

Review Article

From research to discovery: developing scholarly research competence in health professions education

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ABSTRACT

This evidence-informed narrative review examines how research engagement in health-professions education can develop into continuing scholarly participation, from research experience and publication to scholarly discovery, connection with subsequent scholarship and interpretation of research indicators. Literature addressing research engagement, thesis-to-publication experiences, scientific communication, scholarly discoverability, bibliometrics, research indicators and responsible research assessment was identified through targeted searches of PubMed/MEDLINE and scholarly databases, supplemented by citation tracking and guidance from scholarly organisations. Evidence was synthesised narratively to develop an educational perspective. Research engagement can support skills and scholarly interests among health-professions learners. Evidence from medical education illustrates the transition from student research projects and theses to publications. Publication creates a formal scholarly record, while identifiers, metadata and indexing support discovery and connection with related scholarship. Bibliometric indicators describe selected dimensions of scholarly activity, and their interpretation depends on the indicator, unit of analysis, source, time period, field and purpose. Building on existing scholarship on bibliometric and scholarly metrics literacy, we adapt the concept for health-professions education as a practical educational competency: the ability to understand commonly encountered scholarly indicators, recognise what they describe, identify their source and context, and interpret them appropriately. This definition is an educational synthesis rather than a claim of a universally standardised competency framework. Research education can extend beyond conducting a study to communicating research, participating in the scholarly record, understanding scholarly connections and interpreting research indicators responsibly. The pathway—RESEARCH → PUBLISH → DISCOVER → CONNECT → UNDERSTAND → GROW—frames research as a continuing scholarly journey.

Keywords: Bibliometrics, Education, Medical, India, Research, Scientific communication

INTRODUCTION

Research engagement is an important component of health-professions education because it provides learners with opportunities to formulate questions, appraise evidence, apply research methods and communicate scientific findings.^{1,2} Participation in research can

therefore contribute to the development of skills that extend beyond completion of an individual project and support continuing scholarly activity.³⁻⁶ For many learners, a dissertation, thesis or supervised research project represents their first sustained experience of moving from a question to evidence. This experience can

become an important foundation for subsequent scholarly work.

The educational value of research, however, does not necessarily end when the study is completed. A completed research project may progress from a dissertation or project report to a manuscript, peer review and publication, after which the work becomes part of the scholarly record. Published work can subsequently be discovered through scholarly databases and connected with related research through citations, references and collaborations. Understanding this progression can help learners appreciate scientific communication as a continuation of the research process rather than as a separate activity undertaken only after research has finished.

Evidence from health-professions education illustrates the growing engagement of learners with research. A systematic review and meta-analysis identified a range of educational and scholarly outcomes associated with medical student research engagement.³ Subsequent reviews have described curricular approaches that support research-skill development among medical students, while recent syntheses have further examined the educational outcomes and broader scholarly development associated with student research engagement.⁴⁻⁶ In an Indian study of 606 medical students, 78.22% considered research pivotal to their academic trajectory, illustrating the place that research can occupy in students' professional development.⁷ Recent bibliometric evidence also demonstrates the medical student and resident contributions to the indexed literature over time.⁸ Together, these findings support viewing research engagement as an educational experience with potential relevance to continuing scholarly development.

An important transition within this experience is the movement from thesis or project to scholarly publication. Studies from India have documented publication of a proportion of postgraduate theses, while international research has examined students' experiences of converting academic work into research publications.⁹⁻¹¹ The transition requires learners to distil a substantial research document into a focused scholarly article, communicate findings according to disciplinary conventions, respond to peer review and understand the processes through which research becomes part of the scientific literature. These activities provide opportunities to develop scientific communication alongside methodological competence.¹²

Once research is published, researchers encounter another dimension of scholarly practice: understanding how their work can be identified, discovered and connected with subsequent scholarship. Digital identifiers such as the Digital Object Identifier (DOI) and researcher identifiers such as ORCID, together with bibliographic metadata and indexing systems, support the organisation and discovery of scholarly publications. Citations and other indicators

can provide information about selected dimensions of scholarly activity. Understanding these elements is increasingly relevant to researchers who encounter publication records, citation information and research indicators during their academic development.

