: a systematic review. *Health Res Policy Syst*. 2015, 13:30. [10.1186/s12961-015-0017-8](#)
85. Ackel-Eisnach K, Raes P, Hönigl L, et al.: Is German Medical Education Research on the rise? an analysis of publications from the years 2004 to 2013. *GMS Z Med Ausbild*. 2015, 32:Doc30. [10.3205/zma000972](#)
86. Azer SA, Dupras DM, Azer S: Writing for publication in medical education in high impact journals. *Eur Rev Med Pharmacol Sci*. 2014, 18:2966-81.