Five Key Articles on Curriculum Development for Graduate Medical Educators

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ABSTRACT

Background Curriculum development is an essential domain for medical educators, yet specific training in this area is inconsistent. With competing demands for educators' time, a succinct resource for best practice is needed.

Objective To create a curated list of the most essential articles on curriculum development to guide education scholars in graduate medical education.

Methods We used a modified Delphi method, a systematic consensus strategy to increase content validity, to achieve consensus on the most essential curriculum development articles. We convened a panel of 8 experts from the United States in curricular development, with diverse career stages, institutions, gender, and specialty. We conducted a literature search across PubMed and Google Scholar with keywords, such as "curriculum development" and "curricular design," to identify relevant articles focusing on a general overview or approach to curriculum development. Articles were reviewed across 3 iterative Delphi rounds to narrow down those that should be included in a list of the most essential articles on curriculum development.

Results Our literature search yielded 1708 articles, 90 of which were selected for full-text review, and 26 of which were identified as appropriate for the modified Delphi process. We had a 100% response rate for each Delphi round. The panelists narrowed the articles to a final list of 5 articles, with 4 focusing on the development of new curriculum and 1 on curriculum renewal.

Conclusions We developed a curated list of 5 essential articles on curriculum development that is broadly applicable to graduate medical educators.

Introduction

Curriculum development is an essential skill for medical educators and plays a large role in the development of competent trainees.[1-4] Medical educators across all specialties are often tasked with curriculum development, yet few have specific training in instructional methods.[5-9]

There are various textbooks and published literature that provide descriptions of essential aspects of curriculum development; however, many of these resources are either too theoretical for practical application or overly comprehensive for an introduction.[10-12] Many medical educators often have competing demands on their time; thus, there is a need for a succinct collection of articles that will allow them to quickly review and apply vetted principles of curriculum development to their own programs.[9]

To meet this identified need, we sought to identify essential curriculum development articles through consensus of an interdisciplinary group of medical education experts. These articles are intended to cover key principles and practices of curriculum development and serve as both a practical introduction to the topic and a resource for additional learning. The final list may be applicable to graduate medical educators with an interest in practical and theoretical aspects of curriculum development, medical trainees interested in developing into skilled clinician-educators, and nonacademic physicians who have an interest in creating targeted educational experiences for students.

Methods

We conducted a literature search with the assistance of a research librarian using PubMed with controlled vocabulary (eg, Medical Subject Headings terms) and keywords, such as "curriculum development" and "curricular design," to identify relevant articles published in English between 2000 and 2022. We also searched Google Scholar with the same keywords, language, and date restrictions. We included articles that addressed a general overview or approach to curriculum development. We excluded those that did not have a full text article available, single curricular innovation descriptions, and articles not focused on

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the methodology of curriculum development. The first and last author reviewed studies for eligibility based on the above criteria. They first performed an abstract review, followed by full-text review of all manuscripts whose abstracts met initial inclusion criteria. They also performed a bibliographic review of included articles.

We conducted a modified Delphi process to determine which articles provide the most essential information to guide educators in developing, implementing, evaluating, and publishing curricula. The modified Delphi technique is a systematic group consensus strategy designed to increase content validity.[13] We convened a Delphi panel of 8 graduate medical educators with diverse career and specialty experience in the United States. Previous work has suggested that 6 to 10 experts is an appropriate number for obtaining stable results in the modified Delphi method.[14-16] The panelists hailed from 2 different institutions and included 6 assistant professors, 1 associate professor, and 1 professor. Five panelists identified as women and 3 as men. Specialties represented on the panel included: anesthesia, emergency medicine, family medicine, general surgery, and internal medicine. All panelists had created, implemented, and evaluated curricula. We collected data April through September 2022.

