Research in Medical Education

A Primer for Medical Students

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I. What is research in medical education (MedEd)?

Medical education research aims to advance the knowledge, skills, and professionalism of medical students by understanding and evaluating educational ecosystems. These ecosystems include policies related to admissions and curriculum, people who serve as teachers and mentors, instructional technology and other resources, the attitudes that pervade a given institution or educational experience, and even the students themselves. Ultimately, research in medical education is conducted to:

- address contemporary issues and questions in medical education
- design, evaluate, and support curricular innovations
- assess and reform the culture underlying medical education

What are the origins of MedEd research?

The 1910 Flexner Report, officially titled "Medical Education in the United States and Canada," was a landmark document that brought about medical education reform in North America. Abraham Flexner, a research scholar at the Carnegie Foundation, visited all 155 medical schools in operation at the time to assess the state of medical education. Disappointed by the existing medical education ecosystem, Flexner commented on the poor quality of curricula and teaching facilities, lack of standardization, and the schools' disproportionate emphasis on financial gain. Flexner instead advocated for formal analytic training via a strong foundation in biomedical sciences and hands-on clinical training in academic hospitals, a construct that still stands today.

Flexner also endorsed the idea of research geared towards improving patient care, but did not believe research itself was a worthy goal, with his motto: "think much, publish little." Accordingly, the Flexner report, though instrumental in the rethinking of medical education, was not the start of the medical education research movement itself. A review of history and limited literature notes the continued absence of the concept of MedEd research until the mid-1950s. Many organizations related to medical education (i.e. AAMC, AMA, LCME) already existed or were being formed at the time, but these focused more on oversight, funding, and other administrative functions. Studies suggest that the origins of MedEd research fall in between 1955 and 1959, with evidence for its rise in the AAMC's *Journal on Medical Education* (JOME, now *Academic Medicine*), annual meeting research sessions, and concurrent change in organizational structure.

Early MedEd research was conducted in the traditions of experimental psychology and cognitive science by behavioral scientists not necessarily having a background in medicine. In the past several decades, substantive change has been seen in how MedEd research is conducted and who the principal investigators are. Chief among the changes is the inclusion of a broader range of theoretical perspectives and research methodologies and of medical educators as scholars. MedEd research clearly benefits from a multitude of perspectives and close collaboration among medical educators and behavioral scientists.[1-2]

[1] Norman G. Fifty years of medical education research: waves of migration. Med Educ 2011; 45: 785-91.
[2] Kuper A, Whitehead C. The practicality of theory. Acad Med 2013; 88(11): 1-2.

What types of topics are studied?

Medical education is a broad discipline, more easily seen as a complex ecosystem with many variables across classes, institutions, regions, and even countries. These interrelated factors include curriculum design, instructional format, learning delivery models, program and performance evaluation, faculty selection and efficacy, learning environment and culture. A 2011 study that assessed the themes in medical education research in the past 20 years, noted that MedEd research frequently explores the psychological impact of these factors on the individual student. Below is a list of the top themes in medical education research cited in the 20-year review.

1. Student assessment & evaluation	16. Use of simulations
2. Clinical skills training	17. Admission to medical school
3. Clinical clerkships	18. Medical licensing exams
4. Problem-based learning	19. Knowledge retention
5. Community-based training	20. Specialty choice
6. Clinical competence assessment	21. Patient safety
7. Teaching the clinical sciences	22. Scholarship in education
8. Communication skills training	23. Humanities in medicine
9. Student characteristics	24. Teaching through lectures
10. Objective structured clinical exam (OSCE)	25. Interprofessional education
11. Teaching the basic sciences	26. International medical graduates
12. Nature of clinical reasoning	27. Women's health
13. Professionalism in medicine *(incl. attitudes, cultural competence, ethics)*	28. Underrepresented minority students
14. Costs of medical education	29. Computer-assisted instruction
15. Faculty development	

[1]Rotgans JI. *The themes, institutions, and people of medical education research 1988-2010.* Advanced Health Science Education Theory Practice Journal. 2012.

