Perspective

Inquiry in the Medical Curriculum: A Pedagogical Conundrum and a Proposed Solution

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Abstract

Habits of inquiry are considered an essential component of the modern physician's profile. These habits drive physicians to recognize and address the continuous challenges inherent to the practice of medicine; consequently, they meet the aims of better patient-centered care, better health of communities, and improved functioning of the health system. Many medical schools have endeavored to integrate inquiry into their curricula as a means of supporting development of adaptive expertise, a construct that encompasses habits of inquiry. However, the diversity of conceptualizations of inquiry has resulted in correspondingly diverse instructional implementations. Much of the emphasis has been on inquiry methods (e.g., engagement in research projects, courses in research methods and statistics), but the learners' inquiry disposition and its essential attitude component have received little attention in instruction and assessment. The authors propose that both inquiry methods and attitude need to be developed explicitly and simultaneously to prepare physicians to successfully be willing and able to address the challenges of today's health care environment. Since attitudes are established predictors of behavior, a positive inquiry attitude may be the ultimate determinant of physicians' engagement in behaviors of adaptive expertise (i.e., recognizing when learned procedures do not apply, and learning or inventing effective solutions). Addressing the attitude toward inquiry as early as possible in medical school is critical because strong attitudes are difficult to modify. Thus, a curriculum that supports positive inquiry attitude formation and strengthening will carry well beyond medical school and residency training.

The goal of medical education is to prepare clinicians who will improve the health of individual patients as well as the health of their communities and the functioning of the health system. Physicians must accomplish this goal in the context of rapidly evolving medical knowledge, technical innovations, changing societal expectations,[1,2] and the diagnostic uncertainty that is inherent to the practice of medicine.[3] To address these challenges, physicians must engage in inquiry, a flexible, innovative, creative, and exploratory approach that leads to both learning and invention of appropriate solutions. Since engagement in inquiry is a defining characteristic of adaptive expertise,[4–6] based on definitions in the literature,[5–8] we propose a working definition of adaptive expertise in medicine: "Timely, mindful, and proficient engagement in inquiry as a habitual and positive response to practice challenges or gaps in knowledge that is needed to address and solve patient problems, public health problems, and/or health systems problems." This habit needs to be intentionally and explicitly developed during medical training, a recommendation supported by several recent proposals for reform of medical education.[1,9,10]

However, as we examine below, educators conceptualize and operationalize inquiry in various ways within medical curricula. We scrutinize current inquiry strategies to discern the level of alignment with the goal of training for adaptive expertise in clinical practice. We identify conceptual gaps with important consequences for instructional design and assessment.

Conceptualization of Inquiry

The medical education literature conceptualizes inquiry inconsistently, which is a situation also found in the general education literature.[11,12] For instance, when used in instructional methods

such as problem-based learning, the term *inquiry* describes how students discover knowledge through modeling, scaffolding, and enacting the investigatory activities of researchers.[13] Many medical schools use the term *inquiry* to describe the scientific research activities of students[14–17] and their knowledge of scientific methods, including those needed for the practice of evidence-based medicine (EBM). In an exploratory review of medical school websites, curricular documents from our own medical school, and statements made in curricular committees, we found multiple uses of the term *inquiry*. These included inquiry as a mental disposition or stance (e.g., skeptical, critical, curious, creative, imaginative); as an approach to solving dilemmas in clinical practice (i.e., a way to reason and solve clinical problems); as procedures of science, particularly the scientific method; and as the process of making decisions on the basis of scientific information. It is not clear how such variety of perspectives can support the development of adaptive expertise.

To address the inconsistent conceptualization of inquiry, we begin with the concepts developed by John Dewey, one of the most influential philosophers of education, in his treatise *Logic: The Theory of Inquiry.*[18] From Dewey's deep and complex reflection on inquiry, we highlight methods and disposition as two critical and interdependent elements of inquiry that are directly applicable to medical education. From his pragmatic point of view, Dewey presents inquiry as including effective procedures to transform problematic situations into understandable and manageable ones.[19] This concept applies to medical education because non-routine problems, which regularly confront physicians, must be transformed, through appropriate methods, into something manageable. Methods thus include not only the scientific method as applied in the natural sciences, but also approaches from the social sciences and from philosophy. Dewey also

highlights the importance of disposition. He asserts that managing a non-routine problem leads to cognitive, behavioral, and affective responses that, if enacted habitually, become a routine feature of our general dispositions. Interestingly, these two elements of Dewey's conception of inquiry—methods and disposition—were also embraced by Flexner,[20] although he used the term *attitude* instead of *disposition*.

The concepts of disposition and attitude are often used interchangeably. Although some feel that disposition is more encompassing than attitude, there is no clear agreement on conceptualizations of disposition in the educational and philosophical literature.[21] For instance, inquiry disposition, sometimes called habit of mind or thinking disposition, has several and inconsistently proposed components.[22–29] On the other hand, the long tradition of empirical research on attitudes in the psychology literature has resulted in consensus that attitudes influence our perceptions and guide our behavior.[30] For this reason, we posit that, even if the inquiry disposition were to encompass the attitude toward inquiry, the dependence of the former on the latter and the much larger body of knowledge on attitudes justify our focus on attitudes.

