

Essential Foundational Education Research Methods Articles for Graduate Medical Educators: A Delphi Study

Ethan Feig
 RYANNE MAYERSAK , MD
 CHRISTINE LUO , MD, PhD
 MACKENZIE R. COOK, MD
 LAUREN SIGMAN, MD
 JAIME JORDAN , MD, MA

JEFF RIDDELL, MD
 LEILA ZUO , MD
 ANGELA HOLLY VILLAMAGNA , MD
 ERIN BONURA , MD, MCR
 LALENA M. YARRIS , MD, MCR

ABSTRACT

Background Graduate medical educators interested in designing and conducting education research may seek foundational general overview articles on education research methods.

Objective We aimed to identify the most useful foundational education research methods articles for medical educators.

Methods We identified candidate articles through a 2020 Ovid MEDLINE literature search augmented by the authors' personal files and by cross-checking references of included articles. Articles that were primarily about general education research principles were included; articles were excluded if they were not focused on medical education research methods, were published prior to the year 2000, were written in a non-English language, or had no available abstracts. We conducted a modified Delphi study with 10 participants representing a range of specialties and education research experience to find consensus about the most useful articles. We planned 3 rounds of the Delphi process, the first to eliminate any articles not deemed useful for this audience, and the second and third rounds to include articles that at least 80% of the panel deemed "most useful" to education researchers.

Results Of 25 relevant articles identified in the literature search: one was excluded in round 1, 7 met the a priori threshold of 80% agreement for inclusion in round 2, and an additional 2 met inclusion in round 3. These 9 foundational education research methods articles relevant to graduate medical educators are described, along with a capsule summary and specific use for education researchers.

Conclusions Our modified Delphi study of foundational education research methods articles identified 9 articles deemed useful for graduate medical educators who are seeking methods resources.

Introduction

While most graduate medical educators have some research training, the nuances of education research can differ from research in epidemiology and from clinical research commonly taught in medical school and residency.¹⁻³ Additionally, as educators transition from consumers of the literature to researchers conducting their own scholarship, questions arise about education research methods. Thus, educators may seek resources to guide them in developing, implementing, and disseminating education research projects.

The literature contains resources on a wide range of research topics, but graduate medical educators may struggle to find foundational methods articles that are practical and applicable to medical education problems. Specifically, there is a need for articles

that provide a general overview of education research methods, or "primers," that are useful to researchers with a diverse range of experience. Mentors often have their own files of helpful resources but may be missing articles that could be useful to mentees and collaborators.

This study aimed to comprehensively review the medical education research methods literature and perform a modified Delphi study to identify the most useful foundational articles for both novice and experienced education researchers. The resultant list of articles may help guide graduate medical educators in conducting studies and may also serve as a resource for faculty development and graduate medical education training in education research methodology.

Methods

We applied a conceptual framework based on the theory of spiral curricular learning, which posits that

DOI: <http://dx.doi.org/10.4300/JGME-D-23-00941.1>

trainees should revisit basic concepts repeatedly, building upon existing knowledge with iterative cycles of more detailed learning.⁴ This lens influenced: (1) our aim of identifying articles that would both reinforce general concepts and provide more detailed content for deeper learning; and (2) our modified definition of “expertise” for our Delphi panel to include a range of education research experience.⁵ We assembled an author team of 10 panelists representing 3 institutions, 4 specialties (surgery, emergency medicine, anesthesiology, and infectious disease), and varied academic ranks (1 education fellow, 3 assistant professors, 5 associate professors, 1 professor) with education research experience ranging from novice to expert to participate in the consensus-building process, as well as one nonvoting medical student who administered the surveys, tracked participation, and prepared anonymous summaries of the results for each round.

An Ovid MEDLINE database search was conducted by 2 authors and a research librarian in October 2020 on foundational medical education research methods articles from 2000 to 2020. Our search strategy included both text and index search concepts related to faculty, medical education, physicians/medical staff, and methods. The search yielded 120 articles, which were independently reviewed by 2 authors for inclusion/exclusion criteria, with discrepancies resolved by discussion. Articles primarily about general education research principles (ie, overviews, or primers) were included; articles were excluded

if they were not focused on medical education research methods, were published prior to the year 2000, were written in a non-English language, or had no available abstracts. Additional articles were identified from the authors’ files and by manually checking the references of all identified articles, and these also underwent 2 author inclusion/exclusion criteria screening.