What are examples of successful studies?

Successful MedEd research projects are quite diverse with respect to topic and research methodology. The table below lists a small selection of the seminal articles that have shaped how we conceptualize and conduct MedEd research and practice today.

Topic	Study Title / Year	Key Takeaways
Standardized patient exams	*Direct, standardized assessment of clinical competence / 1987*	Describes the design criteria and validation of the first standardized patient exams.
Problem-based learning	*Problem-based learning: a review of literature on its outcomes and implementation issues / 1993*	Based on a meta-analysis-type literature review, the authors recommend that caution be exercised in making comprehensive, curriculum-wide conversions to PBL until more is learned about the particular strengths and weaknesses of this instructional method.
Performance ratings	*Comparing the psychometric properties of checklists and global rating scales for assessing performance on an OSCE-format examination / 1998*	Global rating scales scored by experts were more reliable and valid than checklists. Further, the presence of the checklists did not improve the reliability or validity of the global rating scale over that of the global rating scale alone. Global rating scales administered by experts are a more appropriate summative measure when assessing candidates on performance-based examinations.
Diagnostic reasoning	*Diagnostic reasoning strategies and diagnostic success/ 2003*	Compares the use of hypothetico-deductive reasoning, scheme-inductive reasoning, and pattern recognition among expert and non-expert physicians, finding that pattern recognition and scheme-inductive reasoning were associated with the greatest likelihood of diagnostic success.
Admissions	*An admissions OSCE: the multiple mini-interview / 2004*	Describes the validation of an OSCE-type assessment that can be used to augment standardized test scores and college grades for medical school admissions in order to capture interpersonal skill.
Professionalism	*Disciplinary action by medical boards and prior behavior in medical school / 2005*	Compares the academic performance records of physicians disciplined by a state board and matched control physicians who had not been disciplined, finding that disciplined physicians were twice as likely to have demonstrated unprofessional behavior in medical school.
Clinical supervision	*Medical competence: the interplay of individual ability and the health care environment / 2010*	Proposes that competence be approached in the context of the particular clinical environment, such that the assessment of competence is tied to a trainee's performance of essential clinical activities that define the profession. Competence is implicit in the eventual entrustment of trainees to perform these professional activities.
Student empathy	*Decline in empathy of medical students / 2011*	The implicit emphasis on detachment, self-interest, and objectivity in conjunction with student workload and stress contribute to a decline in empathy through medical school.

II.   Why should I do a MedEd research project?

Why are medical students especially qualified to do MedEd research?

As medical students, you are front and center of the medical education process! Oftentimes, great ideas about "what works" in education are dashed on the shoals of reality. Representing that rocky shoreline, students are in the unique position to evaluate how a process is currently working and what impact actually results from educational intervention. Though not everything can be seen in real-time, hindsight often provides medical students the ability to see what worked in their education and what did not based on their individual goals.

You are also in the perfect position to be a part of your own research while improving your own education! Participating in MedEd research can foster valuable insight into teaching and learning that you might not gain any other way than by analyzing educational ecosystems. Ideas for educational innovations often stem from educational experiences from other institutions, but usually they are a result of speaking with your peers and upperclassman on a frequent basis. This honest, peer-level bond allows you to get candid, sincere advice from those who have been or are currently going through the process. Being on the front lines also allows you to gauge how changes and assessments are progressing and adjust as necessary.

Will a MedEd research project be valuable for residency?

Though research is not a requirement for all specialties and residency programs, it is highly recommended that you participate in research if you desire a residency in a competitive field or at an academic program. Many programs pride themselves on placing their residents into academic fellowships and faculty roles of academic institutions. This will vary widely based on where you are applying and for what field, and speaking to members of that community will be your best approach to figuring that out. However, research will make any application more appealing!

