MEDICAL SCIENCE EDUCATOR

A Toolkit for Explorers in Medical Sciences Educational Scholarship: From Ideas to Dissemination

Design, implement, and disseminate a medical sciences educational scholarship project

Jonathan J. Wisco, Ph.D.

- An introduction to medical sciences education

Abstract

Almost without exception, the authors of this Educational Scholarship Committee Toolkit at some point in their career started at the same medical sciences education trailmarker labeled, "begin here." Similar to wilderness backpackers, explorers in medical sciences educational scholarship need basic necessities to help them navigate the adventures of discovering new information that will inform best practices to teach current and next generation health care providers. In a society and culture that needs compassionate care more than ever, the need for quality medical sciences education couldn't be more timely.

IF the overall goal is to develop students into life-long learners with adaptive expertise...

…THEN we need to approach the teaching and learning experience differently.

This Toolkit serves as the first step toward becoming a medical sciences education scholar who can help transform education. *This is a map written by guides who have walked - and in some cases, blazed - the trails you will encounter on your adventure.* This Toolkit also serves as a reminder of medical sciences education scholarship fundamentals for those who are more experienced explorers. Therefore, navigating the map can be as simple as starting clicking the first trailmarker, "Identifying a mentor," and following the map sequentially by clicking on the green navigation buttons at the bottom right of each page (or left to backtrack). Or, the more adventurous explorer can click on any of the trailmarkers to start, and navigate back to the Toolkit Map at anytime, using the center navigation button.

When you are ready for the next step toward becoming a medical sciences education scholar, we encourage you to meet the guides themselves through the Essential Skills in Medical Education (ESME) and IAMSE Fellowship Programs.

Happy Exploring!
The Educational Scholarship Committee

Toolkit Guide

Identifying a mentor

- Define the mentoring relationship.
- Describe strategies for promoting effective mentorship.
- Determine the type of mentorship that is right for you.

Amber J. Heck, Ph.D.

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Abstract

Mentorship in medical education scholarship is a professional relationship among individuals where knowledge and skills are leveraged to achieve scholarship goals. Mentorship can exist in many forms, each with benefits and limitations. In seeking mentorship, mentees should explore purpose and expectations, and consider a broad variety of opportunities. The actions of a mentee can greatly influence the success of a mentoring relationship, and therefore, mentees should be proactive in taking steps to advance mentorship. There are many ways to get there, but ultimately, successful mentorship in medical education scholarship supports mentees in achieving their scholarship goals.

Defining Mentorship

While mentorship has a long history (dating back to Homer's Odyssey), our modern appreciation of mentorship is based on the work of Roche in 1979 (1). Roche found that those who have engaged with mentors are more successful, more knowledgeable, and derive more satisfaction out of their work. There are many definitions of "mentor" and "mentorship." The Merriam Webster dictionary defines a mentor as "a trusted counselor or guide" (2). Mentorship can occur in a variety of ways, with different goals and priorities. Here, we will highlight the importance of selecting an effective mentor, defining roles and developing objectives, establishing rapport, and include some suggestions for mentor/mentee activities.

In a mentoring relationship the goals of the relationship are varied and should be specifically defined. In medical education, long term goals often include increasing research productivity, enhancing professional networking, and improving career satisfaction (3). In reaching the goals, established together by the mentee and mentor, a mentor's roles include being available for meetings, inspiring productivity, promoting self-direction through questioning and listening, developing scientific skill through teaching and feedback, and celebrating successes (4).

Identifying a mentor

Strategies for Promoting Effective Mentorship

Rapport building is an important first step in any mentoring relationship, and is based on negotiating expectations and establishing trust. Trust is determined by factors such as ability, benevolence, and integrity (5). Seniority of the mentor can greatly influence these factors, though peer to peer mentorship has demonstrated effectiveness too. In addition, perceptions of trust can be enhanced when mentor and mentee share similar characteristics and background, such as gender, ethnicity, or other lived experiences (5). In choosing a mentor, it is important to consider trustworthiness. This can be accomplished through asking yourself the following questions: Do I feel this individual has the necessary skills and competencies to positively influence the skills and competencies I strive to achieve? Do I believe this individual is capable of and has the intention to support me to reach my goals? Do I think this individual is credible and has a set of principles that align with my own? And perhaps most importantly: Do I feel a sense of connection with this individual?

Expectations between mentors and mentees have to be aligned. This can be accomplished informally or established through a formal mentoring compact (6), to address availability and timing of communications, mentee/mentor goals for the relationship, and expectations regarding quality of and ethical responsibility in the conduct of research. A sample form has been provided which may be useful to organize your thoughts and to share with your mentor.

Once a mentor: mentee relationship has been established, it is important to clarify the goals to pursue. Mentors should best guide mentees in this process through questioning and listening, keeping in mind the mentee's research and career path, independent of that of the mentor. In other words, you should not expect to be included in your mentor's research, and your mentors should not expect that you will always pursue similar research interests to their own.

Mentors play an important role in promoting continual progress towards achieving goals through inspiration, teaching, and feedback. The success of a mentoring relationship is primarily measured according to the mentee's ability to meet the goals established. Therefore, goals should be measurable and achievable. Common goals in medical education research are directed toward achieving project milestones based on specific aims, submission of funding applications, presentations at professional meetings, and peer-reviewed publication. To ensure goals are attainable within a specific time frame, they should be written as SMART goals which require the goal to be specific, measurable, achievable, relevant, and time-bound. SMART goals should be shared with mentors, who can then provide feedback specific to each element.

Determining the Type of Mentorship that is Right for You

Your goals dictate the type of mentorship you need. A long-term mentor, or primary mentor, provides consistent support in achieving the mentee's goals in scholarship and career advancement. In some situations, a primary mentor might not have the requisite expertise or experience to best address an issue. In such cases, a short-term mentor might be desirable for the specific task, such as: writing a human subjects research protocol or deciding which assessment tool is most appropriate. Anticipating this, you should associate yourself with multiple mentors with different areas of expertise. Whenever challenges arise, your primary mentor can help you identify the appropriate individual for the specific task.

Many institutions now have mentoring programs available to faculty, which facilitate connections with more experienced faculty who are willing and able to act as mentors. Some professional organizations also offer programs for mentoring. As an example, the IAMSE Medical Educator Fellowship program provides participants with opportunities for mentorship in the areas of professional development and medical science educational scholarship. These program-based mentoring relationships are cultivated over multiple years and often lead to ongoing professional relationships.

Mentoring relationships are most often considered one-to-one; however, group mentoring is also an option. Group mentoring refers to when one or more mentors works with a group of mentees. It can occur formally or informally. Referring back to our previous example, the IAMSE Medical Educator Fellowship forms mentoring groups, which include multiple mentors and mentees, to further facilitate participants' growth through peer-to-peer opportunities for collaboration and feedback. You may already be participating in informal peer group mentoring without knowing it. In this type of informal group mentoring, peers or colleagues, who act as both mentors and mentees, gather to share, discuss challenges, learn together, and learn from one another, which supports all in reaching their individual scholarship goals.

Seniority is one factor you probably already consider when identifying a mentor, however, peer mentoring has many benefits, some of which cannot be fulfilled by a mentor who is too much your senior. Peer mentoring is a mentoring relationship between two individuals who are at a similar career stage, where one (the peer mentor) has more experience with a particular task or more knowledge in a particular domain than the other (the peer mentee). Peer mentoring is a more accessible option, as there are usually more peers available to you, and trust and rapport are easier to build, due to the shared characteristics and

Identifying a mentor

lack of power dynamic. Peer mentors may be better able to empathize with the mentee's current circumstances and challenges, as they recently, or currently, experienced them too. For example, a peer may be able to assist you in approaching your department chair to request support for your scholarship idea, if they recently did the same. In addition, when mentor and mentee are closer in age, they are more likely to have shared communication preferences, experiences with technology, and expectations for meaning and value in work. The benefits of the former are obvious. The benefit of the latter is that a peer mentor may better understand your motivation for scholarship and outlook on how scholarship fits into your overall career goals. Perhaps the major benefit of peer mentoring, which sets it apart from traditional mentoring, is that the exchange is more often two-way, leading to co-learning. The result is a more equal investment across the two parties, which may increase the productivity and longevity of the relationship.

Finally, experienced faculty can greatly benefit from reverse mentoring, where a more junior faculty member serves as a mentor and assists the more senior mentee in achieving a goal. These relationships are often aimed at bridging the generational skill gap. For example, due to differences in education and lived experiences, junior faculty may have more skill in and knowledge of a particular form of technology. Senior faculty members interested in scholarship related to technology, social media, and social, cultural, or generational studies, would benefit from finding out what more junior faculty have to offer.

In the past, successful mentoring relationships were most often established informally by getting to know a colleague at work, and communication occurred through in-person meetings. However, modern platforms for virtual communication, and their widespread availability, now allow mentoring to happen even when mentor and mentee are separated by great distances. Therefore, mentors no longer have to be co-workers. Look within your professional organizations, such as IAMSE, to find mentors that are best suited to help you meet your scholarship goals.

Conclusion

Mentorship in medical education scholarship supports mentees in achieving their scholarship goals. Mentors lend support to mentees by sharing time, knowledge, skills, and experiences. Mentoring relationships are built on trust and shared expectations; therefore, communication is key to a successful relationship. Mentees can play a proactive role in the success of the relationship by exploring ways to further refine goals and structure communications with mentors. Mentorship comes in many shapes and forms. Mentees seeking to advance their scholarship should cultivate mentoring relationships with multiple individuals and groups, with a variety of skills and experiences. Overall, medical education scholars should appreciate and take full advantage of the wide variety of mentoring opportunities that exist.

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Defining the scholarly project

Amber J. Heck, Ph.D.

- Identify a topic for the educational research project.
- Define educational scholarship.
- Identify a topic for the educational research project.

Abstract

Educational scholarship refers to any scholarly work which is developed to address a specific objective within the field of education, and which is peer-reviewed and disseminated. Educational scholarship can exist in many forms, which can be categorized under the broad headings of non-research scholarly work and educational research. At times, it may be unclear what counts as scholarship. At other times, the endless possibilities for scholarship may present challenges in defining a project. To define an educational scholarship project, one must consider their interests and current activities, the importance and scope of the project, and the opportunities or challenges to dissemination. Common barriers to defining a project include a lack of experience or familiarity with the criteria of scholarship, and a lack of access to mentorship or examples of scholarship. Ultimately, a successfully defined project reflects the interests of the scholar, is important to the field, and has the potential for dissemination.

What defines scholarship?

Defining a scholarly project is a process which exists on a continuum. Therefore, many educators find themselves at the beginning, with no clear idea of what direction to go. In this case, it may be helpful to start with a few simple questions. What defines scholarship? And what am I already doing that counts?

In medical education, scholarship comes in many forms and is defined on multiple levels. Boyer defined scholarship as existing within four areas of academic work: discovery, integration, application, and teaching (1). The scholarship of discovery refers to our traditional viewpoints on research. It is the contribution of new knowledge to the field through application of the scientific method. The scholarship of integration is focused on making connections across topics, sources, or disciplinary boundaries. The scholarship of application refers to applying existing knowledge to aid other professionals and society in addressing an issue. The scholarship of teaching refers to applying a scholarly approach to the components of teaching, with the goal of impacting practices or disseminating knowledge. Glassick expanded upon Boyer's model through the lens of assessment and identified six characteristics that all forms of scholarship have in common (2). These are: clear goals, adequate preparation, appropriate methods, significant results, effective presentation, and reflective critique.

All medical educators are participating in one or more of these areas of scholarship to different degrees. The most common is the scholarship of teaching. Within this area, we can further define educator activities. The Association of American Medical Colleges (AAMC) defines these educator activities as teaching, learner assessment, curriculum development, mentoring and advising, and educational leadership and administration (3). Now, more than ever, it is important that teaching innovations be documented and disseminated, as they are instrumental to faculty advancement, and the evolution of medical science education.

How do we use this information to define a scholarly project? First, you should consider how activities you already participate in can lead to scholarship. Which areas of Boyer's model do your current activities fall under? For those related to the scholarship of teaching, what category of AAMC activity is it? Once the activity is defined according to these models, you can further assess the activity based on your scholarly approach to it. Have Glassick's criteria been met? If not, what steps do I need to take?

Some educators my find they have already taken steps towards identifying and defining the scholarly project. Others may find that they are just starting out. When considering a new scholarly project that is not already a part of your current activities, you can apply the same approach. The key is to further define the project according to scholarship and activities, and consider how to take a scholarly approach by applying Glassick's criteria. In either case, with new or existing activities, the MedEdPORTAL Educational Scholarship Guides are a helpful resource to organize your thoughts and ideas, and transform these activities into medical educatoin scholarship (4).

Defining the scholarly project

Identify a topic for educational scholarship.

When identifying a topic for a scholarly project, the first and most important criteria, which must be met, is interest. Ask yourself, do I find this sufficiently interesting to dedicate a significant amount of time to it? If the answer is no, you should take a step back and reconsider the steps defined above. If the answer is yes, excellent! It is now time to narrow your focus. There are many brainstorming methods you can use to transform your ideas into specific topics, narrow your focus, and formulate research questions.

The key to conceptualizing your ideas is to organize your thoughts. One way to do so it by asking yourself a series of questions considering your broad topic of interest. What are the different aspects of or subtopics within this topic? Which one do I want to focus on? What do I know and not know about this topic? What questions can ask about this topic? Are my questions specific and clear? There are many available resources and strategies to help you do so. Worksheets available from online resources, such as the one referenced here, can be utilized (5). Concept mapping is also helpful in practice. Concept maps can be used to visually represent a topic according to its subtopics and make connections between subtopics. There are many free online tools available for concept mapping, or pen and paper will work just as well (6). Finally, free writing is another method. In free writing, set a specific time limit (5 or 10 minutes), and write everything you know, and don't know, about your topic. Don't' worry about grammar or editing, just let the ideas flow. Once you have finished, analyze your work to identify ideas that have emerged. Chances are you have formulated a set of possible research questions.