This latter stage introduces a distinct educational opportunity. Researchers do not need to become bibliometric specialists to understand the indicators associated with scholarly work. Rather, they can benefit from developing a practical ability to ask what an indicator measures, the level at which it operates, which source produced it, what period it represents and for what purpose it is being used. In this review, we refer to this practical educational competency as bibliometric literacy. We use the term to describe an ability to understand commonly encountered scholarly indicators, recognise their meaning and context, and interpret them appropriately.

Accordingly, this evidence-informed narrative review considers the scholarly journey of research within health-professions education, from research engagement and scientific communication to publication, scholarly discovery, connection with subsequent scholarship and interpretation of commonly encountered research indicators. We propose that understanding this journey can form part of developing scholarly research competence and present a learner-oriented pathway—Research → Publish → Discover → Connect → Understand → Grow—as an educational synthesis of the literature.

METHODS

Review approach

This article presents an evidence-informed narrative review examining how research engagement within health-professions education can extend from research experience and scientific communication to publication, scholarly discovery, continuing scholarship and interpretation of commonly encountered research indicators. The review was designed as an educational synthesis rather than a systematic review or an evaluation of intervention effects.

Information sources and search approach

Literature was identified through targeted searches of PubMed/MEDLINE and scholarly databases using combinations of concepts related to health-professions and medical student research engagement, research education, thesis or dissertation publication, scientific communication, scholarly discoverability, bibliometrics, research indicators and responsible research assessment. Relevant references identified through citation tracking were also considered. Guidance and conceptual documents from relevant scholarly organisations were examined where they informed the interpretation of

identifiers, metadata, bibliometric indicators or responsible research assessment.

Evidence selection and synthesis

Sources were considered when they contributed directly to one or more of the educational themes addressed in the review. Priority was given to systematic reviews, scoping reviews, longitudinal or observational studies, educational studies, methodological literature and authoritative guidance relevant to the review question. Landmark publications were retained where they provided important conceptual foundations, while recent literature was used to reflect contemporary developments in health-professions education, scholarly communication and research assessment. Evidence was synthesised narratively across the identified themes rather than pooled quantitatively. The synthesis was then translated into an educational perspective linking research competence, scientific communication, scholarly participation, bibliometric literacy and continuing scholarship.

From research experience to scholarly contribution

For a health-professions learner, research often begins with a question arising from clinical practice, community

health, education, laboratory observation or an identified knowledge gap. Moving from that question to a study provides an opportunity to develop practical research competencies: reviewing evidence, selecting an appropriate design, collecting and analysing information, interpreting findings and communicating conclusions. These experiences can contribute to a learner's developing understanding of how knowledge is generated and evaluated.³⁻⁶

The completion of a dissertation, thesis or research project marks an important point in this process. The resulting document brings together the research question, relevant literature, methods, findings and interpretation. It is also a record of the learner's experience in conducting research. From an educational perspective, the completed project can therefore be viewed not only as an academic product but also as a foundation for further scholarly communication. A useful way of understanding this progression is to distinguish the research experience from the scholarly contribution that may develop from it. The research experience encompasses the activities through which evidence is generated. The scholarly contribution begins when that evidence is communicated in a form through which other members of the scholarly community can engage with it. Publication represents an important transition between these stages.

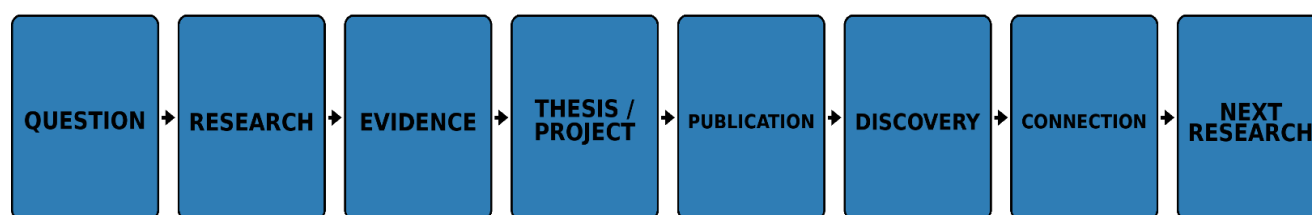


Figure 1: The research-to-scholarship journey.