Academic programs in particular look favorably on MedEd research because it shows that you are invested in the process of improving your education and that of those around you. Completing MedEd research not only shows your interest in this area, but also shows your dedication to developing and completing a project and your readiness to participate fully in an academic medical center by educating others and participating in curriculum reform. Feedback is an essential part of any residency program's evaluation of both its residents and itself. Showing that you are able to objectively evaluate the education you are receiving lets a residency know that you will provide valuable feedback on the educational objectives of a program. They want residents that want to be involved!

Participation in MedEd research also sets you apart from other candidates who have invested in more conventional areas of study. Having MedEd research projects on your CV may help residency programs set up interviews with faculty who have similar interests, which leads to interesting and memorable discussion for you and them!

What career paths align with an interest in MedEd research?

In your immediate future, participation in MedEd research will better prepare you for your role as resident, where there will be formal and informal expectations for you to teach medical students and, later in residency, your more junior peers. If you envision yourself practicing at an academic medical center, note that participation in some form of research is a requirement for hiring, promotion, and tenure at almost every academic institution. Choosing MedEd research for your field of study will make you more competitive for educational leadership positions, such as curriculum committee chair, clerkship director, residency program director, and beyond. Because medicine is a field that is constantly evolving, those employed in the field are life-long learners. Participating in this process will benefit you regardless of your specialty and practice choice, and also will help you truly succeed in an academic- or research-oriented career.

III.   How can I get started on a MedEd research project?

How do I develop a research question?

Sometimes the hardest part of a research project is coming up with an idea that is feasible, can have a meaningful impact, and has not already been done. Limiting the scope of your idea to a time frame and level of effort that won't unduly interfere with your ongoing studies is also challenging. Thankfully, ideas don't spring from a vacuum, and medical students are not expected to independently lead something they've never done before. Ideas emerge from mindfully participating in everyday experience with others. A great way to generate research questions is to participate in ongoing educational innovations at your home institution, collaborate as a junior partner in ongoing MedEd research projects, and build relationships with others at your institution who are doing MedEd research.

Who leads MedEd projects?

At an institutional level, the primary faculty who conduct research in medical education are often those affiliated with the medical school administration. Student Affairs deans, leaders in curriculum development, clerkship directors, and research program directors are well-represented in the pool of medical education researchers. Some schools may have a medical education 'track' or 'concentration,' or more informal groups such as a medical education 'journal club,' or even faculty dedicated to medical education.

How can I find a research mentor at my medical school?

There are, of course, a variety of faculty members that are involved in medical education research, thus the best route to finding the relevant people at your institution would be to ask the leaders in your research office and/or your student affairs deans for further direction.

How can I collaborate with others on a research project?

There are likely to be others at different institutions with expertise in your area of interest. Many may be interested in your findings or be able to provide guidance as you develop your project. These can be positive mentoring opportunities that could complement the advising you receive from a member of your local faculty. Look for these opportunities as you review the literature. AAMC-sponsored meetings, events, and publications are excellent venues to learn about research in medical education and network with other scholars in the field.

Are there established programs/grants for doing MedEd research?

Although research programs (both paid and unpaid) are more abundant in the areas of basic sciences/clinical research, there are several opportunities for involvement in formal medical education research programs, as shown in the table below. Some programs are geared towards student principal investigators, some programs have broad eligibility guidelines, and some require faculty principal investigators (though students may be involved). Programs also vary in terms of how long funded

projects are expected to take and the duration of the proposal process. Sometimes you can do interesting research as an offshoot of a program that is already funded or help a faculty member propose and conduct a funded project that is larger in scope. Sometimes grants include funds for travel, which could support the presentation of your work as a poster or paper at a conference. As is often the case, conducting an independent background web search (starting with the links below) and talking to faculty doing funded medical education research at your local institution are the best two avenues to start with.