The Delphi panel reviewed and voted on articles in sequential rounds. In the first round, panelists rated articles on a 1 to 7 scale according to their perceived importance to include in a list of essential articles on curriculum development (1=not at all important, 7=extremely important). We determined a priori that articles with a mean score of greater than 4 would advance to the next round and those with a mean score of 4 or less would be eliminated. In the second and third rounds, panelists voted either yes or no on whether the article should be included in the final list. During these rounds, panelists were limited to a maximum of 5 yes votes in order to generate a manageable list of articles that would provide a comprehensive understanding of the domain. We determined a threshold of 75% yes votes for inclusion *or* 75% no votes for exclusion *a priori*. Panelists were invited to provide written comments in each round. We calculated descriptive statistics.

This study was deemed exempt by the Institutional Review Board of the David Geffen School of Medicine at the University of California, Los Angeles.

Results

Our literature search returned 1708 articles. The authors did not add any additional articles outside the literature search results. We excluded 1618 based on abstract review, leaving 90 for full-text review. Of these, 26 satisfied our criteria above and were included in the modified Delphi process (online supplementary data TABLE). We completed 3 Delphi rounds, each with a 100% response rate (online supplementary data TABLE). After the first round, 6 articles were eliminated, and 20 articles advanced to the next round. After the second round, 1 article met the threshold for inclusion in the final list and 14 articles were eliminated. In the third round, 1 article was eliminated, and 4 articles met the threshold to include in the final list. A total of 5 articles are included in our final list of the most important articles on curriculum development. A brief summary of each article and its application to graduate medical educators is described in the TABLE.

Discussion

To the best of our knowledge, we created the first consensus list of essential articles on curricular development. Four of these articles focused on the development of new curricula,[17-20] and one focused on curriculum renewal,[21] highlighting that curriculum development is an iterative process that must include continual updating and improvement. Three articles were anchored in Kern's 6-step curricular framework.[17,19,20] It is interesting that other conceptual frameworks for curriculum development, such as the spiral curriculum model or network model, were not emphasized in selected articles.[22,23] This could be indicative of the prevalence of Kern's framework in practice and/or the perceived value of this model by our expert panelists.[10,11]

One article specifically addressed curriculum development in the virtual environment.[17] The selection of this article acknowledges current realities in which virtual education is more commonplace and may be an important supplementary component of medical education going forward.[24-26] Finally, one article highlighted how to turn curricular development work into scholarship.[19] The inclusion of this article underscores the need of educators for expertise in education scholarship, which has been previously identified in the literature.[7-9] As a collective, these articles encompass the key steps of curricular development from inception through scholarly dissemination.

This study is limited as the search excluded non-English articles and single innovation type articles, which may have led to the omission of key evidence. The choice of Delphi panel experts from 2 US institutions excluded expertise from the larger international pool of medical educators; a differently composed panel may have yielded different results.

Next steps for this work require feedback from early-career education scholars regarding whether these articles function successfully as succinct, high-yield resources. Input from education mentors concerning

TABLE
Final List of Selected Curriculum Development Articles (in Alphabetical Order)