Once you have narrowed your research question, there are several methods you can employ to analyze it and transform it into something actionable. The most well noted are the FINER criteria and PICOT method (7). The attributes of your research question may be analyzed according to the FINER criteria. FINER stands for Feasible, Interesting, Novel, Ethical and Relevant. In order to apply the FINER criteria, ask yourself questions. Do I have adequate expertise, time, and resources to answer the question? Will other medical science educators find this work interesting? Does this research question confirm, refute, or extend previous work on the topic? Would this study be approved by the institutional review board (IRB)? Will this question yield result that contributes to best practices or extends scientific knowledge in the field? The PICOT method helps make research questions actionable, and sets you up for the steps detailed in the remainder of this toolkit. PICOT stands for Population, Intervention, Comparison group, Outcome of interest, and Time. Again, the method involves asking yourself a series of questions. What specific population of students or faculty am I interested in? What intervention will I employ? Do I need to compare this population to another, and if so, who? What do I intend to accomplish, measure, or affect? What is the time frame to follow up to assess whether my intervention has an affect? For scholarly projects that are not hypothesis driven, such as reviews, select only the questions that apply.

Moving Forward with your Scholarly Project

One you have generated a specific and actionable research question; you are ready to state your hypothesis, define specific aims, determine your methodology, and, ultimately, start moving forward with your scholarly project. As you do so, continue to refer back to the criteria and methods described above. Ask yourself: What is the ultimate goal of this scholarship? Is my approach to the topic addressing all of the important characteristics of scholarship? How does this relate to my other educator activities? Do I still find this interesting? Do I need to revisit brainstorming to further refine? Are my actions addressing my question? Do my findings contribute to the field of knowledge and will others find them interesting? It is okay for a scholarly project to evolve during the process, given the appropriate steps are taken to address institutional requirements. Overall, your experiences with your scholarly project should be, at most times, enjoyable, sufficiently challenging that you are growing as a scholar, and exciting because of the potential you have to influence the field of medical sciences education.

Resources

What defines scholarship?

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Conducting a literature review

Staci Leisman, M.D.

- Develop a relationship with an institutional librarian to identify appropriate resources for the project of interest
- Critically appraise the educational research literature to initiate a research project

Abstract

Before embarking on a medical education research project, it is critical to know if similar research has been undertaken. You want to be sure that your project will add to the current literature, either by reporting new findings or confirming older findings in a new setting. To do this, a thorough literature search will be required. While it is possible to do a literature search on your own, having access to an institutional librarian can make the literature search more effective and efficient.

Finding an institutional librarian

Most academic medical centers in the United States and many throughout the world will have institutional librarians, who have advanced degrees in library science. These individuals can make the difference between a disorganized search and a highly efficient one. If you do not have access to an institutional librarian, you could consider finding a collaborator who does.

Make an appointment with your institutional librarian to explain the scholarly project you'd like to undertake. He or she can help you refine your question to make it more targeted and specific. In some settings, the librarian will conduct a literature search for you. In others, he or she may point you to the journals which are considered the most high-quality in the medical education field, and provide advice on which databases may be most fruitful for finding the most relevant manuscripts.

He or she may also offer guidance on how to set up and use a reference manager, so when you are conducting your search, you can keep the results organized for use later.

Conduct a literature search

There are many ways to conduct a search and many databases through which to search. Each has its own advantages and disadvantages.

- PubMed has the advantage of being able to search by journal, and articles cited are from journals that have been peer reviewed and vetted by PubMed. The user interface can be more difficult to navigate and is not intuitive. Having a session on using PubMed with an institutional librarian can be critical in improving the productivity of your searches. You can also view a series of "how-to" videos on YouTube: https://www.youtube.com/playlist?list=PLBD13A2628C7A9965
- Google Scholar employs the optimized Google Search features, which makes it more user friendly compared to PubMed. It also will list all of the manuscripts in which each item has been cited, which can help you to find the most cited and impactful articles. However, the references may not all be "Pubmed indexed" and it is harder to sort by a particular journal.
- MedEd Portal (https://www.mededportal.org/) by the AAMC, can also provide peer-reviewed medical education literature. These are particularly useful if your scholarly project is to create a new curriculum; MedEd Portal may have a similar one for you to review.
- Scopus (scopus.com) is a database that includes relevant articles, as well as books, book chapters and abstracts. This can help you to broaden your search beyond articles. Additionally, Scopus will list the entire bibliography of a searched article, which can be instrumental in quickly finding seminal and relevant papers. The Scopus database will also include titles in fields other than biomedical sciences, such as the humanities and social sciences, which may be helpful in an educational research topic. Scopus tutorials can be found here: https://service.elsevier.com/app/overview/scopus/

Conducting a literature review

Use a reference manager to ensure you only have to do one literature search

One of the most frustrating things is conducting a search, finding papers, and then forgetting what the authors/titles were. Being organized as you conduct your search is critical!
Before you start your search, familiarize yourself with a citation manager. Many have the ability to make folders and pull free full text publications or abstracts from the internet. Create a folder for the project you are researching, so all of your manuscripts can be stored in one place. As you find relevant manuscripts, download the citation to the citation manager.

It can also be helpful to create a spreadsheet to organize your manuscripts. For example, create columns for:

- Title
- Author
- Journal
- Year
- Type of paper (concept; needs assessment; curriculum; innovation; intervention; etc)
- Sample and intervention
- Findings
- Relevance (low, medium, high)
- Summary

Later, when you go back to review and write your paper, you will quickly be able to find your references and add them to the relevant sections of your paper.

Critically Appraise the Literature

As you review the literature, you must critically appraise it, asking yourself questions such as:

1. Are the subjects of the paper similar to my students/trainees? If not, that is OK – you may be able to repeat the study in your own subjects, which helps you add to the literature.
2. Does the methodology of this paper make sense? If the study is doing an uncontrolled intervention, how valid are the findings?
3. How relevant is this to the research I am trying to undertake?
4. Is this paper biased?

Accessing papers that are behind a paywall

One challenge that can arise is finding what seems to be a great paper, but not being unable to access the paper because of a paywall. Many corresponding authors will have contact information listed within the abstract and will be happy to share a PDF copy of the paper with a scholar.

Summary

- Consulting with a research librarian is critical to an efficient, high-yield, and wide-ranging search
- Use multiple databases to find relevant articles, including PubMed, Google Scholar, MedEd Portal and Scopus
- Keep your findings organized by downloading to a reference manager and summarizing key points in a spreadsheet
- Critically appraise the literature you find, to ensure it is relevant and methodologically sound.

Resources

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Selecting a conceptual framework

Kathryn N. Huggett, Ph.D.

- Define the key terms theory, theoretical framework, and conceptual framework
- Explain the the significance of conceptual frameworks
- Describe how to identify conceptual frameworks to support your work
- List 2-3 conceptual frameworks commonly found in health professions education and research

Abstract

Selecting the relevant conceptual framework(s) underpinning your research topic is an important early step in your scholarly work. Conceptual frameworks "represent ways of thinking about a problem or a study, or ways of representing how complex things work the way they do" (Bordage 2009, p. 313). Identifying and understanding these ways of thinking will aid you in developing research questions, designing research studies, and interpreting the findings. Likewise, conceptual frameworks can guide the development of educational interventions and the evaluation of the outcomes and their impact (Zackoff 2018). Conceptual frameworks offer a shared vocabulary and well-grounded principles that enable others to build on your work and advance the field (Bordage, Lineberry and Yudkowsky 2016).

Introduction

Selecting the relevant conceptual framework(s) underpinning your research topic is an important early step in your scholarly work. In this toolkit we will define key terms, review the significance of conceptual frameworks, discuss how to identify conceptual frameworks to support your work, and share examples of conceptual frameworks commonly found in health professions education and research.

Definitions

The terms theory, theoretical framework, and conceptual framework are frequently used interchangeably and the health professions education literature reflects this lack of precision. There are some commonly agreed upon definitions among those who study and write about research approaches and methodology. These are helpful to learn in order to improve your knowledge of research traditions, to improve your scholarly work, and to improve communication with peer reviewers and editors. **Theory** is "an abstract description of the relationships between concepts that help us understand the world" (Varpio, Paradis, Uijtdehaage, Young 2020, p. 990). A **theoretical framework** is a "logically developed and connected set of concepts and premises – developed from one or more theories – that a researcher creates to scaffold a study" (Varpio, Paradis, Uijtdehaage, Young 2020, p. 990). Finally, a **conceptual framework** is the justification for conducting the study. The conceptual framework must explain why the research is important and how the findings might contribute to what is already known (Varpio, Paradis, Uijtdehaage, Young 2020, p. 990). A note of caution: Some scholars differentiate between conceptual frameworks and best practices, noting that there are some established best practices in education that are guided by structured approaches that resemble frameworks. For example, the logic model (Dwyer and Makin 1997) is an established, structured approach for program evaluation. Some program developers also use the logic model to guide needs assessment prior to developing a program. Use of the logic model is a best practice and even required by some entities that fund new program development. While some scholars include the logic model as a conceptual framework, others do not (Zakckoff, Real, Abramson, Li, Klein and Gusic 2018).

Selecting a conceptual framework

Significance

Conceptual frameworks are significant because they provide multiple perspectives or lenses to examine an educational research question or program. They also guide the three critical stages of an educational research or educational development project. First, they guide choices about the focus of a research study or content of an educational development project. Next, they guide the selection of methods for the investigation or educational intervention. Finally, they guide the interpretation of the findings and outcomes (Bordage, Lineberry, Yudkowsky 2016). Conceptual frameworks offer a shared vocabulary and well-grounded principles that enable others to build on your work and advance the field (Bordage, Lineberry and Yudkowsky 2016). Conceptual frameworks are so important to the quality of educational scholarship that journal reviewers and editors expect that authors will include a description of the conceptual framework guiding the work --or at minimum a reference to how the author's practical teaching problem falls within existing frameworks -- in their manuscript (Durning and Carline 2015).

Identification

Identifying a conceptual framework is easy once you become familiar with the literature on your topic of interest. Work with a librarian to generate a list of key search terms and locate relevant literature. From there, read the articles and pay close attention to the list of references. Of course, read carefully for any mention of frameworks or underlying concepts. Ask the librarian to help you find literature reviews on the topics, or methods papers, as they also contain valuable insights and references. If you are exploring a new topic with a limited number of articles, you may need to search the literature in related fields in order to find relevant conceptual frameworks. Health professions education draws upon scholarship from multiple fields and disciplines, including education, sociology, information science, organizational psychology, and cognitive psychology. Thus, you will want to broaden your search to include fields outside of the health professions. A librarian will be able to assist you and suggest appropriate research databases.

Examples

Conceptual frameworks offer a way to think about a need, problem, or question. For example, a course director who is creating new opportunities for reflection and debriefing within a course might employ **Reflective Practice** (Schon 1984) as the supporting conceptual framework to guide the development and assessment of the reflection activities. A faculty member who is converting their lecture slide presentation to a team-based learning (TBL) activity might work with an instructional designer, referencing **Cognitive Load Theory** (Van Merrienboer and Sweller 2010) to ensure the new instructional materials reduce the cognitive load in learners, thereby promoting learning and retention. A final example is the clinical educator who aims to compare two approaches to clinical skills simulation and the role of immediate feedback in the simulation. This researcher could develop a research question and investigation using the conceptual framework **Deliberate Practice** (Ericksson 2004).

Resources

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Defining the research question(s)

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Zhimin Jia, M.B.B.S., M.Med., M.D., Ph.D.

- Formulate a clear question based on interests and literature review
- Examine the goodness of the question for quality and scope
- Write a hypothesis, or expected outcome

Abstract

Writing your research question is an important process that enables you to **focus on what is a meaningful, important and doable project.** Because the research question is a rather short piece of writing, compared to the methods or background, one might think it is a less-important. This could not be further from the truth. Your research question will serve as a springboard to your project, so it needs to be created with attention to both detail and practicality. If the research question is not well thought out, the research might end up being too broad or too vague or not really relevant to the bigger issue. [1].

How do I move from my research topic to a research question?

Research questions may address any aspect of medical education. The variety of topics reflects the reality that medical education is influenced by multiple factors: what students and faculty bring to the classroom, teaching methods, learning environment, and assessments, to name a few. Medical school learning also ultimately affects patients--their experience and outcomes. Therefore, many important questions in medical education are about patient care or the factors that will affect it, like clinical skills, attitudes and behaviors.

For examples of research questions, it may be helpful to look through a medical education journal such as Medical Science Educator. Some of the most frequently studied topics on medical education are listed in a 2012 report by the AAMC.[2]

Research questions vary in form, depending on the goal of the research. As you write your question, clarify 1) What is it that you want to study or compare? 2) Who do you want to study? 3) What are your expected outcomes or measurements? Your question should also include the following important elements, often described with the acronym PICOT: Population, intervention (for intervention studies), comparison group, outcomes and time.[3] Below are the major types of studies and some examples.

1. Descriptive: A question that seeks to describe a variable, characteristic or attribute.
   Example: What is the reported prevalence of mistreatment for students and residents at 3 teaching institutions?

2. Describing Relationships: A question about the relationships between variables.
   Example: Is there an association between emotional intelligence and empathy in first year medical students?

3. Effects of Interventions: A question about whether a new method, course, or approach produces a change.
   Example: Does a curriculum in LGBTQ issues reduce bias in medical and dental students?

4. Establishing validity: A question about whether an assessment is valid or reliable.
   Example: Is a new tool to assess professionalism through peer-review reliable in 2nd year Physician Assistant students?

It is a good idea to start by writing down some research questions that you have. You might have identified a gap in the literature, a problem you would like to solve, or an approach that you think would benefit students. As you write these questions down, it helps to write down a simple rationale for each one. The rationale will help you clarify how your research will fit in to the existing literature. It might also prompt you to go back to read the literature.

How can I make my question more succinct?

Usually, a researcher begins with a broad question and then goes through a process of further defining it. Take the example of the following question: "Does a flipped classroom improve learning in medical students?" It is a good and important question, but it requires much more clarification before you will be able to turn it into meaningful research. A more answerable and specific question might be: "Does a flipped classroom focused on mood disorders improve clinical reasoning skills in a preclerkship Behavioral Science course?" The second version has more specific information about the learners, the intervention and the outcomes.

Defining the research question(s)

How to know if you have it right?

Once you have a version of your research question, you will want to test it against some criteria. Some such criteria were mentioned in an earlier chapter on Defining the Scholarly project. The I-SMART criteria below provide these major criteria. [4]

I-SMART
(important, specific, measurable, achievable, relevant and timely)

Importance: Is the question important to you and others in your field?