Program/ Grant Title	Institution/ Organization	Description
AMA Foundation Seed Grant Research Program	*American Medical Association (AMA)*	The program provides grants to support medical students, physician residents, and fellows in conducting small research projects.
Stemmler Medical Education Research Fund	*National Board of Medical Examiners (NBME)*	The program provides grants to support research for the development of innovative assessment approaches for undergraduate, graduate, and continuing medical education.
Research Reviews / Synthesis Papers	*Society of Directors for Research in Medical Education (SDRME)*	The program provides grants to support research review/synthesis papers that make a substantial contribution to advancing practice, theory, or research in medical education.
Regional Grant Programs	*Association of American Medical Colleges (AAMC) Group on Educational Affairs (GEA)*	Each of 4 regions (Northeast, Southern, Central, Western) has a program that provides grants to support medical education research that will lead to the establishment of new programs of study.

IV.   How are MedEd research projects structured?

What are the steps for developing a scholarly MedEd project?

There are several approaches to designing a MedEd research project. Below is a framework[1] that may serve as a good starting point for a new question or hypothesis.

I.   Refine your study question

- Review the literature to identify gaps.
- Clearly state a problem and the significance of addressing it.
- Develop a conceptual framework: a theory model, or approach that places a question within a theoretical context.

II.   Define your outcomes

- An outcome is the dependent variable of your study and should help you answer your specific question directly
- Challenge yourself to predict the outcome of your study. What would your study suggest if your prediction was proven to be true or false?
- Plan to collect information about your outcome in an unbiased manner.

III.   Identify designs and methods to enable you to study your outcome, such as:

- Observations: Determine relationships or associations between variables
- Experiments: study the effect of changing one variable on another
- Qualitative research: study the reasons behind certain behaviors and decisions
- Validations: collect evidence to test the predictive value of scoring instruments (e.g. course evaluations)
- Surveys: Ask questions to better understand a subject's characteristics
- Systematic Reviews: Use an established method/criterion to summarize previously published studies

[1]Adapted from Beckman, TJ. *Developing scholarly projects in education: a primer for medical teachers*. Medical Teacher. 2007.

Where can I read more about how to design, conduct, and report on MedEd research?

General

Bordage G. Conceptual frameworks to illuminate and magnify. Med Educ 2009; 43: 312-9.

Eva KW, Lingard L. What's next? A guiding question for educators engaged in educational research. Med Educ 2008; 42: 752-4.

Cook DA, Beckman TJ, Bordage G. Quality of reporting of experimental studies in medical education: a systematic review. Med Educ 2007; 41: 737-45.

Program Evaluation

Durning SJ, Hemmer P, Pangaro LN. The structure of program evaluation: an approach for evaluating course, clerkship, or components of a residency or fellowship training program. Teach Learn Med 2007; 19(3): 308-18.

Haji F, Morin MP, Parker K. Rethinking programme evaluation in health professions education: beyond 'did it work?' Med Educ 2013; 47(4): 342-51.

Systematic Reviews

Cook DA, West CP. Conducting systematic reviews in medical education: a stepwise approach. Med Educ 2012; 46(1): 943-52.

Markert RJ. Enhancing medical education by improving statistical methodology in journal articles. Teach Learn Med 2013; 25(2): 159-64.

Schifferdecker KE, Reed VA. Using mixed methods research in medical education: basic guidelines for researchers Med Educ 2009; 43(7): 637-44.

Lavelle E, Vuk J, Barber C. Twelve tips for getting started using mixed methods in medical education research. Med Teach 2013; 35(4): 272-6.

Validity research

Colliver JA, McGaghie WC. The reputation of medical education research: quasi-experimentation and unresolved threats to validity. Teach Learn Med 2008; 20(2): 101-3.

Downing SM. Validity: on the meaningful interpretation of assessment data. Med Educ 2003; 37: 830-7.

Sullivan GM. A primer on the validity of assessment instruments. J Grad Med Educ. 2011; 3(2):119-120.

Rickards G, Magee M, Artino Jr AR. You can't fix by analysis what you've spoiled by design: developing survey instruments and collecting validity evidence. J Grad Med Educ. 2012;4(4): 407-10.