Article	Brief Summary	Application to Graduate Medical Educators
Chen et al, 2019[17]	Online curricula has increased the dissemination and availability of high-quality health professions education. Four common online curricular formats are described, along with their advantages and limitations. These formats include blended curricula, instructor-led fully online curricula, self-paced modules, and massive open online courses (MOOCs).	This article outlines a systematic approach to online curriculum development centered on Kern's 6-Step Approach for Curriculum Development for Medical Education, with a particular focus on highlighting the special considerations for the various forms of online curricular formats to allow for more rigorous and thoughtful development and design.
Mcleod et al, 2015[21]	Renewal of established health sciences curricula is an important component of curricular design. This process should be forward looking, thoughtful, and responsive to emergent trends and innovations, allowing for evolution of the curriculum to enhance student learning. The overall goal of curricular renewal is to assure timely, evidence-based curriculum responsiveness to changes in health care, practice, and student needs.	Health science curricula require regular review and revision to stay current in response to changes in health care practice and innovations, student needs, and new educational approaches. This article reviews the health care education literature and articulates 12 practical tips for curriculum renewal, helping to prevent stagnation of health sciences curricula and allowing for a responsive and informed curriculum that is valued by teachers and learners alike.
Mills et al, 2020[19]	This article highlights guiding principles to focus on during early curriculum development that can enhance educational scholarship quality and chance for successful publication. It reviews key concepts and multiple structured approaches for educational research with respect to curriculum design and scholarship.	While this article's target audience are pediatric hospitalists, the principles summarized are adaptable and applicable to those seeking to translate educational curricula into research projects that result in scholarship.
Prideaux, 2003[18]	A curriculum includes at least 4 core elements (content, teaching and learning strategies, assessment processes, and evaluation processes). Curricular design is the process of defining and organizing these elements into a logical pattern. This can be done through 2 main model types, which this article explores and reviews. In brief, prescriptive models indicate what curriculum designers should do, while descriptive models describe what curriculum designers actually do.	This article serves a succinct and focused introduction to the basic elements and various models of curricular design, as well as introducing the concept of curriculum maps. Through this review, it introduces and defines core concepts including: the objectives model, outcomes-based curriculum, statements of intent, the situational model, and curricular maps.
Schneiderhan et al, 2019[20]	Developing curricula is an important topic at all levels in medical education, from teaching medical students to residents and faculty. The aim of this article sought to reduce ad hoc curricular design through describing a systematic approach including 6 steps: performing a needs assessment, determining content, writing goals and objectives, selecting the educational strategies, and implementing and evaluating the curriculum.	This article's 6-step approach may serve as a template and provide structure for educators seeking to develop or refine an existing curriculum.

whether this approach is useful would also be valuable. If so, a strategy for updating and disseminating seminal "best practices" articles could follow, for curriculum development and other key medical educator topics.

Conclusions

Through a modified Delphi approach using diverse experts, we developed a list of essential articles on curricular development for the early-career medical education scholar.

References

1. Sherbino J, Frank JR, Snell L. Defining the key roles and competencies of the clinician-educator of the 21st century: a national mixed-methods study. *Acad Med*. 2014;89(5):783-789. doi:10.1097/ACM.0000000000000217