Micro-definitions: Discovery - the process through which a scholarly work can be located and identified by readers. Connection - links between a published work and related or subsequent scholarship through references, citations, collaboration and other scholarly relationships.

The pathway illustrates that research can have a continuing scholarly trajectory. A research question leads to the generation of evidence; the evidence is documented in a thesis or project report; selected findings can then be developed into a scholarly manuscript and submitted for publication. Once published, the work becomes part of the scholarly record and can be discovered, read and connected with other research. These connections can contribute to new questions, collaborations and subsequent research.

This perspective also places publication within the broader educational experience. Preparing a manuscript requires a learner to identify the central research question, determine which findings are most relevant, organise evidence coherently and communicate the contribution within the conventions of scientific writing. Peer review further provides an opportunity to engage with scholarly critique and refine scientific communication. Thus, the transition from completed research to publication can

itself represent a meaningful stage in the development of scholarly research competence.

For students and early-career researchers, the practical message is straightforward: the end of data collection is not necessarily the end of the research journey. The evidence generated through a carefully conducted project can become a manuscript, a published contribution and a point of connection with subsequent scholarship. Understanding this journey helps learners see publication not simply as an additional academic activity, but as one way in which research can continue to contribute to scientific learning and knowledge exchange.

From dissertation to publication: scientific communication as a developing research competence

A dissertation and a scholarly article share the same research foundation, but they serve different purposes. A dissertation documents the research experience

comprehensively, including its background, methodological decisions, findings and interpretation. A journal article presents the central contribution in a focused format intended for communication with a scholarly readership. Moving from one form to the other therefore requires more than shortening the text; it requires the researcher to identify the central question, select the evidence that addresses it most directly and communicate its contribution clearly.

We refer to this process as scholarly distillation the deliberate transformation of a comprehensive research document into a focused scholarly communication. The process provides an opportunity to revisit the research question, examine the coherence between methods and findings, refine interpretation and develop scientific writing skills. It can also introduce learners to authorship, journal selection, submission procedures, peer review and revision.¹³ Evidence from India demonstrates that a proportion of completed postgraduate research can progress to journal publication. Dhaliwal and colleagues examined 160

master's theses from a university medical college and reported that 48 (30%) had been published in indexed scientific journals.⁹ More recently, Kakar and Gogia examined postgraduate theses submitted to the National Board of Examinations and reported publication of 144 of 434 theses (33.2%).¹⁰ These studies provide examples of the transition from postgraduate research to the published literature and illustrate the potential for academic research completed during training to become a scholarly contribution.

The transition also has an educational dimension. In a mixed-methods study of medical students who had undertaken master's thesis research, Björklund and colleagues examined students' experiences of the publication process. Among respondents for whom publication was relevant, 79% reported additional learning associated with the publishing experience.¹¹ The findings suggest that publication can provide learning opportunities extending beyond the original research project, including experiences of scientific communication and engagement with the publication process.

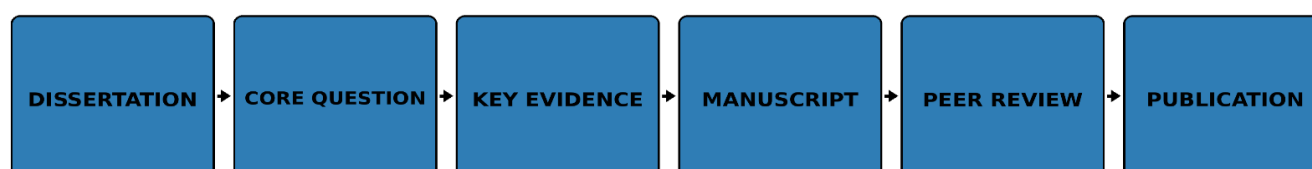


Figure 2: From dissertation to scholarly article

Micro-definition: Scholarly distillation - transforming a comprehensive research document into a focused article that communicates its central scholarly contribution.