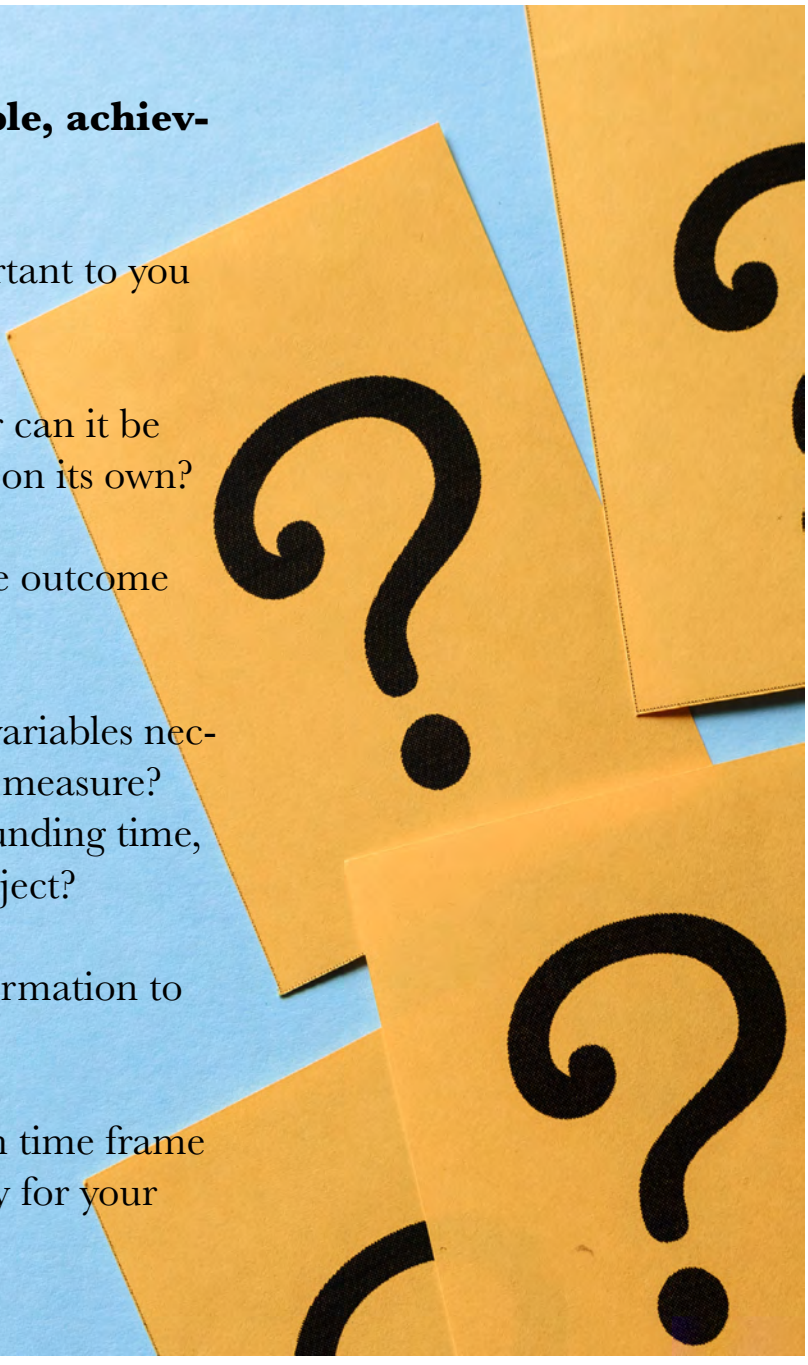
Specific: Is the question specific, or can it be distilled down further? Will it stand on its own?

Measurable: Is there a measurable outcome (or outcomes) for the study?

Achievable: Can you collect data variables necessary to study outcome you wish to measure? Do you have the resources (people funding time, etc.) to successfully complete the project?

Relevant: Will results add new information to the literature?

Timely: Can study be completed in time frame that is reasonable for you (or possibly for your granting agency)



Can I change the question?

Designing a good research question is an iterative process. It may be that you want to change your question after sharing it with colleagues. You also might want to make changes as you continue to read the literature and develop your methods. The research process should be both creative and educational for you and making changes before you start your research is the perfect time.

Writing a hypothesis

Writing a hypothesis or expected outcome from your research is an important part of the process of moving from the research question to designing your study. It will help you to think about what measurements you will make and whether those measurements will actually enable you to answer the questions. It will also help you to think ahead about what your data will look like quantitatively or qualitatively.

Resources

Annotated Bibliography of Journals for Educational Scholarship: https://omerad.msu.edu/images/documents/annotated-bibliography-of-journals.pdf

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Selecting a research study type

Diana Glendinning, Ph.D.

- Deduce the research study type

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Zhimin Jia, M.B.B.S., M.Med., M.D., Ph.D.

Abstract

Writing the research question will lead you to the next step: determining the research design. Look at your question and think about how you might approach it. Will you need to divide your subjects into different groups to compare them? Do you need to select specific groups of people? When will you want to make your measurements? Do you need to create a survey? As you think through implementing the study, your design will begin to reveal itself. Your goal is to state clearly what type of design you are using.

Deducing the Research Study Type

The chart below, adapted from the Center on Evidence Based Medicine, lists the major types of study designs. The chart can help you identify and classify your study design.

All types of study designs are used in medical education research. Although this chart may appear to be hierarchical, it is not so in terms of importance of research studies. There is a need for all types of research questions and study designs, as long as the research is developed with a scholarly knowledge of the field, within a conceptual framework, and designed with sound methodology. With the appropriate question and design, your research can make significant contributions to the knowledge-base and progress of medical education.

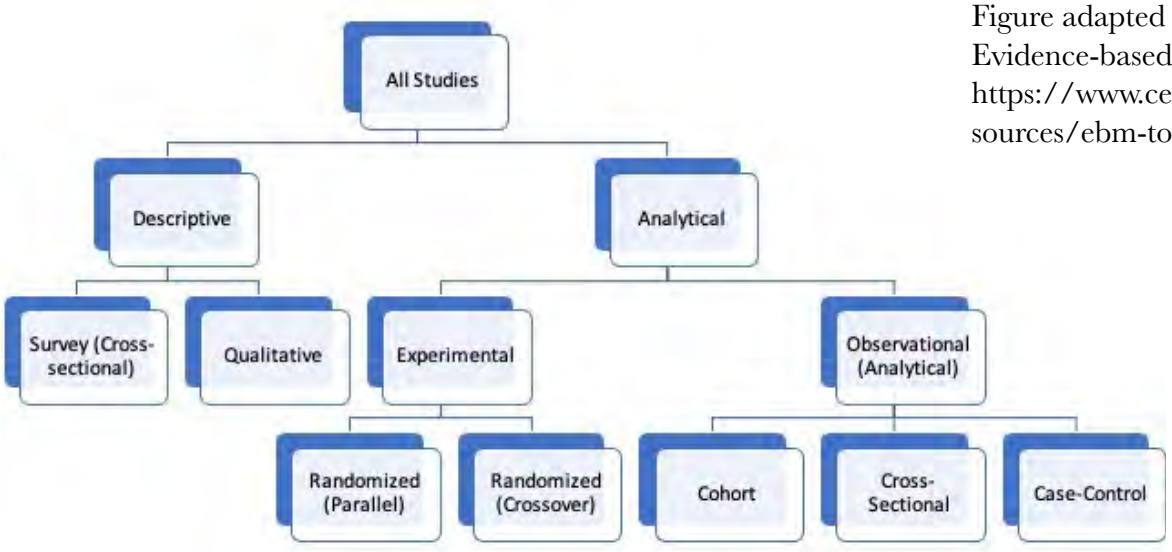

Figure adapted from the Center of Evidence-based Medicine https://www.cebm.ox.ac.uk/resources/ebm-tools/study-designs

Is your Study Descriptive?

Descriptive Studies are those that describe features or characteristics of a population, usually of people, but of any variable of interest. The subjects studied in medical education are often students, faculty, patients, or clinicians. A descriptive study does not seek to answer specific questions about relationships between variables, or whether an intervention, like a course, is effective. Measurements in descriptive studies may be quantitative or qualitative. If measurements are made at one time, the research is referred to as being cross-sectional. The results of descriptive studies, by identifying features that were not recognized prior to the research, can often lead to specific hypotheses that may be tested in future studies.

Here are some examples of descriptive research studies:

- **Developmental research:** Research that documents patterns of change or development over time. Examples might be child development, disease progression, or learning.
  Example of Developmental Research Design: *A study is designed to measure implicit bias in children of different ages between 5-17 years old.*
- **Normative research:** This type of research measures average values for some, often physical, characteristics. They may also be related to behavior and performance. Some examples might be normal values for blood pressure, height, weight, or (in education) test scores.
  Example of Normative Research Design: *A study is designed to measure normal BMI values for professional weight-lifters.*
- **Case report/Case series:** These studies describe features of one or a few subjects and are often used to document a novel situation, an innovation or an unusual case in medicine.
  Example of a Case report: *A case report is used to describe physical responses during the transition to a vegan diet in an obese patient with diabetes.*

- **Qualitative Research:** This type of research uses a specialized approach to explore human experiences through interviews and observations. The narrative responses of subjects are documented rather than measured numerically (quantitatively).
  Example of Qualitative Research: *A research study chronicles experiences with professional identity formation in clinician-educators.*
- **Survey research:** Surveys are often used when the research is interested in quantitative measurements related to attitudes, knowledge or historical information about subject's backgrounds. Surveys need to be reliable and valid, which may have been established in prior research.
  Example of Survey Research: *Measurements of perceived stress in second year medical students prior to taking the STEP 1 exam.*

Selecting a research study type

Is your Study Analytic?

Analytic Studies: A study is analytic if the purpose is to quantify relationships between variables or the effects of an intervention or exposure on outcomes of interest. They are also used to compare groups. Analytic studies are broadly divided into 2 types: ***Experimental and Observational***. Many research studies in undergraduate medical education and analytic because they seek to justify a teaching intervention or improvement.

An important property of analytic studies is **control over extraneous variables and other sources of bias.** To answer questions about variables of interest, you must carefully design the study to prevent variables that are not of interest (extraneous variables) from leading you to the wrong conclusion. Uncontrolled variables in the study produce **bias**, which will call into question your results.

Experimental studies are the gold standard for measuring whether specific variables, treatments, or interventions effect an outcome, is the experimental study. These studies involve testing a hypothesis about the effects of an intervention on a group. These are the studies that are used for clinical trials but are often impractical in undergraduate or undergraduate medical education.[1] Groups of individuals are selected and placed into groups through randomization. Randomization should theoretically make groups **equivalent** by roughly equally distributing extraneous variables among groups. Randomized cross-over studies use one group of subjects, but the order in which groups receive an intervention is randomly assigned.

Observational ("Exploratory") Research

In most educational research, an experimental study is not possible because it is not realistic to randomize, control for all variables, or create a pure control group.[1] These studies, often referred to as "Quasi-experimental"[2] can provide high-level, educationally important, information as long as sources of bias are identified and then controlled. They borrow from methods developed in epidemiology research.

Observational studies ask specific questions about variables and relationships between variables, but the variables are already in place. Therefore, as a researcher, you cannot assign people to groups (randomly or otherwise) or control treatments or exposures. In medical education research, this might mean making measurements after students have experienced teaching.

A well-designed observational study enables you to explore causes, consequences and predictors of outcomes. Many important observational studies have contributed a great deal to medical education research. A well-designed observational study enables you to study groups of subjects that differ based on experience, exposure, or history and test hypotheses about relationships. Even though observational designs inherently don't allow for as much control as experimental studies, they are many ways to control for bias.

Observational studies may be prospective or retrospective. A prospective design studies things that have not yet happened. A retrospective design examines events that have already occurred.

Main types of observational designs.

Cohort Studies. In a cohort study, one or more groups (cohorts) of individuals are studied prospectively.

Outcomes of interest are measured based on the "exposure" that each group experienced. Cohort studies are usually prospective but may also be designed retrospectively, using the same subject groups. In a retrospective study, the same types of cohort groups are decided upon based on their natural conditions, but they are studied after they have received the training, treatment or exposure.

Example of Prospective Cohort Study: *A study examining knowledge of medical errors in a cohort of students who completed medical error training vs. those who did not.*

Example of Retrospective Cohort Study: *A study examined intubation skills in students who had been trained using simulation vs. conventional training.*

Case-control Studies: A case-control study investigates individuals who share some characteristic vs. those who do not. The study is designed to look in the participants' background for "exposures" that were present or not present in an effort to determine whether these factors are related.

Example of a Case Control Study: *A study that compares physicians who were disciplined by state medical boards to physicians who were not, to determine whether they had professionalism infractions during medical school.*

Cross-sectional Studies: In a cross-sectional study, individuals are studied at one point in time. Rather than looking forward to observe an outcome (prospective cohort), or backwards (retrospective cohort). Analytical cross-sectional studies aim to look for relationships between variables that are measured concurrently.

