

Health professions education scholarship: The emergence, current status and future of a discipline in its own right

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The study of medical education, as a domain of scholarly pursuit, has enjoyed a remarkably rapid development in the past 70 years and is now more commonly known as health professions education (HPE) scholarship. In this contribution, the author reviews the developments of the field from the perspective of Boyer's four criteria that determine scholarship: discovery, integration, application and teaching.

The author concludes that, given the scientific infrastructure which has emerged, HPE scholarship can arguably be considered a discipline in its own right, covering a unique niche, with inherent dependence on both medical and other health professional sciences on one hand and social sciences, including educational sciences, on the other.

1 The historical overture of scholarship in medical education

The education of medical students to become doctors, general practitioners or medical specialists, is a long route, requires hard work and involves abundant knowledge acquisition. This phrase may characterise in a nutshell how many people would summarise all they know about medical education, unless they have personal involvement. Most educational scientists, as well as most biomedical scientists, involved in educational or medical scholarship may not realise the richness of the intersecting field of medical education scholarship, currently subsumed under the broader term of "health professions education".

This article was independently solicited for special issues of the *Beiträge zur Hochschulforschung [Journal for Higher Education Research]* and *FASEB BioAdvances* (ten Cate, 2021), with quite different audiences, both of which are, as we estimate, not deeply informed about medical education.

The purpose of this contribution is to inform educational scientists and biomedical scientists about the intersecting domain of health professions education, elucidating its history and current status as a rapidly emerging scholarly domain.

The intersection of two fundamental pillars of a thriving society – population health and population education – is the art of educating doctors and other health professionals to serve the health of populations. Medical education has always enjoyed the dedicated

interest of physicians and educators. Mythology teaches us that the first renowned medical student and educator, Asclepius, son of Apollo and Coronis, had been educated himself in the art of medicine by the centaur Chiron and had learned about healing and resurrection from a snake who became his company along with a magical rod (Figure 1). Rod and snake became and remained the most important symbols of medicine throughout the ages until today, as witnessed by the many logos of medical associations around the world. It should be acknowledged that Chiron and Asclepius were not only famous for their medical knowledge, but also known for their educational skill.

Figure 1: Hendrick Goltzius (1558 – 1617): Apollo, about to entrust centaur Chiron with the education of Asclepius [Courtesy National Gallery of Art, Washington DC]



In the 21st century, medical and biomedical sciences have become a major industry through specialised hospitals, laboratories, universities and commercial enterprises. Education, while for many ages focused on primary schooling and handicraft for the youth, has developed in the past century in industrialised societies with secondary education for most and tertiary education for many citizens with important scientific foundations. The science of education has developed strongly in the 20th century.

Medical education itself has been a respected art throughout history. Famous medical scholars and educators through the ages include Hippocrates, Celsus, Galen, Andreas Vesalius, Herman Boerhaave, William Osler and William Halsted as prime examples until the early 20th century (Bliss, 1999; Lindeboom, 1968; Ludmerer, 1999; Lyons &

Petrucci, 1987), and most medical schools take pride in some of their own professors of the past, honouring their names and faces in portrait galleries and lecture halls.

Figure 2: Rembrandt van Rijn: The Anatomy Lesson of Dr. Nicolaes Tulp, 1632 [Courtesy Mauritshuis, The Hague, the Netherlands]



2 The birth of medical education as a domain of scholarly study

While the art of teaching medicine became widely acknowledged over the centuries, the study of medical education, with its focus on methods and effectiveness, independent of individual educators, became a focused domain of study only recently. Its emergence can be considered to have started primarily from the mid-20th century, linked to the development of new approaches to the medical curriculum, with new methods, objectives and content. With the rapid increase of medical schools around the world, from 566 in 1953 to 2,881 in 2018 (Rizwan et al., 2018), the interest in scholarship of medical and, later, health professional education has developed remarkably.