Surveying

Magee C, Rickards G, Byars LA, Artino Jr AR. Tracing the steps of survey design: a graduate medical education research example. J Grad Med Educ. 2013;5(1):1-5.

Willis GB, Artino Jr AR. What do our respondents think we're asking? Using cognitive interviewing to improve medical education surveys. J Grad Med Educ. 2013;5(3):353-56.

Qualitative Research

Hanson JL, Balmer DF, Giardino AP. Qualitative research methods for medical educators. Acad Peds 2011; 11: 375-86.

Sullivan GM, Sargeant J. Qualities of Qualitative Research: Part I. J Grad Med Educ. 2011; 3(4):449-452.

Sargeant J. Qualitative Research Part II: Participants, Analysis, and Quality Assurance. J Grad Med Educ. 2012; 4(1):1-3.

Randomized Control Trials

Sullivan GM. Getting off the "gold standard": randomized controlled trials and educational research. JGME 2011; 3(3): 285-9.

Norman G. RCT = results confounded and trivial: the perils of grand educational experiments. Med Educ. 2003; 37: 582-4.

V.   What is the timeline for doing a MedEd research project?

How long does it take to complete a MedEd project?

One of the most important things you can do with a MedEd research project is demonstrate your ability to commit to a project you've started and see it through to completion. It helps to be self-aware regarding your available time and level of effort. MedEd projects, like all research projects, have varying timelines depending on the topic (*see section I*) and the structure of the project (*see section IV*). Timelines may not turn out to be what you anticipated (usually they go longer than expected), but generally speaking, if the project is analyzing a program or data at a point in time, the project could be initiated and completed in 6 months or less, perhaps as a summer research project. Projects that look at the impact of a course/project/process initiated at the start of the project will generally take much longer and may span multiple years, as they are capturing impact/change over time. Interventions such as new curricula or teaching methods are likely to fall into the latter category, as the quantitative outcomes of these changes will require at least one year to assess (e.g. student performance). The timeline is thus something to keep in mind when deciding what type of topic/structure to choose. For all projects, the time needed to seek institutional review board approval must also be considered. Your best course of action is to discuss timelines with your mentor prior to committing to a project.

When should I start thinking of a topic of interest?

It is never too early to start thinking about a topic/subject of interest. If you have a long-standing interest in academic medicine, you may already have ideas in mind. The most important thing to consider is when you will have time to work on research during medical school. Most medical students have more time during their 1st year, summer after 1st year, or early 2nd year, and perhaps in their 4th year. Once you have determined your availability to work on research, you will likely need a 6-month head start to select a mentor/topic and officially sign on to a project. Many students start thinking about research about 6 months into medical school, around fall/winter/early spring of their 1st year.

When should I begin searching for a research mentor?

As outlined above, it is first important to find out your medical school schedule across all 3/4 years and determine your availability to work on a research project. Beginning to look for a research mentor about 6 months in advance of when you want to begin research is a reasonable timeline to ensure you are prepared.

VI. How can I present or publish a MedEd research project?

What criteria are used to evaluate MedEd research projects?

Criteria for evaluating MedEd research for publication or presentation will vary as broadly as the number of journals and conferences available to you. The first step to sharing your MedEd research with the MedEd community will be to find the appropriate outlet. It may seem like a daunting task to find a vehicle that will help you reach the broadest target audience you can. The best place to start will be your mentors, who may be able to guide you in narrowing down your search to those best matching the goals of your own research. It can also help to pay close attention when you read MedEd articles, noting what journal they came from, how they are formatted, and so forth. This can help you develop your own sense of "what editors want."

From there, the criteria regarding the structure and content for a publication or presentation will be made available from the publication of choice. Read each "For Authors" section or "Call for Abstracts" carefully to make sure you are aware of the criteria that you must meet to be in order to be considered for acceptance / publication.

Which journals/publications accept MedEd research papers?