2. Yarris LM, Coates WC, Lin M, et al. A suggested core content for education scholarship fellowships in emergency medicine. *Acad Emerg Med*. 2012;19(12):1425-1433. doi:10.1111/acem.12032
3. Coates WC, Lin M, Clarke S, et al. Defining a core curriculum for education scholarship fellowships in emergency medicine. *Acad Emerg Med*. 2012;19(12):1411-1418. doi:10.1111/acem.12036
4. Jordan J, Yarris LM, Santen SA, et al. Creating a cadre of fellowship-trained medical educators, part ii: a formal needs assessment to structure postgraduate fellowships in medical education scholarship and leadership. *Acad Med*. 2017;92(8):1181-1188. doi:10.1097/ACM.0000000000001460
5. Trainor A, Richards JB. Training medical educators to teach: bridging the gap between perception and reality. *Isr J Health Policy Res*. 2021;10(1):75. doi:10.1186/s13584-021-00509-2
6. Shafer KM, Hira RS, Sinha SS, et al. Academic advancement in the current era: integrating and empowering clinician educators. *J Am Coll Cardiol*. 2019;73(5):620-623. doi:10.1016/j.jacc.2018.11.032
7. Clarke SO, Jordan J, Yarris LM, et al. The view from the top: academic emergency department chairs' perspectives on education scholarship. *AEM Educ Train*. 2017;2(1):26-32. doi:10.1002/aet2.10070
8. Jordan J, Coates WC, Clarke S, et al. The uphill battle of performing education scholarship: barriers educators and education researchers face. *West J Emerg Med*. 2018;19(3):619-629. doi:10.5811/westjem.2018.1.36752
9. Jordan J, Coates WC, Clarke S, et al. Exploring scholarship and the emergency medicine educator: a workforce study. *West J Emerg Med*. 2017;18(1):163-168. doi:10.5811/westjem.2016.10.32636
10. Kern DE, Thomas PA, Howard DM, Bass EB. *Curriculum Development for Medical Education: A Six Step Approach*. Johns Hopkins University Press; 2016.
11. Thomas PA, Kern DE. Internet resources for curriculum development in medical education: an annotated bibliography. *J Gen Intern Med*. 2004;19(5 Pt 2):599-605. doi:10.1111/j.1525-1497.2004.99999.x
12. Schlegel EFM, Bird JB, Burns CM, et al. Curriculum design and scholarship for new educators: a professional development workshop for medical students. *MedEdPORTAL*. 2021;17:11130. doi:10.15766/mep_2374-8265.11130
13. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs*. 2000;32(4):1008-1015.
14. Thangaratinam S, Redman CW. The Delphi technique. *Obstet Gynaecol*. 2005;7(2):120-125. doi:10.1576/toag.7.2.120.27071
15. Pines JM, Alfaraj S, Batra S, et al. Factors important to top clinical performance in emergency medicine residency: results of an ideation survey and Delphi panel. *AEM Educ Train*. 2018;2(4):269-276. doi:10.1002/aet2.10114
16. Eubank BH, Mohtadi NG, Lafave MR, et al. Using the modified Delphi method to establish clinical consensus for the diagnosis and treatment of patients with rotator cuff pathology. *BMC Med Res Methodol*. 2016;16:56. doi:10.1186/s12874-016-0165-8
17. Chen BY, Kern DE, Kearns RM, Thomas PA, Hughes MT, Tackett S. From modules to MOOCs: application of the six-step approach to online curriculum development for medical education. *Acad Med*. 2019;94(5):678-685. doi:10.1097/ACM.0000000000002580
18. Prideaux D. ABC of learning and teaching in medicine. Curriculum design. *BMJ*. 2003;326(7383):268-270. doi:10.1136/bmj.326.7383.268
19. Mills DM, Teufel RJ 2nd. Tools for medical education scholarship: from curricular development to educational research. *Hosp Pediatr*. 2020;10(5):452-457. doi:10.1542/hpeds.2019-0293
20. Schneiderhan J, Guetterman TC, Dobson ML. Curriculum development: a how to primer. *Fam Med Community Health*. 2019;7(2):e000046. doi:10.1136/fmch-2018-000046
21. Mcleod P, Steinert Y. Twelve tips for curriculum renewal. *Med Teach*. 2015;37(3):232-238. doi:10.3109/0142159X.2014.932898
22. Drew C. Bruner's spiral curriculum—the 3 key principles. Helpful Professor. Published November 19, 2019. Accessed March 19, 2023. https://helpfulprofessor.com/spiral-curriculum/
23. Ireland J, Mouthaan M. Perspectives on curriculum design: comparing the spiral and the network models. *Res Matters*. 2020;30:7-12.
24. Gottlieb M, Sebok-Syer SS, Bawden A, Shah M, Jordan J. "Faces on a screen": a qualitative study of the virtual and in-person conference experience. *AEM Educ Train*. 2022;6(6):e10827. doi:10.1002/aet2.10827
25. Tsyrulnik A, Gottlieb M, Coughlin RF, et al. Socially distanced, virtually connected: faculty and resident perceptions of virtual didactics. *AEM Educ Train*. 2021;5(3):e10617. doi:10.1002/aet2.10617
26. Essilfie AA, Hurley ET, Strauss EJ, Alaia MJ. Resident, fellow, and attending perception of e-learning during the COVID-19 pandemic and implications on future orthopaedic education. *J Am Acad Orthop Surg*. 2020;28(19):e860-e864. doi:10.5435/JAAOS-D-20-00579

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