Usually many factors together, operating coincidentally, enable such an emergence of a discipline. Medical education historian Ludmerer rightly qualifies the years around 1920 as the start of modern medical education in the United States (Ludmerer, 1985), shortly after Flexner's famous but critical 1910 Carnegie Report, which forced US schools to either close or modernise (Flexner, 1910), – while less influential in Europe (Custers, 2010). The first issue of the *Journal of Medical Education* appeared in 1920,

but, frankly, the start of medical education development and research as a scholarly endeavour may be better located around 1950, the year that the Western Reserve University established a committee to modernise their medical curriculum, followed by the University of Colorado a few years later, two endeavours that were extensively documented (Hammond et al., 1959; Williams, 1980) and therefore enable to pinpoint the start of a movement. With George Miller, Stephen Abrahamson, Hilliard Jason, Christine McGuire and Howard Barrows at universities in New York, Michigan, Illinois and California, prominent examples of a first generation of medical education scholars emerged, together constituting a new discipline about 70 years ago, when the first distinct units of education research were established in medical schools (Abrahamson, 1991; Miller, 1970). In parallel, in the 1950s, medical education became an external object of study by social scientists, who produced influential psychological and sociological reports of what it means to become a doctor (Becker et al., 1961; Eron, 1955; Merton et al., 1957). Outside the United States, McMaster University in Canada, the University of Dundee in Scotland, and Maastricht University in the Netherlands are among the first institutions with units for scholarship in medical education in other countries.

A few individuals, teachers, researchers or even centres with a specific interest in a particular domain of scientific pursuit may not yet make the field a recognisable scholarly domain. So, the question is, what would be needed to call someone a medical or health professions education (HPE) scholar¹ and to call a community of such individuals *scholarly*? Ajjawi and colleagues found that an environment fostering researcher identity formation, collaborative relationships and protected time for research is likely to make health professions education scholarship thrive (Ajjawi et al., 2018). To create this identity, the scholar should belong to a community with specific characteristics. Scholarly communities may be defined using Ernest Boyer's widely cited four criteria that, together, should determine scholarship: discovery, integration, application and teaching (Boyer, 1990).

Discovery is the production of new ideas and insights, things that are worth knowing, if only to satisfy scientific curiosity. A significant number of scholars should engage in active HPE research and yield research findings that advance the domain to give this criterion weight.

¹Historically, medical education has first developed a scholarly tradition, and is currently transitioning to or being renamed as the broader field of health professions education, as nursing, veterinary medicine, dentistry, pharmacy, and other health professions have become scholarly active, predominantly in the 21st century. With the establishment of a new journal *Advances in Health Sciences Education* in 1995, the labeling of this domain of scholarship began to shift from *medical* toward health sciences or *health professions*. In this paper, both terminologies are being used more or less interchangeably, depending on the context.

Integration is giving meaning to isolated facts and connecting new findings with what is already known, within and across disciplines. Coherence must be established, by relating to or involving social and other sciences and by various research synthesis efforts, if only to avoid wheels being reinvented. A body of accepted knowledge is to be built through integration.

Application relates to the usefulness of findings to solve problems. Scholarship must “*prove its worth not on its own terms but by service [to society]*” (Boyer, 1990, p. 23). It should be visible through improved medical and health professions education curricula in practice, through improved competence of graduates and, ultimately, through better health care.

Teaching, as “*the highest form of understanding*” (Boyer, 1990, p. 23), involves scientific communications and the education of future scholars. While Boyer had students and individual interactions in mind, teaching can also be done through conferences, publication of books, papers, and modern media. Teaching in its broader sense would be characterised by the sufficient and sustained training of next generation scholars and sufficient publications, conferences, associations that would characterise the existence of a true interactive scholarly community.

Glassick (Glassick, 2000) and O’Brien et al. (O’Brien, Irby et al., 2019) have elaborated Boyer’s criteria for individual scholars in health professions education scholarship units, but the criteria may also apply to the scholarly HPE community at large. In this contribution, I will use these criteria to examine the domain of health professions education scholarship in general.