Example of a Cross-sectional Study: *A study was designed to determine whether personality factors and test anxiety were correlated in medical students.*

Observational studies look at factors that occur naturally, and not due to an experimental manipulation. Unlike experimental studies, they cannot be interpreted as revealing causal relationships. They describe associations and may uncover previously unknown relationships. For this reason, observational studies sometimes form the basis for a subsequent experimental interventions (e.g., a randomized controlled studies). As mentioned above, a randomized controlled study may never be feasible because they are pre-existing variables, have already occurred, or because they cannot be manipulated for ethical reasons. Causal arguments can also be made from observational data if they meet several criteria.[3]

Resources

Michigan State University Resources for Medical Education Research: https://omerad.msu.edu/research/resources-for-medical-education-research-and-scholarship#topic04

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Designing a study and selecting a methodology

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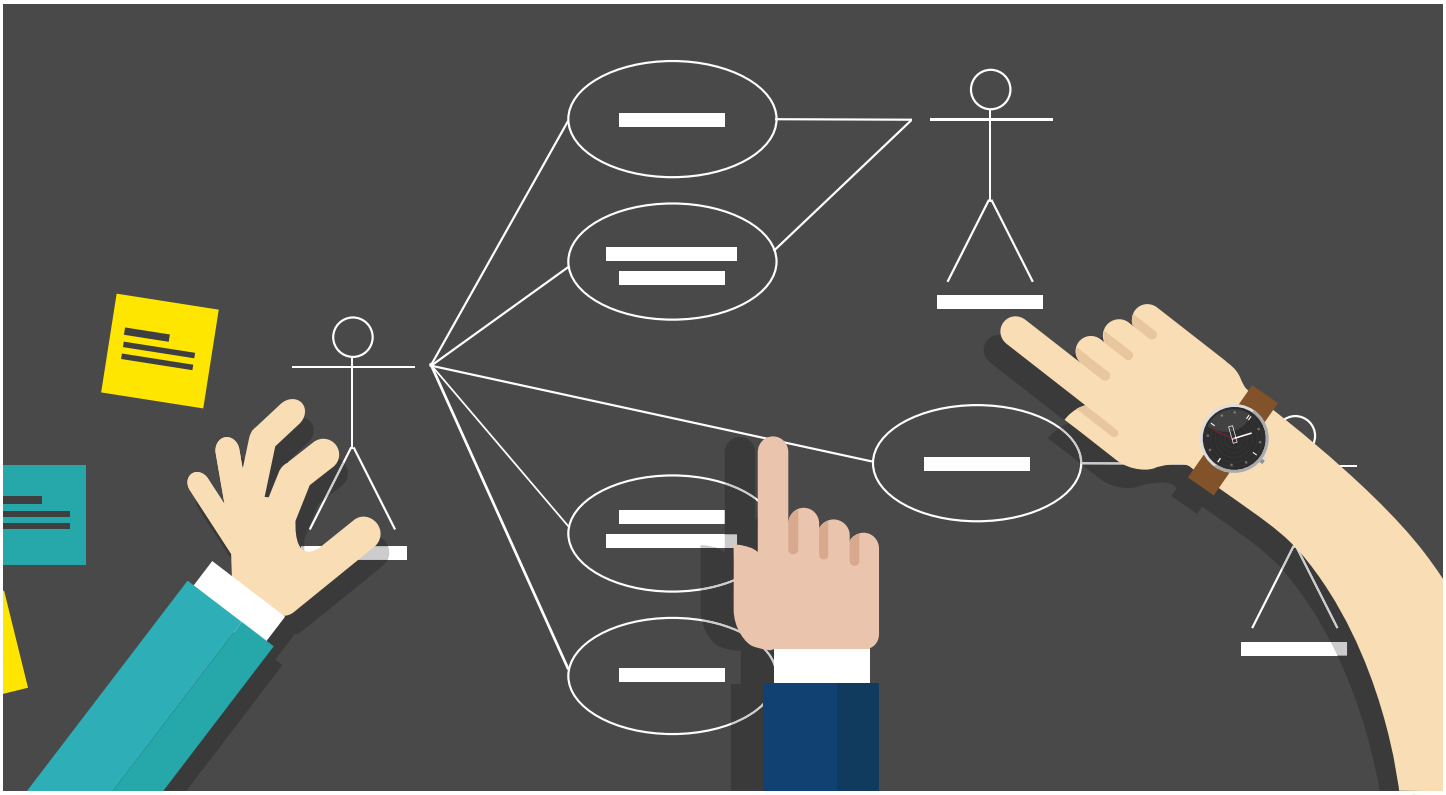
Diana Glendinning, Ph.D.

- Devise the appropriate methods to address the research question and seek the appropriate resources
- Understand the primary research designs for research in medical education
- Differentiate between inductive and deductive approaches to reasoning
- Differentiate between qualitative and quantitative research methods
- Describe the types and purpose of mixed methods research
- Define valid outcome measures that are achievable and reliable
- Detail qualitative and quantitative data collection methods
- Ascertain the study participants and timeline of engagement
- Know the difference between a sample and population
- Know the purpose of different types of sampling, and the different approaches of sampling



Abstract

Any research design can, in principle, use either quantitative or qualitative data and use any data collection method. The different research designs include experimental research, correlational research, causal research, comparative research, case study, survey research, historical research, and action research.Qualitative research tries to answer questions about how and why things happen and the qualities of entities. Quantitative research tries to investigate the effects of specified variables. The various data collection methods used for quantitative research are questionnaires, surveys, rating scales, checklists, psychometric scales, and schedules. The data collection methods for qualitative research include interviews, groups, observation, diaries, self-reports, case studies, documentary analysis, experiential accounts, stimulated recall, critical incident analysis, and action research. It is imperative to select the appropriate research design and research methodology.

Population is the term used to describe the group that we want to say something about in our research. The sample should be as representative as possible of the population. Sampling techniques include probability sampling techniques and non-probability sampling techniques. Various probability sampling techniques are simple random sampling, systematic sampling, cluster sampling, and stratified sampling. Various non-probability sampling methods are convenience sampling, purposive/judgmental sampling, quota sampling, and snowball/chain referral sampling.

Designing a study and selecting a methodology

Primary research designs for research in medical education

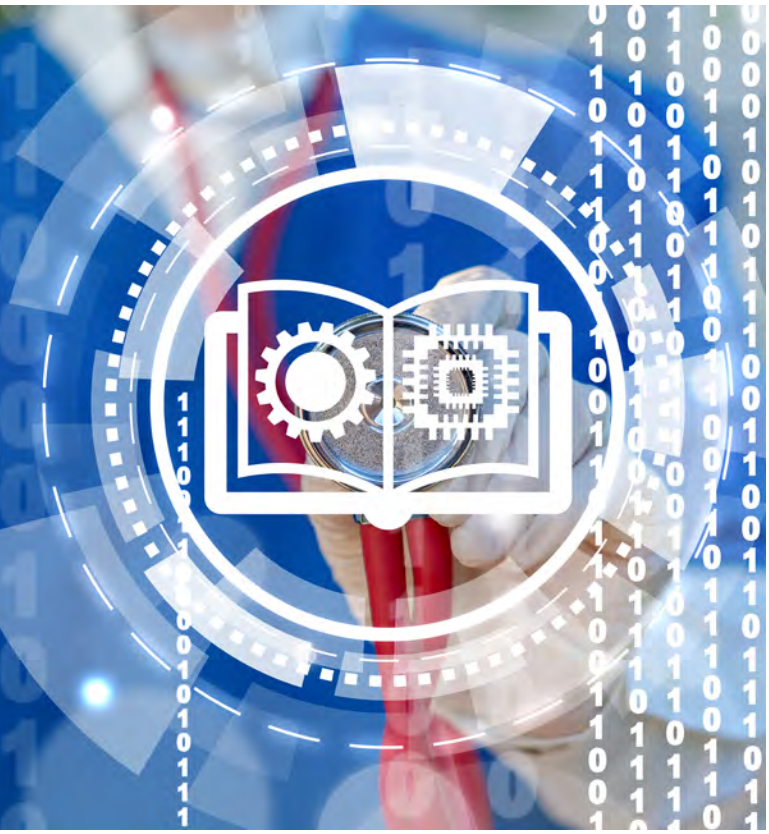
Research design is not related to any particular type of data or any data collecting method [1]. The different research designs include experimental research, correlational research, causal research, comparative research, case-study, survey-research, historical research, and action research. Experimental research measures the effect of an independent variable (the entity being changed or manipulated, such as a new teaching method) on dependent variables (entities that are affected by the independent variable; for example, student outcomes). Correlational research is to determine relationships between two or more variables and explore (but not to prove) implications for cause and effect. Causal research investigates the impact of one or a group of variables on another and can be used to predict what impact a specific change will have on the existing norm. Comparative research can be the act of comparing two or more items to discover something about one or all of the items being compared, similarities and differences. Case-study is an in-depth study of a single individual, group, incident, or community. Survey-research uses questionnaires, interviews, and or statistical surveys to gather information about people and their thoughts and behaviors. Historical research is the study of some aspect of the past by analyzing documents or interviewing people who lived and were involved at the time of interest. Action research is gathering information to change a condition in a particular place (not to generalize). Interventional research aims to alter specific conditions by practical measures, and at the same time, to study the course and the results of the intervention. It is experimental research, without randomization.

Quantitative research begins with a hypothesis or an idea, which then, through the collection of data, generates numbers and, by deduction, allows a conclusion to be drawn [2]. In contrast, qualitative research begins with an aim to explore a particular area, gather data, and generates hypotheses and ideas from these data, largely through the process called as inductive reasoning [2]. Quantitative research believes that the world is a sole reality made up of facts that can be investigated [3]. Qualitative research assumes that the world is made up of multiple realities, constructed by different individual experiences, opinions, and ideas of the same situation [3]. Some would say that the real difference between quantitative and qualitative research is that the former relies on numbers, and the latter relies on data. It is quite possible to present quantitative data in a highly descriptive format. And qualitative data can be in quantified form.

Mixed methods research involves using both tandem approaches so that a study's strength is greater than either quantitative or qualitative research. There are three mixed methods, which include sequential mixed methods, concurrent mixed methods, and transformative mixed methods [4]. Sequential mixed methods are when the findings from one stage and research method are elaborated in subsequent inquiry stages [5]. Qualitative and quantitative data are merged into one comprehensive analysis in concurrent mixed methods, and data are collected simultaneously [6]. In transformative mixed methods, the theory is central to inform or refine data collection or used for social transformation [7]. The purpose of mixed methods can be triangulation, complementarity, development, initiation, and expansion [1].

Qualitative and quantitative data collection methods

The various data collection methods used for quantitative research are questionnaires, surveys, rating scales, checklists, psychometric scales, and schedules. Questionnaires are essentially a listing of statements or questions used to collect opinions or information from people. They are used in surveys, where the researcher is investigating to measure ideas or facts; they may also be used in experimental designs. Attitude scales and rating scales are one variation of the survey where the researcher is investigating to measure attitudes or opinions. They may ask participants to rate a concept or an experience to measure their degree of certainty, engagement, satisfaction, and etc. Structured interviews are where the interviewer has a specific structure or schedule for the interview and aims to gather opinions or information with a particular focus. As the name implies, semi-structured interviews [8] are slightly less controlled and allow for a larger degree of flexibility in response to at least some of the questions. Observational research involves observing specific behaviors usually observing one group of people or an individual interacting in some professional, social, or learning environment. It involves interaction analysis, where the investigator notes the interactions between specific individuals in the group. Psychological testing and aptitude testing may have exclusive appeal in a setting where one is concerned to explain factors affecting student performance (e.g., in clinical procedures, cognitive tasks, and written exams) or effectiveness and professional performance.



Reliability in this context can be thought of as objectivity and trustworthiness, the extent to which any event would always be regarded as in the same way by the same person or different investigators [9]. Reliability is that the test must produce consistent results and not be significantly influenced by outside factors [9]. There are two aspects to the reliability of a quantitative research tool (such as a specific questionnaire, rating scale, observation schedule, or psychometric test): test-retest reliability and internal consistency. Validity is an essential quality of a test. Validity is whether or not a tool measures accurately and what is required to measure [10]. There are many validity types, including concurrent validity, construct validity, content validity, cultural validity, face validity, external validity, internal validity, and predictive validity. Statistical tests for determining quantitative tools and data's concurrent validity are correlational analysis, multidimensional measurement, and reliability tests.

The data collection methods for qualitative research [11, 12] include interviews, groups, observation, diaries, self-reports, case studies, documentary analysis, experiential accounts, stimulated recall, critical incident analysis, and action research [13, 14]. An open interview points toward that the interviewer wants to explore an issue, and they do not want to limit the interviewee by asking specific, pre-planned questions. An interview is semi-structured when it both offers questions that direct the interviewee's attention and allows them to command what they explore within their answers. Discussion groups are used as a method of collecting the opinions of participants within an interactive group setting. The focus group was created to elicit a group's responses to a particular stimulus, for example, discourses, images, and texts. The keywords regarding the rigor of qualitative methods are internal validity, external validity, reliability, credibility, transferability, and dependability [15].

Designing a study and selecting a methodology

Different types of sampling, and the different approaches of sampling

Various sampling techniques used for quantitative research methods are simple random sampling, systematic sampling, cluster sampling, and stratified sampling. Simple random sampling is a method where a group of individuals is randomly selected from the population. Systematic sampling occurs when a decision is made to obtain a sample by selecting individuals from a list in a systematic way (e.g., every 3rd, 5th, or 10th person on the list). Proportional stratified sampling is where the sample is taken from different sub-groups of the population compared to those subgroups' membership ratio. Non-proportional stratified sampling is where the sample is taken from different sub-groups of the population in proportion to the researcher's view (based on the research question) of the importance of each sub-group. Cluster sampling is whereby random samples are taken from successive random samples, e.g., a random sample of students taken from within a random sample of classes from within a random sample of schools.

The sampling methods commonly employed for qualitative research methods are convenience sampling, purposive/judgmental sampling, quota sampling, and snowball/chain referral sampling. Snowball sampling [16] is the initial contact that gives names of others they believe could help the researcher. One person leads to another person who leads to a third, and so on. This is a beneficial technique when the population is not known and the researcher has few leads. Purposive sampling [17] is a common sampling method in qualitative research. Here the researcher considers carefully the characteristics of those she or he wishes to study [6]. The characteristics may represent what the individual does for living, specific experiences they might have had, or any other feature that enables them to insight into the area of interest. Quota sampling is a technique that is used in market research. This is similar to stratified random sampling but without the rigor. Researchers are given quotas for their interviews and observations (x number of women of a certain age, y number of men of a certain age). The researcher will continue to ask people to take part until they have fulfilled their quota.

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Identifying sources of funding

Jonathan J. Wisco, Ph.D.

Kathryn N. Huggett, Ph.D.

- Understand the rationale for seeking funding for your project.
- Identify different opportunities for funding educational scholarship projects.
- Develop an appropriate strategy to applying for funding.

Abstract

Good educational research studies are built on a foundation of thorough literature search, appropriate theoretical and conceptual frameworks, a justified research question with testable hypothesis or exploratory design to generate a hypothesis, sound research design, and reasonable conclusions based on the data. This section of the Toolkit will discuss best practices for identifying and securing funding for educational studies. Sometimes well-designed studies only need minimal funding in order to be successful. Investigators should perform a needs assessment to determine whether financial resources are necessary, and if so, the appropriate source from which to apply for funding. Common educational research study elements that typically need funding include investigator salaries, research associate/assistant stipends, subject participation compensation, computer software/hardware, miscellaneous supplies, travel to conferences, and publication costs. Sources for funding range from federal granting agencies to foundations to private donations, each with preferences to support different aspects of scope and study requirements. Investigators should consider employing a strategy to work with program officers to understand how their team can meet the research objectives of funding organizations, develop a plan to address scientific questions, and apply for funding.