Each round of voting for the Delphi process was completed online using Google Surveys (Google). Participants provided their names at the beginning of each round to track participation, but this information was reviewed only by the nonvoting member of the team who prepared the anonymous results for group review and discussion after each round. One panelist was also an author on an included article and did not screen nor vote on that article in any round. The first round prompted participants to read each article and rate it on a Likert-type scale from 1 to 7 (1=unlikely to be useful; 7=illuminating, highly useful). Each article needed to meet an a priori threshold of 3 on the 7-point scale to advance to the next round. The second round asked panelists to review results from round 1 and indicate whether each article belonged on a “must-read” list of foundational education research articles (response options were “no,” “maybe,” and “yes”). Articles with 80% of panelists selecting no were excluded; those with 80% of panelists selecting “yes” were included on a final list of articles, and the remaining articles were carried through to the third round. The final round presented both the round 2 results and links to the

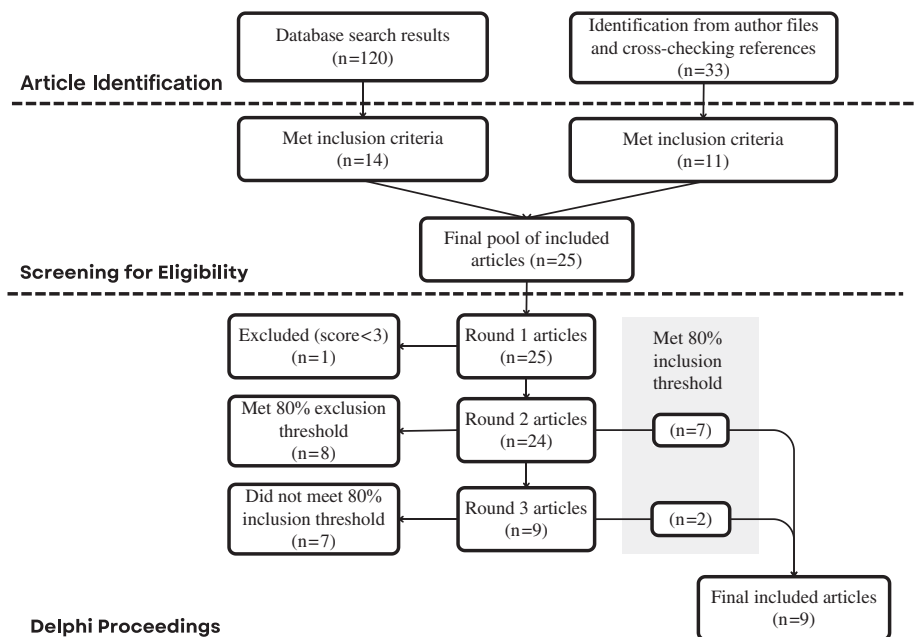


FIGURE
Flowchart of the Literature Research and Modified Delphi Process

TABLE

General Education Research Methods Articles Deemed Most Useful for Early Career Researchers