Indeed, the following modern conceptualization of attitude in the psychology literature allows us to place it as an essential and testable element of the inquiry disposition: An attitude is "an overall evaluation of an object that is based on cognitive, affective, and behavioral information."[31] We propose that the inquiry attitude focuses on the learning and/or invention needed to address practice challenges or gaps in knowledge to solve the problems of patients, communities, or health systems. An unfavorable inquiry attitude would lead to avoidance of learning or invention, while a favorable one would lead to the intentional investment of cognitive

resources to "not only use and build, but also to purposefully adapt and re-engineer knowledge effectively."[4] Although attitudes are generally considered durable and stable,[32] their strength can be modified,[33] a feature that makes them an important target of curricular intervention. Accordingly, inquiry is an intertwined construct of methods and attitude. Thus, medical curricula need to address both the methods of and attitude toward inquiry.

Operationalization of Inquiry in Medical Curricula

Inquiry in the medical school curriculum has generally been operationalized as inquiry-based learning (e.g., in problem-based learning),[13] inquiry techniques and procedures (e.g., biostatistics, critical appraisal of the literature),[34] and EBM.[35,36] Scholarly projects have long existed as forms of inquiry in curricula of a few medical schools, and more schools have recently responded to calls for reform by incorporating similar explicit inquiry elements in their curricula.[37] They include longitudinal inquiry programs, inquiry-focused electives, and required inquiry blocks that can be grouped as scholarly concentrations.[38] The generally expected deliverable is a "scholarly product" such as poster presentations, articles, reviews, or abstracts.[14–17] The common feature of these programs is medical students' engagement in scientific research.[16]

The origin of this operationalization of inquiry (i.e., to instill inquiry by training physicians to think and act like scientists) may be, at least in part, in Flexner's assertion that "the progress of science and the scientific or intelligent practice of medicine employ exactly the same technique."[39(p55)] Despite Flexner also underscoring the critical importance of both scientific and social science methods and attitudes, the aspects of his report most often taken up by others are

those that resulted in biomedical scientific content and the scientific method dominating the medical school curriculum.[40]

Two additional influences on operationalizing inquiry as engagement in scientific research are our current need to train more physician scientists,[41,42] and the "research imperative," which implies a moral obligation to pursue medical research. This imperative exists at the level of our society, and it grounds the belief that physicians need to be trained in scientific research. However, the underlying reasoning in this imperative has been questioned,[43,44] which highlights the fact that even seemingly self-evident concepts may be so only on the surface.

The prominence of the scientific research operationalization of inquiry is also evident in published guides[34] and curriculum descriptions on the web pages of accredited medical schools, including those in the Scholarly Concentrations Collaborative,[45] a group of leaders in medical education working to improve and grow opportunities for student research and discovery. These approaches assume that scientific thinking will translate into improved clinical thinking and better patient outcomes. However, such evidence has not yet been produced, and these programs have generally not been devised with a theoretical framework to support their goals, strategy, structure, and evaluation.[14,15]

Delineating the Issues About Inquiry in the Medical School Curriculum

Conceptualizing inquiry as an intertwined construct of methods and attitude highlights the need to promote learning methods of inquiry while progressively developing the inquiry attitude. We think that there is room for growth in both methods and attitude within inquiry elements of the medical school curriculum. Based on our exploration of inquiry in the curriculum, we see a focus of inquiry instruction on methods (i.e., knowledge and skills), particularly the hypothetical–deductive arguments of the scientific method. These arguments fail to encompass all known types of scientific reasoning[46] and are not necessarily applicable to methods of the social sciences and philosophy, which are just as important in informing the practice of medicine. Not only has the focus on the type of methods been narrow, but also instructional components fail to specifically develop a positive inquiry attitude. The paucity of research on this topic of inquiry attitude may suggest that curriculum designers assume that a positive inquiry attitude naturally follows applying inquiry methods.

Assuming that we can develop methods and a positive attitude of inquiry, the next concern is transfer, because educators expect the methods and attitudes of scientific inquiry to transfer to clinical practice. The education literature defines transfer as the ability to use knowledge or skills acquired in one domain to solve new problems in a different domain.[47] For scientific research experiences not directly connected to the clinical context, it would be difficult to pinpoint what knowledge and skills should transfer to the clinical realm. This situation is especially problematic if we only focus on the scientific method and its important, but still limited, process of problem solving and reasoning. Curriculum designers may assume that the knowledge, skills, and attitudes gained during scientific research experiences in the medical curriculum will contribute to enhanced clinical reasoning and to the development of inquiry methods and attitude

necessary for adaptive expertise in the clinical realm. Such transfer is often assumed, but this assumption warrants critical examination.[48–50] Interestingly, this situation is very similar to that of the various science education standards for K–12 and undergraduate education in the United States, which assume that conducting scientific inquiry helps students make informed decisions. However, an explanation for how this is supposed to happen is lacking and, furthermore, research shows that the epistemic values of science do not inform the decision making of students.[51]