Why seek funding?

Although it always helps to have adequate financial support, excellent studies are built on a foundation of sound scientific principles. Educational research starts when scholarly teams identify a scientific question that they are uniquely positioned to answer. A team's ability to conduct a research project depends on many factors, including expertise and resources available. A thorough literature search to understand the scope of a scholarly problem leads to identifying theoretical and conceptual frameworks from which to develop and study specific research questions. An experimental or exploratory design should be developed. At this point, a team should identify what human and capital resources are available to answer the questions, and/or what funding might be needed. Depending on the approach chosen, it is very possible that little or no funding is needed; likewise, new resources may be necessary, especially if novel approaches or techniques to study the questions are proposed, or funds to travel to conferences to present work may be necessary.

Educational research often falls into the trap of being resource demanding, yet there are relatively few funding resources available. While this perception has some merit – faculty salaries and benefits are the most expensive line items on a grant proposal, and education funding agencies typically do not pay indirect costs – it is important to keep in mind that there are aspects of educational research projects for which sponsoring institutions will generally support. These include consultation fees, student stipends, non-capital equipment, software packages, and research subject renumeration.

Teachers and educational scholars are often hired on "hard money" contracts, indicating that their salary is primarily supported by the home department, college or school. Unlike many basic science research faculty who are hired with "soft money" contracts that require them to fund a percentage of their salary from extramural funding, educational scholars might be able to rely on their hard money contract in order to direct more requested budget toward the other aforementioned resources that also require funding. The other side of this coin is that most grants that fund educational scholarship tend to be smaller in the amount of direct costs that are allowable, and often do not fund indirect costs. As a result, many research institutions place more cultural value on the large, federal grants that can pay for faculty salaries and indirect costs. Some institutions do value small grants, as they demonstrate an ability to effectively communicate your work to an extramural (or intramural) institution that values your scholarly pursuits. In addition, securing extramural funding draws attention to your home institution as one that values all types of scholarly work – including education.

All that said, every academic institution places high value on publications, as it is the primary indicator for academic achievement. For education research, grants can lead to, but are not absolutely necessary for, successfully planning, executing, and publishing work.

Funding opportunities

For many faculty, sources of request for funding announcements (RFA's) by sponsoring agencies include foundations and government agencies. Personal or private philanthropic donations are also a source for funding, but each academic institution has different rules regarding this source of funding, and will not be covered in the context of this toolkit. Please consult your institutional philanthropy office for further guidelines.

Many universities have offices specifically designed to assist faculty with identifying and applying for foundation grants and government agency grants. In many cases, offices for either source of funding are separate divisions of a university's formal efforts to assist faculty with their funding endeavors. Sometimes offices for foundations also work with philanthropists. Often referred to as offices for sponsored programs (OSP's), the staff that are available to help faculty are as valuable for identifying funding sources as librarians are valuable for performing

Identifying sources of funding

literature searches. In other words, if your team has determined that it needs to seek funding to support a project, contact your OSP staff as soon as you can. They are very helpful for setting up application checklists, guiding faculty through the budgeting process, and mediating the acquisition of all necessary signatures for applications. Both foundation and government agency OSP's are generally proactive in listing funding opportunities.

Academic societies, such as IAMSE, are also proactive in listing funding opportunities. Appended to the end of this chapter of the Toolkit is a list of opportunities that have been published in the past year through IAMSEConnects, a service provided by the Public Affairs Committee. We are grateful to members of the Public Affairs Committee for compiling this comprehensive list.

Government agencies continually list RFA's as well. However, most of the opportunities are directed toward basic science of clinical science research. In the United States, the National Institutes of Health (NIH), which is organized to fund medical research, for example typically list education-focused RFA's as part of research training grants (i.e. the Ruth L. Kirschstein Individual National Research Service Award for individual predoctoral and postdoctoral fellows, or for institutional training programs). The Research Education Program (R25; https://researchtraining.nih.gov/programs/research-education/r25), though, is a large-scale grant opportunity for those faculty who would like to develop education programs that support basic science and clinical science programs. For those faculty who are interested in educational research that involves K-12 students (such as service-learning), the Science Education Partnership Award (SEPA; https://nihsepa.org) is a promising avenue to support scholarly work.

The NIH has a very handy online tool to look for funding opportunities call the Research Portfolio Online Reporting Tools (RePORT; https://report.nih.gov). Click on the RePORTER icon, on the left side of the page, and then the Matchmaker icon on the right side of the page. In the text box, enter an abstract of a study you would like to conduct, or the abstract of a study you have published, and the website will return a list of related grants that have been previously funded, including information on their sponsoring Institutes, Study Sections, and the names of their Program Officers (PO's! This repository tool is one of the most useful (and enjoyable!) research tool at the disposal of investigators, and not very people are aware that it exists.

The National Science Foundation (NSF) is organized to fund all types of science work except medical research. Therefore, most medical education work will not align with the funding priorities of NSF, unless it is interdisciplinary and involve another science, technology, engineering, and math (STEM) field. For example, biomedical engineering educational scholarship might be of interest to the Directorate for Engineering and its various Divisions.

Best practices for applying for (and hopefully) securing funding for your project

Recall that all well-planned research projects begin with a thorough literature search, the identification of appropriate theoretical and conceptual frameworks, and the development of a justifiable research question with testable hypothesis and sound experimental design. If the research team identifies funding needs to carry out the work, then contacting the institutional OSP staff representative is an essential next step. OSP's are trained to identify funding resources and connect investigators to PO's. It is the responsibility of the investigator to develop a working relationship with PO's to seek guidance on the scope of funding possibilities (NIH PO's really do want to be helpful!) and maintain communication throughout the application process.

In addition to working with OSP's and PO's, establishing an intramural grant review committee that provides feedback on grant text is extraordinarily helpful. Many of these intramural grant committees are organized initially and organically between investigators into writing groups. Some departments have formalized this resource in order to increase grant submissions. Writing groups comprised of a diverse group of scholars are sources of inspiration for developing and honing ideas. In the same way that many teachers encourage students to develop study groups, writing groups provide a similar source of accountability for educational scholars.

The funding line (or cut line) for most grants can be very low (i.e. grants are very competitive) for some agencies, which can result in a lot of effort with discouraging results. But do not despair! With time, experience, and wisdom, investigators improve in their ability to secure funding. Work with someone who has been successful at securing funding for their work. It will be a good mentorship and coaching opportunity that can be beneficial in many ways.

Funding Opportunities Published through IAMSEConnects
(courtesy of Dr. Maureen Basha and Dr. Inaya Hajj Hussein, members of the IAMSE Public Affairs Committee)

1. IAMSE
Educational Scholarship Grants and Curriculum Innovation Grants, deadline January
http://www.iamse.org/iamse-grants/

2. TBLC Grant
Team Based Learning Collaborative Research Grant. Deadline July
https://teambasedlearning.site-ym.com/page/2022grant

3. AACOM
Research Grants, portal opens December, Deadline March
https://www.aacom.org/reports-programs-initiatives/programs-and-funding-opportunities/aacom-research-grants

Identifying sources of funding

AACOM Sherry R. Arnstein Minority Student Scholarship. Deadline for applications August
https://www.aacom.org/become-a-doctor/financial-aid-and-scholarships/sherry-r-arnstein-minority-scholarship

Dr. Rose M Green Thomas Academic Medicine Scholarship Award- Submission deadline May
.https://www.aacom.org/become-a-doctor/financial-aid-and-scholarships/dr-rose-m-green-thomas-academic-medicine-scholarship-award

Outstanding Advancement in Osteopathic Medical Education Award- link not posted when application cycle closed
https://www.aacom.org/reports-programs-initiatives/programs-and-funding-opportunities/aacom-awards-programs/outstanding-advancement-in-osteopathic-medical-education-award

National Student DO of the Year award –link not posted when application cycle closed
https://www.aacom.org/reports-programs-initiatives/programs-and-funding-opportunities/aacom-awards-programs/national-student-do-of-the-year-awards#:~:text=The%20National%20Student%20DO%20of,dedication%20to%20the%20osteopathic%20profession.

SOME innovation in Medical Education Awards – Applications open in January, must be a member of SOME
https://www.aacom.org/ome/aacom-councils-and-groups/aacom-councils/society-for-osteopathic-medical-educators/some-innovation-in-medical-education-awards#:~:text=The%20SOME%20Innovation%20in%20Medical%20Education%20Award&text=The%20Society%20of%20Osteopathic%20Medical,the%20osteopathic%20medical%20education%20continuum.

National Academy of Osteopathic Medical Educators - Applications open in Fall
https://www.aacom.org/ome/aacom-councils-and-groups/national-academy-of-osteopathic-medical-educators-(naome)

4. AOA Grants/Awards
AOA Distinguished Service Award, nomination deadline May
https://thedo.osteopathic.org/2021/04/seeking-nominations-for-aoa-distinguished-service-award-2/

AOF W. Douglas ward, PhD, Educator of the Year Award, Nominations due May
https://aof.org/eoy

AOA Mentor of the Year award, nominations due May
https://osteopathic.org/students/student-resources/mentor-of-the-year/

AOA inaugural Diversity, Equity and Inclusion Unification Award. Nominations due July.
https://thedo.osteopathic.org/2021/06/call-for-nominations-for-the-aoas-inaugural-diversity-equity-and-inclusion-unification-award/

Bureau of International Osteopathic Medicine Abstract Competition. Deadline for submission August
https://osteopathic.org/about/aoa-events/biom-international-seminar/

5. AAMC grants

AAMC Group on Educational Affairs (GEA) National Educational Research Grant Award
https://www.aamc.org/professional-development/affinity-groups/gea/national-grant-proposals-call

AAMC Award for Excellence in Medical Education
Nominations are due January.
https://www.aamc.org/what-we-do/aamc-awards/excellence

Award for Distinguished Research in the Biomedical Sciences, AAMC, deadline January
https://www.aamc.org/what-we-do/aamc-awards/distinguished-researchNominations

Herbert W. Nickens Award, Nominations due April
https://www.aamc.org/what-we-do/aamc-awards/nickens

Herbert W. Nickens Faculty Fellowship, nominations due April
https://www.aamc.org/what-we-do/aamc-awards/nickens-faculty-fellowship

Herbert W. Nickens Medical Student Scholarships, nominations due April
https://www.aamc.org/what-we-do/aamc-awards/nickens-medical-student-scholarships

2021 Arnold P. Gold Foundation Humanism in Medicine Award, nomination deadline April
https://www.aamc.org/what-we-do/aamc-awards/humanism

Alpha Omega Alpha Robert J. Glaser Distinguished Teacher Awards, Nominations Due April
https://www.aamc.org/what-we-do/aamc-awards/aoa-glaser-distinguished-teacher

AAMC – CGEA Central Group on Educational Affairs Collaborative Grants
https://www.aamc.org/professional-development/affinity-groups/gea/cgea/awards

AAMC – NEGEA Northeast Group on Educational Affairs Medical Education Scholarship Research and Evaluation (MESRE) Grants
https://www.aamc.org/professional-development/affinity-groups/gea/negea/grants

AAMC – SGEA Southern Group on Educational Affairs Innovation in Medical Education Award
https://www.aamc.org/professional-development/affinity-groups/gea/sgea/awards

SGEA Medical Education Scholarship Awards
https://www.aamc.org/professional-development/affinity-groups/gea/sgea/awards

SGEA Medical Education Research Grants
https://www.aamc.org/professional-development/affinity-groups/gea/sgea/awards

Identifying sources of funding

AAMC – WGEA Western Group on Educational Affairs Call for Mini-Grant Proposals, Deadline for submission is September
https://www.aamc.org/professional-development/affinity-groups/gea/wgea

5. AMEE Grants
ASPIRE-to-Excellence call for 2022 submissions, deadline Feb
https://amee.org/amee-initiatives/aspire\

Ian Hart Award for Innovation in Medical Education, Nominations deadline Feb
https://amee.org/awards-prizes/ian-hart-award

Miriam Friedman Ben-David Award, Deadline March (Note must be AMEE member to qualify)
https://amee.org/awards-prizes/miriam-friedman-ben-david-new-educator-award

Faculty Development Research Grants, deadline Dec (AMEE members only)
https://amee.org/awards-prizes/faculty-development-research-grants

TEL committee Innovation Development Grant (only AMEE individual or student members may apply). Expression of interest submission deadline July.
https://amee.org/awards-prizes/tel-committee-innovation-development-grant

6. Canadian Medical Association (CAME) Note: need to be CAME member to qualify
Certificate of Merit Awards, deadline December
https://www.came-acem.ca/awards/came-certificate-of-merit-award/

CAME Rising Star, Certificate of Excellence, deadline December
https://www.came-acem.ca/awards/came-rising-star-certificate-of-excellence/

Meredith Marks New Educator Award, Nomination deadline Nov. Nominees must be Canadian Association for Medical Education (CAME) members.
https://www.came-acem.ca/awards/meridith-marks-new-educator-award/

7. NBME
Stemmler Fund, Cycle opens in Spring (May) and submission deadlines in Summer (July)
https://contributions.nbme.org/contribution/applying-stemmler-fund
Hubbard Award, Nominations due early Fall
https://contributions.nbme.org/contribution/how-nominate
Latin America Grants (Note last grant listed was 2020)
https://contributions.nbme.org/about/latin-america-grants

8. American Association for Anatomy
AAA Outstanding Mentor Award: Nominations due September
https://www.anatomy.org/AAA/Awards/2021-New-Awards/Outstanding%20Mentor%20Award.aspx?hkey=3ed1b83d-5e9e-49d8-b19d-b6e999e153a6

Research Meetings Outreach Grant, deadline in early spring (March)
https://www.anatomy.org/AAA/Awards/Research-Meetings-Outreach-Grant.aspx?hkey=c2b90f0e-829d-4478-b868-8e7c78ddbf48

Anatomy Training Program, deadline early spring (March)
https://www.anatomy.org/AAA/Awards/Anatomy-Training-Program.aspx?hkey=1c28586c-b121-49f1-895e-aefa1a46630d

Innovations Program, deadline early summer (June)
https://www.anatomy.org/AAA/Awards/Innovations-Program.aspx?hkey=b3c18700-d491-4342-bc21-2773f2e57faf

American Association of Anatomy Education Research Scholarship (Note must be an AAA member to qualify), Deadline October
https://www.anatomy.org/AAA/Awards/Education-Research-Scholarship.aspx,

Excellence in Diversity, Equity and Inclusion Award, American Association of Anatomists. Nomination deadline September.
https://www.anatomy.org/AAA/Awards/2021-New-Awards/The%20Excellence%20in%20Diversity,%20Equity,%20and%20Inclusion%20Award.aspx

American Association for Anatomy Early-Career Anatomist Publication Award, deadline January.
https://www.anatomy.org/AAA/Awards/Early-Career-Anatomist-Publication-Award.aspx?hkey=897648b1-1310-432d-8dbe-7bcd50e2a767

9. American Physiological Society
American Physiological Society Teaching Section New Investigator Award, deadline Dec
https://www.physiology.org/professional-development/awards/researchers/teaching-new-investigator?SSO=Y

10. American Association of Nurse Practitioners (AANP) Scholarships, application period opens February
https://www.aanp.org/education/professional-funding-support/scholarships

Society for Academic Emergency Medicine Foundation (SAEMF) Education Research Grant. Deadline August (must be member of SAEMF to qualify)
https://www.saem.org/saem-foundation/grants/funding-opportunities/what-we-fund/education-fellowship-grant

11. Industry
Osmosis "Raise the Line" scholarships for health professional students. Deadline August
https://osmosis.smapply.io/prog/osmosis-scholarship/

Medical Education Research and Innovation Challenge (MERIC), ScholarRx, Letter of intent due December 17th
https://scholarrx.com/scholarrx-announces-call-for-2022-innovation-grant-applications/

IAMSE-ScholarRx Curriculum Development Grants Due November
https://iamse.site-ym.com/news/news.asp?id=576855

Working with the IRB

Amina Sadik, M.S., Ph.D., M.Ed.L.