Table 1: From dissertation to first publication.

1. Revisit the research question.
2. Identify the central contribution.
3. Review the evidence.
4. Choose the article type.
5. Identify the intended readership.
6. Select a suitable journal.
7. Distil the dissertation.
8. Refine the scientific message.
9. Complete ethical and authorship requirements.
10. Submit, learn and revise.

The purpose of this sequence is not to prescribe a single publication route. Rather, it provides learners with a practical way to move from a completed research experience toward scholarly communication. Journal selection is particularly important because the intended readership and scope of a journal influence how a research contribution should be presented.

Entering the scholarly record: publication, identifiers and discoverability

Publication marks an important transition in the research journey. A completed study that has been communicated through a peer-reviewed journal becomes part of the formal scholarly record and can be accessed by readers beyond the institution or programme in which the research was originally undertaken. Publication therefore extends the potential audience for a research contribution and creates opportunities for the work to be read, discussed, cited and connected with subsequent scholarship. For learners, understanding this transition is part of developing scientific communication competence. A published article is not simply a shortened dissertation; it is a scholarly contribution presented within the conventions of a journal and an interconnected information environment. The article's title, authorship, abstract, keywords, references and other bibliographic information provide structured information through which readers and scholarly systems can identify and locate the work.

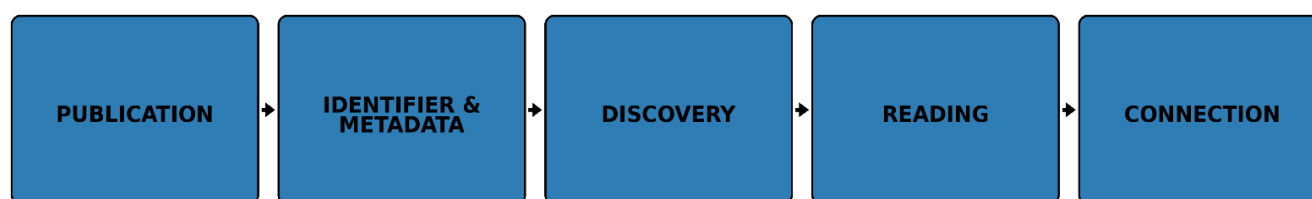


Figure 3: Understanding the scholarly record.

Micro-definitions: DOI - Digital Object Identifier; a persistent identifier associated with a registered scholarly object. ORCID iD - a persistent researcher identifier that helps distinguish researchers and connect them with their contributions. Metadata - structured information describing a scholarly work. Indexing - inclusion of bibliographic information in a searchable scholarly database or information service.

Several elements contribute to the organisation and discovery of the scholarly record. A Digital Object Identifier (DOI) provides a persistent identifier for a registered scholarly object, while an ORCID iD provides a persistent identifier that helps distinguish researchers and connect them with their contributions.¹⁴⁻¹⁶ Bibliographic metadata describes a scholarly work and supports its identification, citation and discovery.¹⁷ Indexing services provide searchable records through which readers can locate relevant literature.

These elements serve related but distinct functions. Publication, indexing and discovery should not be treated as synonymous. An article can be formally published before it is included in a particular indexing service, and different databases may contain different records, coverage periods and metadata. Similarly, the presence of an article in an indexed database indicates discoverability within that system but does not by itself describe the scholarly value or influence of the work.

For a developing researcher, a practical understanding of these distinctions is more useful than memorising the names of numerous databases. When examining a publication record, learners can ask: Where is this article published? What identifier does it have? Which information systems contain its record? Can the bibliographic information be consistently linked to the correct authors and publication? These questions connect scientific communication with information literacy.

The published article can subsequently become part of a network of scholarly connections. Readers may use its findings, authors may collaborate on related work, and later publications may cite or otherwise engage with it. The article therefore acquires a continuing presence within scholarly communication.