Article (Author, Year)	Article Summary	Most Useful Elements for Education Researchers
Abramson et al, 2018 ⁵	General overview to conducting quantitative research that addresses question identification, conceptual framework examples, and attention to Glassick's criteria.	Offers practical insights by illustrating each research step with specific examples, aiding researchers in the development, execution, and presentation of their work.
Beckman et al, 2007 ¹⁰	A primer for conducting quantitative and qualitative education research. Explores the frameworks of Glassick, Boyer, and Kirkpatrick, presenting a practical 3-step approach for crafting medical education projects.	Concise overview of study designs, comparison of quantitative and qualitative, examples of experimental methods. Helpful description of validity evidence as well as selecting appropriate outcomes.
Boet et al, 2012 ¹¹	A review discussing conceptual frameworks, question development, and selecting appropriate methods and outcomes, as well as practical education-specific considerations for ethics, error and bias, and rigor.	Tailored for clinician-teachers, this resource provides both foundational knowledge as well as details such as exemplar question refinement, qualitative methodologies, and tips for dissemination. Features instructive definitions, figure, and boxes.
Bordage, 2009 ¹²	Landmark article on the role of the conceptual framework in framing a study and presenting a scaffolding for readers to build upon in application and future work.	Defines conceptual frameworks and provides examples to illustrate this crucial but complex concept that is essential to rigorous education research.
Bordage et al, 2003 ¹³	A systematic approach for experimental study design and developing a grant proposal.	Provides clear guidance for education research grant writing, highlighting important considerations for rigorous study design.
Bunniss et al, 2010 ²⁸	Thoughtful discourse of 4 research paradigms in medical education research: positivism, post-positivism, interpretivism, and critical theory. Emphasizes the importance of transparency in research methodology and how philosophical beliefs determine the nature of research design.	This accessible overview of methodologies and their philosophical underpinnings includes a table comparing the 4 paradigms. An observational example is presented to illustrate how applying each paradigm can impact data interpretation.
Cook, 2010 ¹⁹	Blend of anecdotal insights and scholarly discourse to provide concrete tips for conducting education research in an approachable and relatable manner.	A user-friendly guide that caters to newcomers, delivering both general advice and detailed instructions. Includes a table of threats to study validity with helpful examples.
Ratelle et al, 2019 ²⁶	Guide to interpreting and conducting quantitative education research, including study framing, methodologic rigor, and evaluating education research quality.	A useful guide for conducting research and for reviewing, which includes important questions to consider when evaluating research, covering concepts such as validity evidence, as well as an overview of rubrics to assess research quality.
Yarris et al, 2011 ³	A primer offering guidance for education research that builds upon an epidemiologic framework for study design, illustrating education-specific approaches to questions, problems, and theories in teaching and learning.	Designed to bridge the gap between clinical and education research, this resource provides insights into study designs, philosophies, and provides examples of avenues for funding and dissemination.

included articles thus far, and asked participants to vote “yes” or “no” to include each remaining article on the must-read list. Articles voted by 80% of the panel as “yes” for inclusion were added to final list (FIGURE).

Descriptive statistics were calculated at each stage using Google Sheets. This study did not qualify as human subjects research and therefore did not require institutional review board review at the primary institution.

Results

Fourteen of 120 articles initially identified from the literature search, and 11 of 33 additional articles identified from the authors' files and bibliographic review of included articles met inclusion criteria, yielding a total of 25 articles.³⁻²⁸ Nine of 10 panelists participated in the first round proceedings, and all 10 panelists participated in rounds 2 and 3.

In the first round of our modified Delphi proceedings, one article was eliminated. In the second round, 8 articles were eliminated, and 7 were included in the list of essential articles. In the final round, 2 more articles met the threshold for inclusion for a final list of 9 essential articles (FIGURE, TABLE).

Discussion

Our modified Delphi study identified 9 foundational education research methods articles that met consensus as essential resources for education researchers. The selected articles were published between 2003 and 2019 and included topics spanning research question development to study design and analysis to result presentation and dissemination.

Medical education research requires rigorous application of research principles with attention to education-specific considerations. This includes a thoughtful approach toward identifying a research problem and delineating a knowledge gap, appropriate research methods and outcomes, and transparent and rigorous data analysis and presentation of results. The identified articles highlight key concepts and may serve to deepen understanding of methodology as each article is likely to reinforce some key principles of the others as well as provide some new information that can build upon the researcher's evolving foundational knowledge.

Graduate medical educators may find these articles to be a helpful starting point for their own faculty development and may also use this list for teaching and mentoring education research. Because there is no Medical Subject Heading (MeSH) term for "education research," and because excellent foundational articles can be found in a wide variety of health professions and specialty-specific journals, this curated list incorporates a broad literature search which was augmented by hand-checking personal files as well as reference lists of all identified articles. Similar methodology may be applied to future efforts to identify key medical education research articles in specific niches.

This study is limited by omitting articles published since 2020 as well as those without an abstract. Also, while the Delphi panel was intentionally created to

include a range in experience levels and specialties, it is unlikely to be representative of all education researchers, and readers may find the articles included to have variable utility. As we used the Delphi method to build consensus among our author team in this study, the panel and author team were identical (except for the one nonvoting author). This method has been used in similar studies but may lead to conflicts of interest between the roles of author and panelist.²⁹ Additionally, Delphi studies require the team to make decisions about the thresholds for consensus and formats of iterative rounds of voting. Although we relied on both established methods for modified Delphi studies as well as thoughtful consideration of the aim of each round of voting when developing our surveys, the study may have fallen short of our goal of identifying the true consensus regarding the most useful resources. To further foundational learning in medical education research, next steps may include developing an online compendium of annotated resources that could be revised periodically, as well as including additional experts for the rating process.