3 Does health professions education qualify as a scholarly domain or discipline?

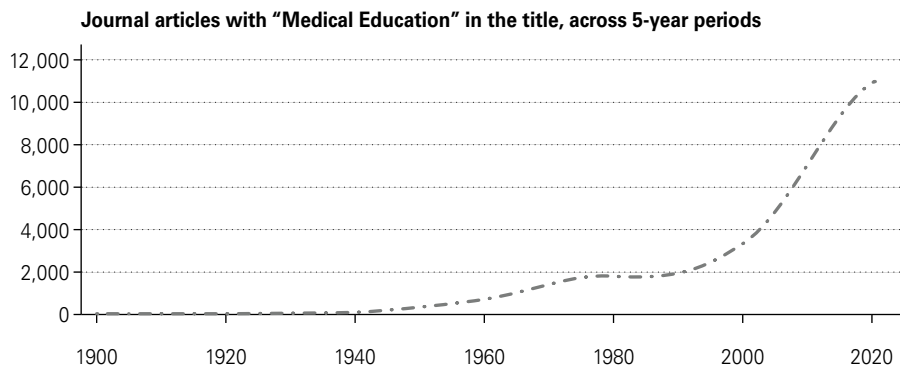
Academic disciplines and subdisciplines are not unequivocally defined. They are usually acknowledged by universities and categorised in faculties, departments and academic courses, sometimes by scientific societies and sometimes by law, when licensing and privileging is restricted. But beyond formal, institutional statements, the dynamics among scholarly individuals, with their interactions and activities, make up what a scholarly community or discipline is. Social Identity Theory posits that for individuals it is important to belong to a group that provides them with identity (Hornsey, 2008). Social identification supports self-esteem and group behaviour (Turner, 1982), as people like to know and take pride in what they are, be able to explain that to others, use it for purposes as seemingly futile as business cards and stationary but also to connect with likeminded others. A defined identity in a scholarly community can also affect promotions in an organisation, and even funding of research. Defining a discipline is not trivial.

3.1 Discovery

To meet the *Discovery* criterion, there must be sufficient researchers who are active discoverers. We do not know how many HPE researchers exactly are active in 2021 worldwide. However, there are some proxy indicators of growth in volume since 1950. If an active researcher would be someone who publishes at least one journal article per year over a sustained period of time, say 10 years, and discovery would be defined as the addition of a fact or insight to the body of knowledge of health professions education, it is worth looking at the number of published papers and their authors at different moments in time.

In 1980, there were three dedicated medical education journals: the *Journal of Medical Education* (now called *Academic Medicine*), *The British Journal of Medical Education* (now called *Medical Education*) and *Medical Teacher*. The oldest one (*Journal of Medical Education*) featured about 450 authors across the year of 1980 (12 issues), including non-researchers but also some who published more than once. In 2020, the estimated number of authors contributing to the 12 issues of this same journal has about tripled. A different proxy of growth is shown in Figure 3, comparable to graphs presented by Jason in 2018 (Jason, 2018). The combined words “medical” and “education” in journal article titles listed on Google Scholar shows a 10-fold increase in less than 50 years. In addition, in those years the number of international peer reviewed medical education journals has steadily grown from 3 to about 35, and about 90 in total predominantly publish on health professional education more broadly (including dedicated education journals in specialty areas such as anatomy, physiology or biochemistry, and other health professions)². If each of these would feature only 100 authors per year and every scholar would produce one scholarly paper per year (both are very conservative estimates), the domain would have close to 100,000 authors. Rotgans estimated in 2010 that 10,000 articles had appeared in the six most common medical education journals in the 12 years prior (Rotgans, 2012). Taking an average number of three authors per paper and multiplying by three for the increased number of current quality journals leads to a similar figure. The quality of the numerous medical education journal articles may not all meet scholarly standards (Albert et al., 2007), but if only 20% would be regarded as truly scholarly, the combined authors would establish a community of at least 20,000 true health professions education scholars. The critical mass for a scholarly community as criterion seems, arguably, amply met.