In this article, we use “scholarly footprint” as an educational term for the observable connections surrounding a research contribution, including its publication record, discoverability, citations, collaborations and other forms of scholarly attention. It is used descriptively rather than as a formal research-assessment construct. The educational message is therefore simple: publication gives research a place in the scholarly record; identifiers and metadata help that

contribution remain identifiable; indexing supports discoverability; and discovery creates opportunities for scholarly connection.

Understanding connections after publication: from the scholarly record to continuing scholarship

Once a research article enters the scholarly record, its journey can continue through interactions with subsequent scholarship. Other researchers may read the work, refer to its findings, include it in a systematic review, build on its methods, develop related research questions, or collaborate with its authors. References and citations provide visible links between publications and allow parts of the scholarly conversation to be traced over time.

For learners, understanding these connections adds an important dimension to scientific communication. A publication is not an isolated endpoint; it becomes one contribution within a larger body of scholarship. Reading how subsequent researchers refer to an article can help a researcher understand how the original findings have been interpreted, extended, applied or discussed in later work. This creates an opportunity for learners to continue learning from their own research after the original project has been completed.

A citation is one observable connection between a publication and a later scholarly work. A later article may cite an earlier study because it uses its findings, discusses its methods, provides context for a research question, compares results or engages with another aspect of the earlier work. Consequently, the presence of a citation provides evidence of a connection between publications, but the number of citations alone does not explain the nature, importance or scholarly meaning of that connection.

This distinction is particularly relevant when researchers first encounter citation counts. A citation count is a quantitative description of how many times a work has been cited within a particular source and period. It can provide useful information about one dimension of scholarly attention, but it does not independently describe the quality, educational relevance, methodological strength or practical contribution of a study.

Research undertaken during health-professions training may form part of a continuing scholarly trajectory. In a longitudinal study of medical students, Waaijer and colleagues examined the relationship between scientific publishing during medical school and publication activity after graduation and reported an association between early publishing activity and later publication careers.¹⁸ The study does not establish that publication during medical school causes subsequent publication activity; nevertheless, it illustrates how research experiences during training can be situated within longer scholarly trajectories. The journey can therefore be understood as: PUBLICATION → DISCOVERY → READING → CONNECTION → NEW QUESTIONS → FURTHER RESEARCH. This pathway shifts attention from publication as a final product toward scholarship as a continuing process.

Bibliometric literacy as an educational competency

As researchers become more familiar with the scholarly record, they increasingly encounter quantitative information about publications, citations, journals, researchers and research fields. Such information may

appear in journal websites, bibliographic databases, institutional profiles, researcher profiles, academic curricula vitae and research reports. Understanding these indicators is therefore becoming a practical aspect of scholarly information literacy.

Bibliometrics refers broadly to the quantitative study of publications and patterns within scholarly communication.^{19,20} Bibliometric analysis can be used to examine patterns such as publication activity, citation relationships, research themes, collaboration networks and the development of scholarly fields. Such analysis generally requires specialised methods and tools.

The educational need considered in this article is different. For educational purposes, we propose bibliometric literacy as a practical educational competency: the ability to understand commonly encountered scholarly indicators, recognise what they describe, identify their source and context, and interpret them appropriately. This definition is proposed as an educational synthesis in this review rather than as a claim of a universally standardised competency framework.

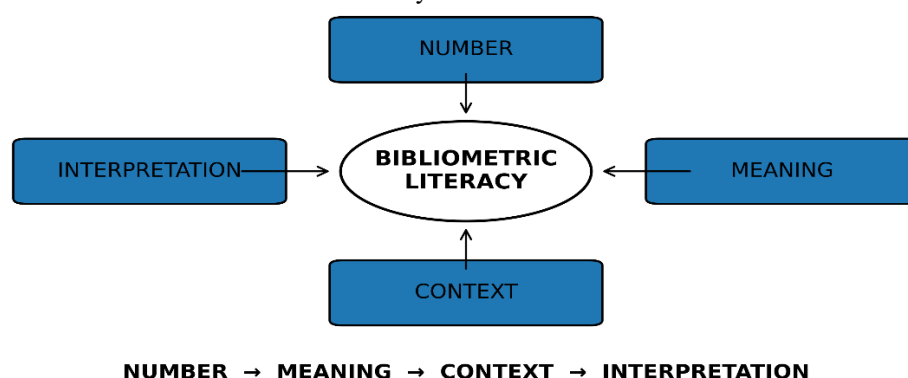


Figure 4: Bibliometric literacy compass.