Conclusions

Our modified Delphi study of foundational education research methods articles identified 9 articles that stood out to our panel as the most useful resources for medical education researchers. This list may be used by graduate medical educators who are seeking methods resources, as well as program directors and mentors seeking to share helpful resources with trainees and colleagues.

References

1. Blanchard RD, Artino AR Jr, Visintainer PF. Applying clinical research skills to conduct education research: important recommendations for success. *J Grad Med Educ*. 2014;6(4):619-622. doi:10.4300/JGME-D-14-00443.1
2. Cook DA, West CP. Perspective: reconsidering the focus on "outcomes research" in medical education: a cautionary note. *Acad Med*. 2013;88(2):162-167. doi:10.1097/ACM.0b013e31827c3d78
3. Yarris LM, Deiorio NM. Education research: a primer for educators in emergency medicine. *Acad Emerg Med*. 2011;18(suppl 2):27-35. doi:10.1111/j.1553-2712.2011.01189.x
4. Harden RM. What is a spiral curriculum? *Med Teach*. 1999;21(2):141-143. doi:10.1080/01421599979752
5. Chan TM, Yarris LM, Humphrey-Murto S. Delving into Delphis. *CJEM*. 2019;21(2):167-169. doi:10.1017/cem.2019.3

6. Abramson EL, Paul CR, Petershack J, et al. Conducting quantitative medical education research: from design to dissemination. *Acad Pediatr*. 2018;18(2):129-139. doi:10.1016/j.acap.2017.10.008
7. Albert M, Hodges B, Regehr G. Research in medical education: balancing service and science. *Adv Health Sci Educ Theory Pract*. 2007;12(1):103-115. doi:10.1007/s10459-006-9026-2
8. Attree M. Evaluating healthcare education: issues and methods. *Nurse Educ Pract*. 2006;6(6):332-338. doi:10.1016/j.nepr.2006.07.010
9. Barnard J, Ledger A. Practical tips for undertaking a medical education research project at undergraduate level: recommendations for both students and supervisors. *MedEdPublish*. 2016;5(1). doi:10.15694/mep.2016.000027
10. Beckman TJ, Cook DA. Developing scholarly projects in education: a primer for medical teachers. *Med Teach*. 2007;29(2-3):210-218. doi:10.1080/01421590701291469
11. Boet S, Sharma S, Goldman J, Reeves S. Review article: medical education research: an overview of methods. *Can J Anaesth*. 2012;59(2):159-170. doi:10.1007/s12630-011-9635-y
12. Bordage G. Conceptual frameworks to illuminate and magnify. *Med Educ*. 2009;43(4):312-319. doi:10.1111/j.1365-2923.2009.03295.x
13. Bordage G, Dawson B. Experimental study design and grant writing in eight steps and 28 questions. *Med Educ*. 2003;37(4):376-385. doi:10.1046/j.1365-2923.2003.01468.x
14. Bordage G. Reasons reviewers reject and accept manuscripts: the strengths and weaknesses in medical education reports. *Acad Med*. 2001;76(9):889-896. doi:10.1097/00001888-200109000-00010
15. Carek PJ, Mainous AG 3rd. The state of resident research in family medicine: small but growing. *Ann Fam Med*. 2008;6(suppl 1):2-4. doi:10.1370/afm.779
16. Carney PA, Nierenberg DW, Pipas CF, Brooks WB, Stukel TA, Keller AM. Educational epidemiology: applying population-based design and analytic approaches to study medical education. *JAMA*. 2004;292(9):1044-1050. doi:10.1001/jama.292.9.1044
17. Chen FM, Bauchner H, Burstin H. A call for outcomes research in medical education. *Acad Med*. 2004;79(10):955-960. doi:10.1097/00001888-200410000-00010
18. Cook DA, Bordage G, Schmidt HG. Description, justification and clarification: a framework for classifying the purposes of research in medical education. *Med Educ*. 2008;42(2):128-133. doi:10.1111/j.1365-2923.2007.02974.x
19. Cook DA. Getting started in medical education scholarship. *Keio J Med*. 2010;59(3):96-103. doi:10.2302/kjm.59.96
20. Cook DA. If you teach them, they will learn: why medical education needs comparative effectiveness research. *Adv Health Sci Educ Theory Pract*. 2012;17(3):305-310. doi:10.1007/s10459-012-9381-0
21. Cook DA, Levinson AJ, Garside S. Method and reporting quality in health professions education research: a systematic review. *Med Educ*. 2011;45(3):227-238. doi:10.1111/j.1365-2923.2010.03890.x
22. Cook DA, Bowen JL, Gerrity MS, et al. Proposed standards for medical education submissions to the Journal of General Internal Medicine. *J Gen Intern Med*. 2008;23(7):908-913. doi:10.1007/s11606-008-0676-z
23. Cook DA, Beckman TJ, Bordage G. Quality of reporting of experimental studies in medical education: a systematic review. *Med Educ*. 2007;41(8):737-745. doi:10.1111/j.1365-2923.2007.02777.x
24. Eva KW. Broadening the debate about quality in medical education research. *Med Educ*. 2009;43(4):294-296. doi:10.1111/j.1365-2923.2009.03342.x
25. Norman G. RCT = results confounded and trivial: the perils of grand educational experiments. *Med Educ*. 2003;37(7):582-584. doi:10.1046/j.1365-2923.2003.01586.x
26. Ratelle JT, Sawatsky AP, Beckman TJ. Quantitative research methods in medical education. *Anesthesiology*. 2019;131(1):23-35. doi:10.1097/ALN.0000000000002727
27. Shea JA. Mind the gap: some reasons why medical education research is different from health services research. *Med Educ*. 2001;35(4):319-320. doi:10.1046/j.1365-2923.2001.00913.x
28. Bunniss S, Kelly DR. Research paradigms in medical education research. *Med Educ*. 2010;44(4):358-366. doi:10.1111/j.1365-2923.2009.03611.x
29. Lai S, Buchheit BM, Kitamura K, et al. Five key articles on curriculum development for graduate medical educators. *J Grad Med Educ*. 2024;16(1):75-79. doi:10.4300/JGME-D-23-00208.1