- Develop a relationship with the IRB chair to access and complete the adequate/appropriate forms for the project's approval
- Complete the necessary training for all personnel involved with the study

Abstract

To avoid any official reprimand, it is crucial that you do not initiate any research projects involving human subjects. Remember that a project that involves analyzing exam performance may well fall under "human subjects" definition and requires training and IRB approval.

You need to gather the following information, either from the IRB chair or materials put out by the institutional IRB.

Classification of the study as human subjects' research

Human subjects research is defined in federal law and it can be difficult to determine what projects need approval and which do not. The IRB will help with the study classification.

How to handle collaborations with people in other locations or institutions

If you are planning to collaborate with a colleague from another institution, you may need to obtain approval from the IRB of your collaborator as well. Your institution's IRB chair will have an answer and will be able to advise regarding the second approval. Meeting first with the IRB chair will save you and the IRB office a lot of time.

Forms and other materials needed to submit an application to the IRB, and which forms are most likely relevant to your study

IRBs can determine that a project is exempt if it falls in a certain list contained in the law. However, exempt determinations must be made by the IRB and not the researcher. If the project cannot be exempt, it can be reviewed by the entire board, or it may go through a (sometimes) faster process called the expedited review, where a few members of the board review it.

Working with the IRB

General experimental design

Inclusion and exclusion criteria for the study participants, how they will be recruited, who will gain consent to participate and how, what will be required of participants, how many participants are needed, and duration of the project all need to be determined before the application is written.

Timeline

The IRB review may take many months, or it may occur very quickly; the speed varies by institution and workload. Allow at least three months for the IRB review to be completed before the beginning of the project, possibly more if you have information that your institution takes longer. In most cases, you should expect to be in touch with the IRB if anything unexpected happens, like someone makes a mistake in the study, or you have an unexpected problem with a participant.

Duration of the study

The duration of the project is a key question on the IRB application that you should consider before determining the timeline of the project. Give yourself plenty of time because the project may not end within a year or two, depending on how data collection, analysis, and dissemination take. Take the precaution of overestimating– it is better to ask for three years, even if you think that you will be done in two.

Complete the necessary training for all personnel involved with the study

Anyone who will be involved in the research project– principal investigator, research assistants, and/or student researchers– is required to complete the training to learn how to protect human subjects when doing research. Again, the IRB chair or information provided by the IRB will provide information about what training is required and how it can be accessed. There may be different tracks of training based on the proposed project, so it is important to know the type of research so the appropriate training can be chosen. Training may take many hours, so it is important to start the research team on the training as soon as possible to avoid holding up the project.

Collecting data

- Adhere to approved human subjects protocol procedures
- Implement the planned methodology to generate data

Amina Sadik, M.S., Ph.D., M.Ed.L.

Abstract

Usually, data collection is dictated by the research question. The most important step is to carefully define your research question, which is in turn determined by the gap you find from a comprehensive literature search. After you finalize your research question, you should be able to know what type of data you need to collect in order to reach your goal. Make sure that you discuss your research question and your plans for data collection with more than one colleague, especially those who have similar research interests. Your meetings with the IRB chair may also make you aware of the type of data to be collected and how to do it when you discuss the aims of your research project. If you have a dedicated statistician at your institution, discuss your project with that person as well. Be flexible, as you may need to make changes to your methodology or design after your discussions with colleagues and/or the IRB chair.

Adhere to approved human subjects protocol procedures

Read very carefully the letter of approval sent to you by the IRB chair. The content of the letter will delineate or dictate what you can do within the limit of the project. If something new arises, you may need to amend the protocol. An amendment must be approved before it is implemented into the project, so allow time for amendments to be approved.

Implement the planned methodology to generate data

Implementing a strong research plan requires "planning" as the feasibility may not be as clear or evident as you think. If your project is well thought out, you should be able to roughly map out the results section of the study. You may consider using one of the concept mapping software that are available for free for this task. The plan should be detailed so it is easy to complete. For example, Table 1 will describe the research participants, and it will contain the sample size, gender, age, year, and GPA per group. Next will come a bar graph, Figure 1, that will show the difference in primary outcome measure between groups. Even with the best planning sometimes projects do not go a planned, particularly as recruiting can be mor difficulty than anticipated. Planning for contingencies and being ready to make changes is key.

The IRB methodology should be written in a way to allow some flexibility if you run into problems. For example, do not limit your data collection of the survey responses by indicating in your IRB application that you will be sending an email and a couple of reminders to students. You should also indicate that you may need to go to the lecture hall two or three times at different intervals to encourage students to participate by explaining to them the goal if your survey participation is low after deploying the survey. Another important strategy is to provide incentives for subject to participate, and include it in your IRB application. Think of finding an incentive for participation and include that in your IRB application. The IRB will want to know if the reward is appropriate for the amount of work you are asking of your participants, so you cannot decide to create an incentive in the middle of the project. As indicated above, you can amend the project through the IRB if needed, but it takes time, and it is better for all involved if you minimize the need to amend the study.

Analyzing data

- Understand the most common types of data acquired in educational research
- Determine the most appropriate methodology – quantitative, qualitative, or mixed methods – to analyze data

Jonathan J. Wisco, Ph.D.

Kathryn N. Huggett, Ph.D.

Abstract

Educational research studies typically yield two types of data – quantitative and qualitative. This section of the Toolkit will describe the most common quantitative and qualitative data, and best practices for analyzing each. A good research design considers the type types of data that will be necessary to analyze in order to answer specific scientific questions. Analyzing data is an art in itself, requiring investigators to understand the breadth and depth of the data and what type of conclusions can be drawn from experimental or exploratory results. Quantitative data typically refers to outcomes that are measured on a type of numerical scale; whereas, qualitative data are non-numeric, often descriptive, an help researchers understand an experience or phenomenon. For any data analysis, investigators should be aware of the strengths and weaknesses of different types of data, and the conclusions that can be reasonably drawn from the data.

Why Theoretical and Conceptual Frameworks Matter

Data analysis is ultimately driven by the frameworks that undergird the research project and its design. A theoretical framework represents the researcher's vision for how existing theories that offer insight into a specific area such as learning or motivation have shaped the research questions and focus of the study. The theoretical framework is not the researcher's understanding of a topic, but rather the researcher's understanding of how other researchers' work can anchor and guide the present study. For example, there are multiple theories of learning that can guide medical educators and researchers, including cognitivism, behaviorism constructivism, humanism, and connectivism (https://www.wgu.edu/blog/five-educational-learning-theories2005.html). These theories and others such as experiential learning and self-directed learning (Dong, Lio, Sherer et al. 2021) provide insight into why and how students remember, understand, apply, analyze, evaluate, and create knowledge.

A conceptual framework, on the other hand, represents the "logical conceptualization of your entire research project" (Kivunja 2018, p. 47). The conceptual framework explains the rationale, goals, design, and analysis plan for the study. The conceptual framework logically connects the relevant theories and supporting literature to the other aspects of the study, including design, analysis and interpretation. Thus, the combination of theoretical framework and conceptual framework inform all aspects of the study including methodology, data analysis and reporting (Kivunja 2018). More advanced considerations of theoretical and conceptual frameworks have also been studied. For a deeper dive into these topics, we suggest referring to the work of Varpio and colleagues (Varpio et al., 2020).

For example, if investigators want to study the role of technology in self-directed learning, one theory of learning upon which the study is based could be connectivism: Providing different types of technology allows students to study on their own and with colleagues outside of the lab, which in turn maximizes the time to learn content, especially if access to the anatomy lab is limited by schedule or availability of teaching assistants. A conceptual framework for a study might be to compare the efficacy of a segmented anatomical model against virtual reality images of cadaver dissections. In this case, the investigators may use IRB-approved surveys or focus groups to ascertain student satisfaction with the different technologies, but might also provide an assessment tool to measure performance outcomes depending on which content was used with a particular tool.

On the other hand, investigators might instead be interested in a behavioral theoretical framework using the same conceptual framework. In this case, the investigators might use the same technology resources, but ask students whether their motivation to study anatomy increased or decreased as a result of the availability and/or usage of the study tools. The investigator could use the same surveys or focus groups, but the questions contained therein may be very different because the theoretical framework is different. The investigators could also use different data tools, such as observational data of how students who used the technology differ from those who did not use the technology to learn new content, or perform in a simulation learning space.

Almost all medical education studies result in quantitative, qualitative, or both types of data, even though the acquisition of the data may be used using different tools. Below are common methods to analyze either.

Quantitative Analysis

When designing a research study involving quantitative analysis, forethought should be exercised to decide what statistical questions that will be answered, since that determines the type of data that will be collected, and the best method of analysis. For example, if the investigators are interested in the relationship between two continuous variables (i.e. age in years and weight), then a regression analysis might be an appropriate statistical test. If the investigators are interested in the relationship between a categorical variable and a continuous variable (i.e.,

Analyzing data

age in categories of young, middle-aged, old; and test scores), then an analysis of variance (ANOVA) might be an appropriate statistical test.

"Choosing The Correct Statistical Test In SAS, Stata, SPSS and R" is one of the most useful websites to determine what statistical test to use given the nature of the data. It was published by the Statistics Department at the University of California Los Angeles (UCLA; https://stats.oarc.ucla.edu/other/mult-pkg/whatstat/). To use this site, the investigator first needs to determine whether the experimental design will investigate one or more dependent variables, how many independent variables will predict the dependent variable(s), and the type of data characterized as the dependent variable(s). The table on the website describes the statistical test needed, and links to the SAS, Stata, SPSS, and R instructions for how to run the analysis using one of these statistical packages. For a full description of different types of data variables, please refer to Laerd Statistics (https://statistics.laerd.com/statistical-guides/types-of-variable.php).

The most common quantitative data in educational research studies involve Likert scale question responses in surveys. Ironically, Likert scales are considered to be categorical qualitative data, not quantitative data. Likert scales are ordinal measurements of subjects' responses to question prompts. An ordinal scale includes data that is rank-ordered, such "strongly disagree… somewhat disagree… neither agree, nor disagree… somewhat agree… strongly agree," as in the case of a Likert scale. Ordinal data can be analyzed using a number of statistical analysis methods. According to the UCLA Statistics Department tool described above, ordinal data can be analyzed using one-sample median, Wilcoxon-Mann Whitney, Kruskal Wallis, Wilcoxon signed ranks test, Friedman test, ordered logistic regression, or non-parametric correlation, depending on the number of independent and dependent variables. The most common method is the ordinal regression, in which continuous (i.e. numerical age) or categorical (i.e. young, middle-aged, old age) independent variables predict one dependent variable expressed in the form of Likert scale data.

Another common quantitative data in educational research involves categorical data of demographic frequencies. Categorical data typically involves counting an amount within a particular classification. For instance, counting the number of students that expressed satisfaction with learning condition A vs learning condition B, if the learning condition would be a categorical study. Categorical data can be analyzed using a number of statistical analysis methods. According to the UCLA Statistics Department tool described above, categorical data can be analyzed using binomial text, Chi-square goodness-of-fit test, Chi-square test of independence, Chi-square test for homogeneity, McNemar, factorial logistic regression, and simple logistic regression. The most common method is the Chi-square test of independence, which measures the association of two categorical variables.

Laerd Statistics is a valuable resource for determining how to perform a statistical test in SPSS. If the correct statistical test can be determined using the UCLA Statistics website, then perform a Google search for "Laerd statistics [insert statistical test]," which yields a page describing the usage of the statistical method, and how to run the method. For example, to determine how to run an ordinal regression for Likert-scale data, search "Laerd statistics ordinal regression," which results in https://statistics.laerd.com/spss-tutorials/ordinal-regression-using-spss-statistics.php. To determine how to run a Chi-square test of independence, search "Laerd statistics chi-square test for independence," which results in https://statistics.laerd.com/spss-tutorials/chi-square-test-for-association-using-spss-statistics.php.

Qualitative Analysis

When designing a research study involving analysis of qualitative data, forethought should be exercised to decide what questions about human behavior will be answered, and how the data will be collected. Poth and Creswell (2020) describe five primary approaches to qualitative data research – narrative inquiry, phenomenology, grounded theory, ethnography, and case study. Each approach has unique features such as the focus of the inquiry, the type of problem best suited for the design, the unit of analysis, the data collection forms, data analysis strategies, and report type (Poth and Creswell 2020) For example if investigators are interested in the environmental factors of a clinical practice that might influence patient satisfaction with their care, then a phenomenological approach might be an appropriate method. Data for this type of study could take the form of open responses from survey questions, focus groups, or interviews. If investigators were instead interested in a first hand perspective of those same clinical care practices, they might use an ethnographic approach. Especially if the investigators are embedded as situations unfold, data may take the form of audio/visual recordings, notes, and interviews (Grossoehme 2014).