Micro-definition: Bibliometric literacy - the practical ability to understand, contextualise and appropriately interpret commonly encountered scholarly indicators.

NUMBER → MEANING → CONTEXT → INTERPRETATION

The compass can be translated into a practical four-step habit: NUMBER → MEANING → CONTEXT → INTERPRETATION. Number: What is being reported? Meaning: What does the indicator actually describe? Context: What information is needed before interpreting it? Interpretation: What does the indicator mean in this specific source, period, unit of analysis and purpose?

For example, a citation count may describe the number of citations recorded for a publication within a particular database at a particular point in time. The number alone does not establish why the publication was cited, whether the citation reflects agreement or discussion, or the methodological or practical contribution of the study. Similarly, an h-index describes a particular relationship

between publication and citation counts for a defined set of publications; it should therefore be interpreted in relation to the researcher, source, time period and field in which it is being considered.

Journal-level indicators require the same care. An indicator associated with a journal describes a characteristic of the journal or its published content at a particular level of analysis; it should not automatically be transferred to an individual article or researcher. Field-normalised indicators are designed to account for differences in citation patterns between research fields and consequently require attention to the reference population and methodology used for normalisation.

The educational purpose is not to discourage the use of quantitative information. Rather, it is to strengthen the ability to use such information appropriately. Quantitative

indicators can provide useful descriptive information when their meaning, source, timeframe and purpose are understood. They become more informative when considered alongside the research itself, qualitative scholarly judgement and the context in which the indicator is being used.^{21,22}

Reading research indicators in context: what common metrics describe

Researchers encounter quantitative indicators at several stages of academic development. A publication may have a citation count; a researcher may have an h-index; a journal may report journal-level indicators; and some databases provide indicators designed to account for differences in citation patterns between fields. These measures describe different objects and dimensions of scholarly activity.^{19,20}

A practical starting point is to identify the unit of analysis before interpreting a number. An indicator may describe an individual publication, a researcher, a journal, an institution or a field. Confusing these levels can lead to interpretations that extend beyond what the indicator was designed to describe.

Micro-definitions

H-index is an indicator based on the number of publications receiving at least a corresponding number of citations within a defined publication set.²³ Field-normalised indicator is an indicator adjusted using a reference population to account for differences in citation patterns between research fields.

Other indicators may be encountered in specific settings. Field-normalised indicators attempt to make citation-related information more comparable across fields with different citation practices by relating observations to an appropriate reference population.^{21,24} Their interpretation consequently requires attention to the normalisation method, reference population and source.

Altmetrics provide another category of information, drawing on online attention and engagement associated

with scholarly outputs. They can provide information about dimensions of attention that are not represented by traditional citation counts, but they measure a different phenomenon and should be interpreted accordingly.²⁵

Consider a publication with a reported citation count. The useful question is not simply “How many citations does it have?” but “How many citations are reported, by which source, over what period, and what does that information describe?” The same approach applies to researcher-level indicators. An h-index reported on one platform may differ from an h-index reported on another because databases can differ in coverage, author identification and record matching.

The time dimension is also important. Publication counts and citation counts represent information available within a particular period. Citation accumulation generally develops over time, and recently published work has had less opportunity to accumulate citations than older work. Field also matters because scholarly fields differ in publication practices, collaboration patterns and citation behaviour.

These principles are consistent with contemporary approaches to responsible research assessment. The Leiden Manifesto emphasises that quantitative evaluation should support expert assessment rather than replace it.²⁴ The Declaration on Research Assessment (DORA) provides guidance emphasising clear, transparent and context-sensitive use of quantitative indicators and recognises that no single indicator can capture the complexity of research contributions.²¹ The Agreement on Reforming Research Assessment similarly places qualitative judgement and broader recognition of research contributions at the centre of assessment, with quantitative indicators used responsibly and appropriately.²²

For health-professions learners, these principles can be translated into a simple habit: NUMBER → MEANING → CONTEXT → INTERPRETATION. Before comparing or interpreting a research indicator, ask: What does it measure? What is its unit of analysis? Which source produced it? What period does it represent? What is the purpose of using it?