Ethan Feig, is a Medical Student, Tel Aviv University, Tel Aviv, Israel; **Ryanne Mayersak, MD**, is Associate Professor of Emergency Medicine and Director of Diversity, Equity, and Inclusion, Oregon Health & Science University, Portland, Oregon, USA; **Christine Luo, MD, PhD**, is Associate Physician, Department of Emergency Medicine, Kaiser Permanente Santa Clara Medical Center, Santa Clara, California, USA; **Mackenzie R. Cook, MD**, is Associate Professor of Surgery, Trauma, Critical Care and Acute Care Surgery, Oregon Health & Science University, Portland, Oregon, USA; **Lauren Sigman, MD**, is Assistant Professor of Emergency Medicine and Departmental Director of Undergraduate Medical Education, Oregon Health & Science University, Portland, Oregon, USA; **Jaime Jordan, MD, MA**, is Associate Professor of Clinical Emergency Medicine, Vice Chair, Acute Care College, Director of Discovery, and Associate Program Director, Department of Emergency Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California, USA; **Jeff Riddell, MD**, is Assistant Professor, Keck School of Medicine, University of Southern California, Los Angeles, California, USA; **Leila Zuo, MD**, is Associate Professor of Anesthesiology & Perioperative Medicine, Oregon Health & Science University, Portland, Oregon, USA; **Angela Holly Villamagna, MD**, is Assistant Professor of Medicine, Division of Infectious Diseases, Oregon Health & Science University, Portland, Oregon, USA; **Erin Bonura MD, MCR**, is Associate Professor of Medicine, Division of Infectious Diseases, Oregon Health & Science University,

BRIEF REPORT

Portland, Oregon, USA; and **Lalena M. Yarris, MD, MCR**, is Professor of Emergency Medicine and Vice Chair for Faculty Development, Oregon Health & Science University, Portland, Oregon, USA, and Deputy Editor, *Journal of Graduate Medical Education*, Chicago, Illinois, USA.

Funding: The authors report no external funding source for this study.

Conflict of interest: The authors declare they have no competing interests.

The authors would like to thank Andrew Hamilton, MS/MLS, for his contributions as the study's Health Science Education and Research Librarian, and Jacob Yarris, BA, for his graphic design assistance for the article's figure.

Corresponding author: Lalena M. Yarris, MD, MCR, Oregon Health & Science University Portland, Oregon, USA, yarrisl@ohsu.edu, X @lainieyarris

Received December 16, 2023; revision received April 28, 2024; accepted June 12, 2024.