Regardless of the means by which qualitative data was collected, and the form in which it exists, at some point investigators will need to "code" the data in order to generate more granular data points from which inferences can be generated. A number of software packages, at different price points are available to help investigators. Most universities subscribe to at least one of the following common titles: MAXQDA, NVivo, ATLAS.ti, QDA Miner, Quirkos, Dedoose, Taguette, MonkeyLearn (https://monkeylearn.com/blog/qualitative-data-analysis-software/). Less sophisticated and more ubiquitous tools, including the Google Workspace apps (Docs, Sheets, Slides, and Jamboard) and Microsoft 365 suite of products (Word, Excel, PowerPoint, OneNote) can also

Analyzing data

be used for coding purposes.

A common sentiment that basic scientists might experience when embarking on their first qualitative research project is feeling like "they are drowning in data." That is because they are! Unlike basic science or clinical data, which has a very discrete feeling, qualitative data can appear overwhelming, and deciding where to begin with analysis can be daunting. There are five principal techniques to analyze qualitative data, including grounded theory, thematic analysis, content analysis, narrative analysis, and discourse analysis, all of which are highly related to one another, but differ in terms of their philosophical and initial approach (https://getthematic.com/insights/qualitative-data-analysis/).

Grounded Theory

As basic scientists tend to be the most comfortable with working with raw data and determining whether the analysis of the data supports or rejects null hypotheses, a grounded theory approach may be the best place to start, but it is also one of the most challenging techniques to learn. Grounded theory is considered both an experimental design technique and a post hoc data analysis technique. The basic premise is to allow the data to "speak to" the investigators without and preconceived notions of how the analysis may unfold. Coding is an essential technique to analyzing qualitative data regardless of the philosophical approach. In grounded theory, as codes reveal, the investigator re-examines the data iteratively while the analysis unfolds instead of waiting until the analysis is completed to make conclusions. In other words, as codes are identified, investigators are influenced by the codes to search for deeper meaning in the original data or codes themselves. The iterative process continues until interpretations of the data yield redundant results. Whether from an experimental design perspective in which investigators analyze the data while they are acquiring it, or from a post hoc data analysis perspective in which investigators analyze data previously acquired, the result in the same. In the end, interpreted meanings from what subjects said is revealed, and reported (Cho and Lee 2014; Kennedy and Lingard, 2006; Tie et al., 2019).

Thematic analysis

Unlike grounded theory, investigators approach data with a priori themes and look for codes and patterns in meaning that either support or refute those themes (https://delvetool.com/blog/thematicanalysis). Thematic analysis can also be used in conjunction with grounded theory, but heuristically termed "axial "or "selective coding" using the jargon of the grounded theory technique. During grounded theory, when data is iteratively examined, each coding round can begin with themes in mind. Altogether, this hybrid version of the two techniques might be better termed, "grounded theory-thematic analysis."

Content analysis

Similar to thematic analysis, investigators use an a priori approach to the data, but this time with specific words, or phrases – specific textual or auditory content – in mind. Again, content analysis can be used in conjunction with grounded theory. For reference, please see: https://www.publichealth.columbia.edu/research/population-health-methods/content-analysis.

Narrative analysis

In narrative analysis, storytelling is at the heart of the data source. Both the participant and the investigator can participate in the interpretation of stories through declarative, clarifying, and deeper investigations. In narrative analysis, accurate transcription of interviews is essential. Given the importance of body language, it might be helpful to propose capturing video data to the IRB: spoken word can be interpreted very differently post hoc from spoken word with body language. For reference, please see: https://delvetool.com/blog/narrativeanalysis.

Discourse analysis

Understanding the context of when or why something is said is important when interpreting how a subject communicates is at the heart of discourse analysis. Narrative analysis can be considered a type of discourse analysis since the former focuses on what is said, and the latter focuses on the context for what is said. For reference, please see: https://www.linguisticsociety.org/resource/discourse-analysis-what-speakers-do-conversation.

The easiest perspective on these five techniques is to think about how ideas are conveyed through language: Fundamentally people communicate through principles of diction and syntax. Whereas diction refers to word choice, syntax refers to the arrangement of words in language. In sum, grounded theory analyzes linguistic data without any preconceived ideas. Thematic analysis approaches data with preconceived notions, and similarly content analysis looks for specific words or phrases. Narrative analysis examines stories, and discourse analysis dives deeper into stories to understand the context for which stories are told.

Mixed Methods Analysis

A mixed-methods analysis intentionally combines quantitative and qualitative methods since mixed methods research design yields both types of data in a single study (Creswell and Plano Clark 2017). A common usage of mixed-methods is to distribute a Likert- scale survey to students, and include free-response prompts or follow-up with focus group interviews. The reverse design can also be used. In either case, the survey data can inform the focus group data, or vice-versa. The scientific questions investigators ask should drive the decision of whether or not to design a mixed methods study and subsequently perform a mixed methods analysis.

Analyzing data

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Presenting your work

- Organize preliminary findings and literature review into a poster or oral presentation
- Incorporate peer feedback to further refine the research project

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Abstract

Scientific presentation is a key component of medical sciences education scholarship. It is a professional way of sharing your thoughts and observations. In general, scientific presentation requires you to set goals, identify venues and audiences, refine your message, prepare presentation materials, and accept and incorporate feedback. All of these activities benefit from the support provided by peers, home institutional offices, and professional organizations. Presenting your work is an exciting and valuable opportunity since it is a two-way process; you will not only share your findings to date, but you will receive peer feedback which may help to refine and further improve your scholarship project.

The Why, Where, and What of presentation

As medical science educators, we may not always appreciate the value that comes with presenting our scholarship. Among the many reasons why presentation is important, one that we wish to emphasize is the value generated by advocating for our field. Through scientific presentation, we promote awareness and increase the visibility of medical science education scholarship, which ultimately benefits the field. Other reasons include the opportunity to contribute to advances in your field, improve your communication skills, network and build collaborations, and enhance your profile as a medical science educator.

Now that you appreciate why you should present, let's discuss where, how and what. Deciding upon the conference at which to present your work will differ for each individual, with regard to location and budget, but a key consideration should be the relevance of the conference theme and who it is expressly aimed at. There are many conferences dedicated to medical sciences education, including the IAMSE Annual Meeting. In addition, many professional societies offer sessions dedicated to education. Ultimately, consider the target audience for whom your work will have most impact. Generally, when your project is at an early stage or you only have limited data, you should opt for a poster presentation. Poster sessions allow for more in-depth discussion with peers, which can be useful during the early phases of your project.

When your project is nearing completion and you have generated some interesting findings that you wish to showcase more widely to the academic community, then an oral presentation is preferred.

Presenting your work

Preparing for your Presentation

The first step in scholarly presentation is abstract submission. Conference abstracts are short – typically around 250 words – so being able to write succinctly is key! Do spend significant time writing and editing your abstract, and solicit peer feedback, because it is the sole determinant of whether or not your work will be selected for presentation. Many conferences use a structured abstract with Introduction or Aims, Methodology, Results and Conclusions. This is a helpful format to follow even if supplied with a free-text box. Your abstract should contain sufficient detail that the reader can ascertain: justification; the research question; the methods used; the key findings; and interpretations. Ensure that your data justify your conclusions. It is critical that you only include the most pertinent findings; the abstract is not meant to provide an exhaustive account of all of your results to date, so be selective.

The design and style of the poster is important; you should aim to create a visually attractive and compelling presentation of your work so far. While an eye-catching design is good in a busy conference hall, avoid using garish colours or excessive clip-art!

There is no standard poster size so be sure to check the dimensions (height and width) and orientation (portrait or landscape) to be used at the conference before you begin to design your poster. You will need to summarise concisely your work as the poster format needs to be readable from a distance. Avoid large blocks of text and make use of figures, graphs, tables, and bullet-points to convey key information.

Always print out a Letter/A4 sized version of your poster in order to proof-read carefully before commencing the large-scale print. Not only will it give you a better idea of the layout, oftentimes you will spot a typo in the hard-copy that was hitherto unnoticed on-screen! It is also a good idea to show your poster draft to colleagues for comment before printing the final version.

Remember that you do not need to include the references on your poster, especially when you have a lot of key data or a long list of references to share. Therefore, consider generating a QR code and pasting it at the bottom left of your poster just under the title "References", for example:

References
Available upon request. Please scan the QR code for contact.

Free QR code generators can be found online.

Alongside the title of your poster, include the logo of your school. You may also add the logo of the conference, but that precludes re-use of your poster so only include if you do not plan to present the same work at another conference.

Similar to the advice given for posters, it is important to focus your oral presentation on the key findings of your research project. For a 10-minute presentation you should aim to have no more than 12 slides, including your title and acknowledgement slides. The content of your presentation should mirror that of the submitted abstract.

Typically, you will have an additional 5 minutes following your presentation for questions from the audience. Try to predict what questions are likely to arise and duly prepare your answers for those. It can sometimes be beneficial to have some extra slides available should you need to elaborate on a particular answer to one of these anticipated questions.

Sometimes you submit an abstract with preliminary data and then a few months later, you obtain larger data or just different results. If you are using preliminary data in the abstract, do not hesitate to indicate in the conclusion "our preliminary data indicate that…", so that when you have your final results, you can corroborate with your preliminary data or refute them as long as you have valid statistical analysis to prove the latter.

Practice makes perfect

Whether you are presenting a poster or an oral communication, it is always important to rehearse your presentation in front of a live audience. For posters, aim to be able to fluently present an overview of your work in 3-4 minutes to conference attendees who stop by your poster. For oral presentations, it is essential that you are able to stick to the strictly allotted time (usually 10 minutes). If you go over this, at best you will reduce the time afforded for questions immediately following your presentation, at worst you will be cut-off mid-sentence and risk leaving a poor impression!

Rehearse and rehearse again the night before the presentation or the morning of the presentation. Some people actually find the room where they will be presenting the following day and ask a colleague or a friend to be there so they can rehearse and get a feel for the room while presenting.

Presenting your work

Presentation Skills

It is important to consider developing your skills in public speaking for the purposes of giving scientific presentations. There are endless resources available online which provide advice and tips on how to better convey your message and engage with your audience. Some important topics to consider are authenticity, message, use of vocabulary, and vocal tone, pitch and volume. Convey authenticity by being yourself and allowing your excitement and passion for the work to shine through. Connect with the audience by talking to them, instead of your poster or screen. Refine your message and keep it simple. Plan for transitions and opportunities to simplify complex concepts so that you never lose the attention of the audience. Know your audience so that you can tailor your vocabulary to meet their needs. In medical sciences education, it is important that your message is understood by scientists, clinicians, and educationalists alike. Speak up so that you may be heard. If a microphone is provided, take care to speak into it and not to wander away from it. You may also consider introducing some vocal variety, changing up your tone and pitch to indicate what audience members should be paying attention to. For those of you intimidated by presenting, you can employ a myriad of strategies during your preparation, such as breathing exercises, visualization, and affirmations. Look for specific resources that can help you address this. (ditto) Lastly, don't forget that professional appearance impacts the ways in which audience members perceive you. Be sure to dress professionally, but also comfortably to reduce distracting gestures (?). To convey confidence, stand tall and keep your chest lifted, walk energetically up to the podium, and smile.

To improve your presentation skills, you can start by observing speakers which you admire. Set goals and continue to grow through practice and peer feedback. Join a public speaking group if you desire more structure to guide you. Regardless of the current skill level, all persons are capable of growing their presentating ability.

Peer feedback on your actual presentation

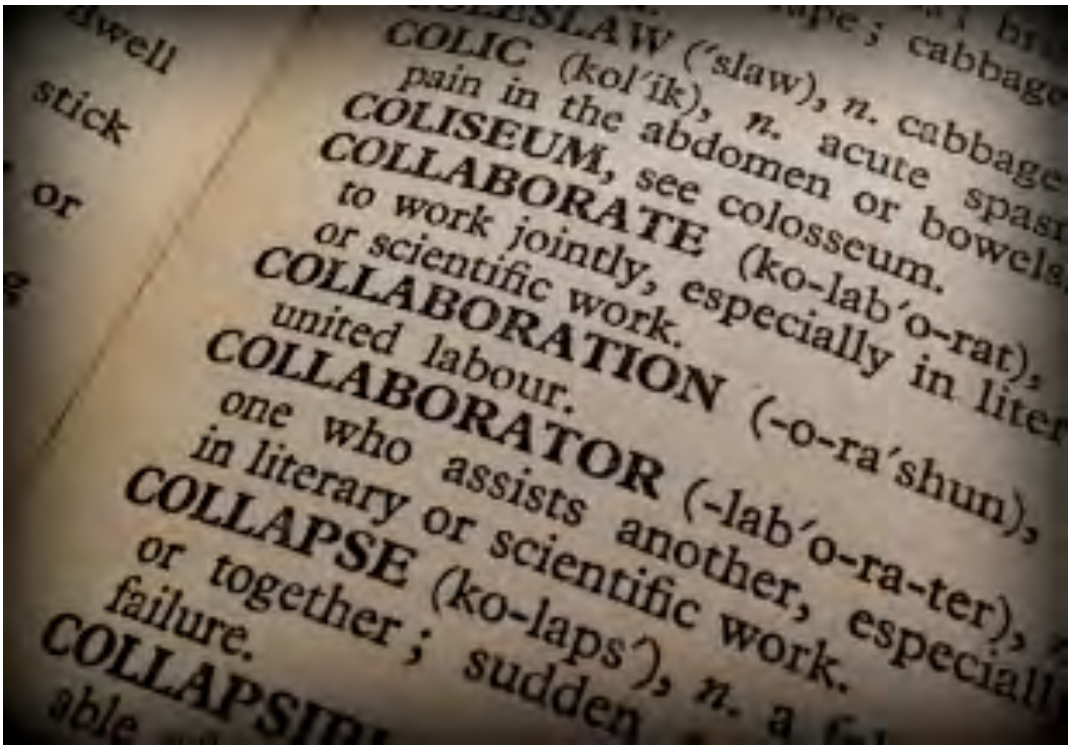
Be sure to take a note of interested individuals as they view your poster; they could become key future contacts, e.g. a reviewer for your manuscript or a research collaborator. Attaching a card-holder containing your business cards to the poster board is a good way to share your details with others, especially during the times out with designated poster sessions.