Table 1: Common research indicators: what they describe and what researchers should remember.

Indicator	Level	What it describes	What researchers should remember
Publication count	Researcher / group / institution	Number of publications attributed within a defined source and period.	Depends on database coverage, document types, attribution and time. Describes output, not the complete contribution.
Citation count	Article / set of publications	Number of citations recorded within a specified source and period.	Changes over time and can differ between databases. Does not explain why a work was cited.
h-index	Researcher	Relationship between a researcher's publications and citations within a defined publication set.	Influenced by career duration, field, database coverage and publication/citation patterns.

Continued.

Indicator	Level	What it describes	What researchers should remember
Journal-level indicator	Journal	A quantitative characteristic calculated at journal level.	Describes the journal or defined publication set; should not automatically be transferred to an individual article or researcher.

From first publication to continuing scholarship

A first publication can represent an important transition in the development of a health-professions researcher. It demonstrates that a research question has been taken through the stages of investigation, scientific communication and peer-reviewed dissemination. At the same time, the experience can provide a foundation for further learning: reading subsequent literature, following developments in the field, identifying related questions, engaging with other researchers and planning future studies. More recent evidence has examined the relationship between structured research opportunities and student research output. Barki and colleagues conducted a longitudinal cohort study involving 2,451 medical students across nine cohorts and examined research outputs in relation to a protected 14-week research period.²⁶

Among these students, 487 (20%) produced at least one research output, generating 597 unique outputs, including 536 journal articles. The protected-block model was independently associated with research output. As with other observational educational research, these findings should be interpreted within the study design and context rather than as evidence that a particular programme structure alone determines scholarly output. The developing researcher can therefore view a publication as both a scholarly contribution and a learning resource: FIRST RESEARCH PROJECT → FIRST PUBLICATION → FOLLOW SUBSEQUENT SCHOLARSHIP → IDENTIFY CONNECTIONS → DEVELOP NEW QUESTIONS → NEXT RESEARCH PROJECT.

The learner-oriented pathway proposed in this review brings these elements together:

RESEARCH → PUBLISH → DISCOVER → CONNECT → UNDERSTAND → GROW

Research - generate evidence through a meaningful research question. Publish - communicate the research as a scholarly contribution. Discover - understand how the contribution can be identified and located. Connect - recognise relationships between the work and subsequent scholarship. Understand - interpret scholarly indicators according to their meaning and context. Grow - carry the research experience into continuing scholarly development.

Micro-definition: Continuing scholarship - ongoing engagement with research, scientific communication and scholarly learning beyond an individual research project.

CONCLUSION

Research education in the health professions can extend beyond learning how to formulate a question, conduct a study and complete a dissertation. It can also help learners understand how their research can be communicated, enter the scholarly record, become discoverable and connect with subsequent scholarship. The transition from research project to publication provides opportunities to develop scientific writing, peer-review experience and continuing engagement with evidence.

As learners encounter publication records and quantitative research indicators, they can benefit from developing practical bibliometric literacy. Knowing what an indicator describes, the level at which it operates, its source, timeframe and intended purpose allow quantitative information to be interpreted within an appropriate context. This approach supports informed engagement with the scholarly record while keeping the underlying research contribution at the centre.

The journey can be remembered as: RESEARCH → PUBLISH → DISCOVER → CONNECT → UNDERSTAND → GROW.

Research generates evidence. Publication gives that evidence an opportunity to enter the scholarly record. Discovery allows others to locate the work; scholarly connections provide opportunities for further learning and research; and bibliometric literacy helps researchers understand selected quantitative descriptions of these connections. The experience can then become a foundation for continuing scholarship. For health-professions learners and early-career researchers, completing a research project can therefore be viewed as the beginning of a scholarly journey rather than its final point. Let your dissertation become your first publication, let your publication become part of the scholarly conversation, and let the experience inform your next research question.

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