There are a wide variety of journals available to submit your publications to. These are, after all, where the articles you read for your literature reviews came from! Though there are many journals focusing on medical education, you can also consider submitting to a general medical journal based on the relevance and impact of your MedEd research.

- Academic Medicine (AAMC Journal)
- Medical Education
- Advances in Health Sciences Education
- Teaching and Learning In Medicine
- Medical Teacher
- BMC Medical Education
- JAMA (American Medical Association)
- NEJM (New England Journal of Medicine)

Below are some composite lists that have been created by medical schools across North America. These lists are not exhaustive, but they do provide more avenues for publications than the small handful listed above.

- Rowan University: Selected Medical Education Journals (with summaries)
- University of Ottawa: Journals that publish MedEd articles (hyperlinks listing)

What conferences showcase MedEd research projects?

When applying to conferences, it is important to know what kind of presentation you would like to prepare. Often there are opportunities for a variety of poster and oral presentations. Think about which type will best showcase your efforts. Also, note that there commonly are funds available to aid with your travel expenses. These can come from grants, departmental travel funds, or some other source you should ask your research mentor about.

- The AAMC Meetings Calendar lists several meetings aimed towards MedEd. The Annual meeting is perhaps the best opportunity to showcase student-driven research available to a wide audience.
- The AMEE is an international association for medical education that often holds their annual conference abroad.
- There are some institution-sponsored conferences, including the popular Innovations in Medical Education (IME) Conference hosted by Keck SOM. Also, look for MedEd conferences hosted in your region.
- The Generalists in Medical Education organization hosts an annual MedEd research conference, often in conjunction with the AAMC annual meeting.
- There are also specialty-based MedEd conferences held, such as the Society of Teachers of Family Medicine (STFM) who hold annual conferences.
- As with the previous list of journals, this list is not exhaustive, but should be viewed as a starting point for exploring your options. You should also investigate at your own institution to see what resources are available, such as this extensive list provided on Vanderbilt SOM website list of MedEd conferences.

VII.   How can I find out more about MedEd research?

Who should I contact at my local institution?

At each institution, there are a variety of faculty members involved in medical education research. Thus, the best route to finding the relevant people at your institution would be to ask the leaders in your medical student research office and/or your student affairs deans for further direction. *See also section V.*

Who can I contact within the AAMC?

There are number of individuals and groups within the AAMC with a wealth of knowledge about and experience in medical education. Follow the links below to find current information about each group, and contact the OSR Director or Chair to get more information before contacting these groups directly.

Organization of Student Representatives (OSR): https://www.aamc.org/members/osr/

The easiest way to take advantage of opportunities in the AAMC is to connect with the Organization of Student Representatives (OSR) at your institution. If you do not know who your representative is, talk to your Student Affairs Dean. You and your representative should also reach out to the OSR Chair (a fellow student) and the OSR Director (a staff member at the AAMC).

Group on Educational Affairs (GEA): https://www.aamc.org/members/gea/

The purpose of the Group on Educational Affairs (GEA) is to promote excellence in the education of physicians throughout their professional lives and, thereby, to contribute to improving the health of the public. Among other things, the GEA fosters the development and continued improvement of medical education programs to enhance physician learning and the advancement of research in medical education and the dissemination of the results of that research.

Medical Education Scholarship Research and Evaluation (MESRE), *formerly known as Research in Medical Education (RIME):* https://www.aamc.org/members/gea/gea_sections/mesre/

The group's goal is to improve the quality of training in medical education research and fostering the continued development of researchers, which we believe can be extended to medical students. The group also hosts the annual RIME conference.

Medical Education Research Certificate (MERC): https://www.aamc.org/members/gea/merc/

The MERC (Medical Education Research Certificate) Program is aimed at helping clinicians and educators understand the purpose/process of medical education research and improving research skills through a series of three-hour workshops. While the course is targeted towards clinicians and educators, the content could likely be adapted for medical students.

VIII.   Can I offer my feedback on this MedEd research "primer?"

Yes! Please follow this link to the <u>survey</u>.