Because the 5-minute Q&A section at the end of an oral presentation is limited, remember to add your contact details (email) on your final slide so that anyone who did not have time to ask a question can follow up with you.

With all that is going on at a conference it is easy to forget the conversations you had about your work, so make a note of any questions you were asked and feedback received while still fresh in your mind. Once you return to your home institution you should use the feedback to refine your ongoing research project because it is rare that we present a final product at conferences. Posters and/or oral presentations are just the beginning of dissemination of your findings. Based on the feedback received, you should be able to polish your figures, clarify your legends, and/or use another statistical test to make your data better "speak" to your audience or "carry" your message.

Networking

Last but not least, make full use of the networking opportunities available through conference attendance. When else do you get protected time away from your desk to meet fellow researchers and experts in the field? Ahead of the actual conference, you should read through the program schedule and note any plenary speakers, presenters, and exhibitors you are particularly interested in meeting. This may seem obvious, but while at the conference be sure to wear your name badge at all times, have business cards at the ready, and use the conference Twitter hashtag. Following the meeting you should connect with attendees you have met on social media and/or send them an email to follow-up on any aspects you are keen to pursue. Some rewarding collaborations can result from this approach.



Conclusion

Scientific presentation is key to disseminating your work and advancing your career. Exploring different venues and presentation formats will help you determine the best fit for your work. Once you decide where and how to present, writing a clear and concise abstract is crucial to securing the opportunity. Whether you are preparing a poster or an oral presentation, refer to best practices in design and practice your presentation to ensure your message is conveyed as intended. In addition to the way your work is presented, the way you present yourself can influence audience member's perceptions of your scholarship, so look outside the data. Lastly, the experience of presenting is invaluable to improving your work and enhancing your professional development. Enjoy your presentation, and take full advantage of all of the opportunities it presents.

Resources

http://www.iamse.org/events-of-interest/
https://www.mededworld.org/Conferences/Upcoming-Conferences.aspx
https://waset.org/healthcare-education-conferences-in-2021

Writing the manuscript

- Identify a journal to disseminate the work and explore the instructions for authors
- Organize final data and previously drafted work into a final publication

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Norma S. Saks, Ed.D.

Abstract

Publishing your research represents the culmination of your hard work and perseverance and, importantly, allows your findings to influence others' educational practice. Firstly, identify an appropriate journal and write your manuscript in accordance with the journal's format. Highlight the pedagogical frameworks underpinning your research and be explicit about how your research contributes to the body of knowledge. Most manuscripts are required to undergo revisions before they are accepted for publication. Be sure to take on-board reviewers' feedback, and be polite and thorough when responding to their comments. Lastly, persevere; publishing is an iterative process. If your manuscript is rejected by the first journal, integrate the revisions and submit to an alternative journal.

Writing your manuscript

1. Become familiar with the scope and format of published educational materials related to your project.

If you have not previously published educational research, begin by reading the existing literature. Familiarise yourself with the scope and format of articles from educational journals. Also note the language used; it can be quite different from the accustomed 'scientific method' depending on which publication you read. However, the aim is for you to publish your work for fellow medical science educators and so ease of understanding by your target audience is essential.

Choosing the journal most appropriate for your work is critical to the impact it will have in the academic community. Two examples of medical education journals are Medical Science Educator and Medical Teacher, the official peer-reviewed publications of IAMSE and AMEE, respectively, but you may wish to consider a research or clinically-focused journal within your specialty with a dedicated educational section.

- Medical Science Educator: Innovations, Short Communications, Original Research, Monograph, Commentary, Letter to the Editor, Systematic/Scoping Reviews
- Medical Teacher: Articles, Short Communications, Letters to the Editor, Twelve Tips, Personal View, Around the World, Commentaries

It is important that you select an educational research project with appeal to a wide audience and that the findings be generalizable to contexts beyond your home institution/discipline. Furthermore, journal reviewers are unlikely to have specialist knowledge in your chosen discipline so avoid use of jargon and provide sufficient detail when describing your study.

2. Utilize the materials you have already prepared.

Rather than approach the writing of your manuscript with a blank sheet of paper, make use of the written material you have already prepared in relation to your research project. It is likely you have completed a review of related literature, that you will have sought independent ethics committee approval, and perhaps submitted a conference abstract of your work. These can form the basis of your draft manuscript, adhering to the format required by the journal that you have selected.

Writing the manuscript

3. Block off designated time to write.

Finding the time to write your manuscript is likely to be the biggest challenge you will face. Blocking off time in your calendar to dedicate to writing, or teaming up with colleagues in your institution for a scheduled morning or afternoon 'writing retreat' at which you can work on your manuscript has proved helpful to many.

4. Specifically address all sections of the manuscript according to the journal in which you are aiming to publish.

Abstract

Journal abstracts are typically around 250 words so summarising your full manuscript in a compelling yet concise way is essential. While it must reflect the paper's content, the abstract will determine whether someone bothers to read your entire article so use it to highlight your key findings and the wider implications of your work. Hint: The most useful abstracts are often written after you complete the main sections of the manuscript.

Introduction

The introduction of your manuscript should provide sufficient background of the research topic, and indicate how this is being challenged or built upon, so the reader can readily understand the rationale for your study. The introduction includes a summary of your literature review relevant to the formulation of your research question(s). The introduction frames the research question(s) and states the aim of the study. If there is a hypothesis this should be clearly stated. It is important that you provide referenced details of the theoretical framework(s) underpinning your work.

When searching the literature, use databases such as PubMed and Embase. However, it will likely be important to expand your search into related areas in the social sciences, so inclusion of a range of databases, e.g. Institute of Education Sciences (ERIC), is often useful when for writing a literature review.

Methods

Readers will be interested in the specific context of the research, so give details of your institution(s), the programme/course involved, how participants were selected, and the duration of your study. Provide information on the chosen study design to address your research question, quantitative and/or qualitative data collection, quality assurance processes (validity, reliability, anonymity) and statistical analysis. If you are following an established method, for example a standardised survey instrument, you should cite the reference for previously published studies using this approach in the Methods section. Include details of ethics committee approval.

Results

Present the findings of your study in the order outlined in the methods section. It is usual to begin with participant data (number and demographics), before a factual description of the main results. Resist the temptation to display every result in graphical or tabular format; ideally, only key findings should be highlighted in this way. Be certain to follow the specific format of Tables and Figures as detailed in your journal's publication information. Representative participant reaction in the format of quotations can provide compelling evidence in education-

al research, so it will be important to supplement quantitative survey data with qualitative data, even if simply gathered via use of a final open-text question ("Any further comments?") in an otherwise quantitative survey instrument.

Discussion

This is your opportunity to discuss your findings in the context of the existing literature by considering whether your results support or contradict previous theories. Never over-interpret your work; all assertions made must be supported by your results. It is important to cite seminal works in your research area, as well as ensuring the inclusion of up-to-date references in your evaluation of the literature. A lack of recent references can suggest to reviewers that your manuscript has been submitted to multiple other journals previously, without due diligence in updating the content in between times.

Remember to highlight any limitations in your study (e.g. low sample size, inadequate follow-up, generalizability). Reviewers will spot these, so it is better to be upfront with any weaknesses. Aim to justify how the study reveals important findings despite these limitations.

Conclusions

Even if the journal does not require a separate conclusions section, you should make the final paragraph of your paper a summary of the key outcomes of your study and the wider implications. Readers will be looking for ways that the research can be applied in their own institutions.

Submitting your manuscript

Ensure that your manuscript complies with the journal's specific instructions to authors, especially around word-count, number and format of figures/tables, use of headings, and reference style. When choosing your title, consider whether it would be readily found using a search for research articles relating to your topic.

After you have completed the writing of your manuscript, take time to proof-read it carefully. Frequent typos and/or grammatical errors can detract from the message you are trying to convey and can reduce the reviewers' confidence in your work.

Writing the manuscript

Responding to the reviewers' comments

Receiving comments from the journal reviewers, or a rejection of your work, will likely be an emotional experience. You will have put time and energy into your project and the submission of the manuscript, so are anxious to have it published. However, keep in mind that rarely are manuscripts accepted without requiring any revisions. You may want to put the comments away for a day or two since it can be difficult to focus on making changes when your feelings are running high, and clarity may come when revisiting the feedback. Even if you receive a rejection, resist the temptation to fire off an angry email to the editor; rather, consider the reviewers' comments and how they can improve your manuscript. Most often, their suggested revisions will result in a better finished article that will ultimately be accepted for publication in that same journal, or in another to which you submit. Occasionally a reviewer will miss the point and you can respond honestly and politely to the comments. If the comments stem from a misinterpretation of your narrative, you should consider how to reword the text to avoid such misunderstandings by others.

When submitting your revised manuscript, it is helpful and often required to specify the changes you have made concerning each of the comments in sequence as this demonstrates to the editor that reviewers' concerns have been addressed comprehensively. When responding to the reviewers' comments, be respectful. Journal reviewers and editors give their time freely – and remember to thank them for their feedback. If you are unable to incorporate a suggestion, be sure to provide a robust account as to why you have not done so; sometimes it is simply not possible to meet all of the requested revisions, particularly those concerning additional data.

Don't give up!

A large proportion of first-round rejected manuscripts are never submitted to another journal, but it is important not to be discouraged. Most "high-impact journals" have high rejection rates, so even papers that are worthy of publication fail to get accepted. Thus, integrate the reviewers' comments into a revised manuscript, and search for another appropriate journal for your work.

Summary

Take home messages:

- Select the most relevant journal for your work
  - Don't be influenced by impact factors for educational publications
- Highlight the pedagogical frameworks underpinning your research
  - Educational scholarship concerns the application of learning theories
- Does your manuscript pass the "so what?" test?
  - Have you explained how your research contributes to the body of knowledge?
- Be polite and thorough when responding to reviewers' comments
  - Reviewers are volunteers with the focus on providing feedback to enhance journal submissions.
- If at first you don't succeed, try, try again
  - If rejected, submit your revised article to another journal

Resources

Handbook for Academic Medicine Writing Workshop: https://journals.lww.com/academicmedicine/Documents/Handbook%20for%20Academic%20Medicine%20Writing%20Workshop.pdf

Ligon B, Turner T, Thammasitboon S (2017) 'Highlighting common pitfalls to avoid when writing the medical education manuscript'. Med Ed Publish, 6 [2], 32 https://doi.org/10.15694/mep.2017.000094

Tang KS, Cheng DL, Wu WC et al. (2020) 'Example-Based Learning as a Guide for Revising a Peer-Reviewed Manuscript'. Med Sci Educ, 30, 1263–1266 https://doi.org/10.1007/s40670-020-01009-9

Steinert Y, McLeod PJ, Liben S, Snell L (2008) 'Writing for publication in medical education: The benefits of a faculty development workshop and peer writing group.' Medical Teacher, 30:8, e280-e285, DOI: 10.1080/01421590802337120

IAMSE Medical Science Educator Reviewer Workshops - Each year the Editorial Board of Medical Science Educator offers two workshops for reviewers of the journal. These are open to members of IAMSE (registration and further details).

A checklist of objectives

- The collection of objectives as a checklist for your study

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Abstract

If you've made it this far in the toolkit, congratulations! The Educational Scholarship Committee Toolkit was written to provide an introduction to those embarking on the adventure of educational scholarship for the first time, or a refresher to those who have been on the career trail for some time and just need a reminder of the basics. This toolkit is by no means exaustive; there is so much more to learn, and new best practices are published continuously. This is a (re)start! We encourage you to seek mentors throughout your career who can help you on this adventure. IAMSE is a wonderful organization that brings educational scholars together. And, IAMSE provides ample opportunities to learn new, or to refine, teaching and a scholarly skills. Below you will find a summary of the objectives from each section of this toolkit. It may serve as a helpful checklist for you as you ascertain where you are on the trail of educational scholarship.

Design, implement, and disseminate a medical sciences educational scholarship project
- An introduction to medical sciences education

Identifying a mentor
- Define the mentoring relationship.
- Describe strategies for promoting effective mentorship.
- Determine the type of mentorship that is right for you.

Defining the scholarly project
- Identify a topic for the educational research project.
- Define educational scholarship.
- Identify a topic for the educational research project.

Conducting a literature review
- Develop a relationship with an institutional librarian to identify appropriate resources for the project of interest
- Critically appraise the educational research literature to initiate a research project

Selecting a conceptual framework
- Define the key terms theory, theoretical framework, and conceptual framework
- Explain the the significance of conceptual frameworks
- Describe how to identify conceptual frameworks to support your work
- List 2-3 conceptual frameworks commonly found in health professions education and research

Defining the research question(s)
- Formulate a clear question based on interests and literature review
- Examine the goodness of the question for quality and scope
- Write a hypothesis, or expected outcome

Selecting a research study type
- Deduce the research study type

Designing a study and selecting a methodology
- Devise the appropriate methods to address the research question and seek the appropriate resources
- Understand the primary research designs for research in medical education
- Differentiate between inductive and deductive approaches to reasoning
- Differentiate between qualitative and quantitative research methods
- Describe the types and purpose of mixed methods research
- Define valid outcome measures that are achievable and reliable
- Detail qualitative and quantitative data collection methods
- Ascertain the study participants and timeline of engagement
- Know the difference between a sample and population
- Know the purpose of different types of sampling, and the different approaches of sampling

Identifying sources of funding
- Understand the rationale for seeking funding for your project.
- Identify different opportunities for funding educational scholarship projects.
- Develop an appropriate strategy to applying for funding.

Working with the IRB
- Develop a relationship with the IRB chair to access and complete the adequate/appropriate forms for the project's approval
- Complete the necessary training for all personnel involved with the study

Collecting data
- Adhere to approved human subjects protocol procedures
- Implement the planned methodology to generate data

Analyzing data
- Understand the most common types of data acquired in educational research
- Determine the most appropriate methodology – quantitative, qualitative, or mixed methods – to analyze data

Presenting your work
- Organize preliminary findings and literature review into a poster or oral presentation
- Incorporate peer feedback to further refine the research project

Writing the manuscript
- Identify a journal to disseminate the work and explore the instructions for authors
- Organize final data and previously drafted work into a final publication


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