We think that there may be context and domain specificity in developing the inquiry attitude; in other words, building a positive inquiry attitude for adaptive expertise in scientific research does not automatically translate into a positive inquiry attitude for adaptive expertise in clinical practice. Dewey emphasized that there is specificity to the context of inquiry: some of the techniques and the attitude are difficult to transfer from one context to another.[19] For example, when we ask medical students to engage in a scientific molecular biology project on clinical samples, they may not understand how this transfers to patient care. In this case, the instructional designer wishes that the reasoning process (e.g., use of evidence and hypotheses), behaviors (e.g., being persistent, diligent, skeptical), and problem-solving strategies used in scientific experiences apply to clinical practice; yet, this seems unlikely. The general consensus is that clinical reasoning skills are context-specific and not generic.[48–50] We underline these possible barriers to transfer because they may pose problems with implementations of inquiry in the medical curriculum. Relatedly, a recent systematic review of EBM training, which is a component of inquiry methods, shows that there is no evidence that such training leads to changes in clinical practice or patient outcomes.[52]

Unfortunately, research on classical mechanisms of transfer shows that transfer does not necessarily happen spontaneously.[53–55] Marked differences in content and context (e.g., the laboratory vs. the clinic) makes transfer not only difficult but, according to some authors, very unlikely.[48] Other authors would add that this is particularly true if there is no deliberate and effortful activation of non-automatic processes.[56] Furthermore, even self-efficacy, goals, and outcomes expectations appear to be domain-specific (i.e., difficult to generalize)[57,58] or arguably idiosyncratic. Given the significant differences in context, content, techniques, methods, and skills between scientific research and clinical practice, the classical perspective in the educational literature would suggest that the desired transfer from these experiences to the clinical realm may be difficult to accomplish without appropriate instructional strategies that can support such transfer.

To optimize transfer, medical students need opportunities for inquiry that correspond to the context of inquiry in clinical practice such as with patients, in health systems, or within the community.[2] To clarify, in terms of a recent theoretical analysis of context, we do not mean that the physical dimension of context (e.g., in the clinical ward) is absolutely necessary; however, the semantic/cognitive dimension (e.g., inquiry about authentic clinical cases) and particularly the commitment dimensions of context (e.g., having an active responsibility, a strong partnership with mentor) may be required.[59] This idea is also consistent with situated learning theory explanations (e.g., knowledge is context-bound) and research on expertise.[60] The resulting recommendation from this literature is that curriculum developers should design learning processes with consideration of the situational and social contexts in which expert performance

is expected to occur. The target domain (i.e., clinical practice) needs to be the starting point of instructional design, potential barriers in the social context (e.g., hierarchy, power dynamics, rigidity) need to be recognized and addressed, and habits of inquiry must be regularly reinforced to result in a learning process.[61]

A Way Forward

Much of the emphasis in new curricula and in the academic literature, including recent recommendations to foster adaptive expertise,[62] is on the development of inquiry methods (i.e., knowledge and skills). We posit that inquiry methods are necessary but not sufficient. The development of a positive inquiry attitude is equally important. The medical school curriculum needs to promote and assess the development of this attitude so that the intention to engage in inquiry translates into adaptive expertise in clinical practice throughout the professional lives of our students.

Given that the inquiry attitude is a cognitive and behavioral trait, it follows that its underlying supporting beliefs can be developed and strengthened through specific curricular interventions. Those interventions need to cover both elements of inquiry—methods and attitude—in their objectives, instructional designs, assessments, and across the curriculum. We expect that a practitioner with strong self-efficacy grounded on competency in inquiry methods, together with a strong inquiry attitude, will be compelled to engage in the inquiry that supports adaptive expertise even in the presence of recognized obstacles of clinical practice.[63,64] Methods of behavior modification based on theoretical frameworks from social psychology, such as the

theory of planned behavior,[65] have developed and strengthened a positive inquiry attitude.[66] We think that these strategies are good candidates to explore for their application in medical education to developing a positive inquiry attitude. This is so because of their emphasis on the equal development of behavioral beliefs, which support attitude, and self-efficacy derived from mastery of inquiry methods.[67–70] We intentionally do not elaborate further on possible approaches to develop and strengthen a positive inquiry attitude because the spirit of this perspective is to stimulate a rich discussion.

Concluding Remarks

One goal of medical school curricula is to place learners on a trajectory toward adaptive expertise for their clinical endeavors. Medical schools aim to achieve this goal partly through elements of inquiry in the curriculum, but there is lack of clarity about the conceptualizations and operationalizations of inquiry that explicitly align with adaptive expertise for clinical practice. In response, we present a vision of inquiry in medical school curricula that promotes learning methods of inquiry while nurturing the progressive development of a positive inquiry attitude. We call on educators to strengthen inquiry in medical school curricula by designing and evaluating instruction longitudinally throughout the entire curriculum with scaffolds that can support the development of inquiry methods and a positive inquiry attitude that directly apply to clinical practice, and by implementing assessments that monitor learning of knowledge and skills of inquiry methods as well as the development of a strong positive inquiry attitude.

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