²A list can be obtained from the author.

Figure 3: Increase of “medical education” in journal article titles

In addition to mass, generally acknowledged advances in the domain should support discovery. If medical education would not be “better” than 70 years ago, then Boyer’s discovery criterion would probably not be met. This criterion is much more difficult to measure or estimate, since there is no measurement instrument to establish whether the 2020 medical graduates are better equipped for clinical practice than in 1950.

Advances and discoveries in educational research often focus on new theories and research methods, rather than evidence-based education advances which stepwise and undeniably show improved education outcomes. New, undisputed facts on which theories and practice can build, such as in physics, chemistry and medicine, are rare (de Landesheere, 1985; Schunk, 2012). Sawyer contends that *“the history of scientific approaches to [general] education is not promising”* and cites the ongoing debate about whether education is a science or an art (Sawyer, 2006, p. 15). Others, however, have established evidence-based principles of learning and instruction (Ambrose et al., 2010; Bransford et al., 2000; Colvin Clark & Mayer, 2016). Different from bio-medical or engineering advances that may be expected to “work” every time new procedures or therapies are applied appropriately, the effects of educational principles are less predictable. Not only do many variables, often not controllable, interfere with outcomes of education, the “system of education” itself is complex and adaptive. A new, “proven” teaching method will, when applied, evoke emotions, motivations and intelligent responses by students. Students, highly motivated to become doctors, will simply do whatever they feel is needed to reach their target, no matter which curricular methods and demands are applied; they are not a black box, or a passive object that can be manipulated, but have a free will to shape their learning pathway to some extent (ten Cate et al., 2011; Teunissen & Westerman, 2011). For instance, excellent

lectures may decrease the students' inclination to self-directed study, to the point that on tests they may perform worse than students who were forced to figure out the complexities of the content matter themselves (ten Cate, 2001). What further complicates educational research is that outcome measures of educational interventions are difficult to determine. While knowledge and skills demonstrated at exams may be considered such outcomes, the true purpose of education, such as in medicine, is effective performance in practice and improved clinical outcomes, which are often determined by biomedical and technical advances, context and teamwork, not just by improved individual skills (Bleakley, 2006; Schumacher et al., 2020).

Despite these difficulties, however, current scholars in HPE would likely agree that many advances have certainly been made and turned into established educational practices in the health care domain. *Discoveries* in medical education are more often new educational or assessment methods, rather than findings supporting generalised theoretical truths. While undisputable evidence of educational innovations with guaranteed success is hard to establish (Regehr, 2010), several changes in medical education, based on credible theory, have had profound influence on medical curricula in the past 50 years and would now be viewed as recommended approaches.

Table 1 shows examples across a 50-year period of findings and educational advances in medicine, *discoveries* if you will, which can be attributed to scholars in the field of health professions education. A limitation is that the table does not do justice to the important scholarly work of many medical educators not associated with single identifiable concepts, findings or innovations. Many other studies have improved medical training, such as applying advanced skills training and advanced assessment techniques, deliberate practice, mastery learning, clinical reasoning tests, instruments to measure clinical learning environments, physical space for education, studies to correlate lapses in professional behaviour with later adverse practice events, studies on theories of workplace learning, motivation, cognitive load in medical education, conditions for interprofessional education, studies on burn-out and depression, and many other innovations that were tried on smaller scale. Still other scholars have helped sharpen the mind by debunking myths about medical education (de Bruin, 2020; Lingard, 2016; Norman, 2018; Paton et al., 2020), or provided major overviews of strengths and weaknesses in medical education, and urged for reform (Cooke et al., 2010; Frenk et al., 2010).

Table 1: Twenty examples of influential innovations and advances in medical education across 50 years of scholarly work

Innovations, concepts and findings	Scholars associated with this innovation	Year of origin/publications
Simulated and standardised patients	Howard Barrows, Stephen Abrahamson	1964 ¹
Objective Structured Clinical Examination	Ronald Harden	1975 ²
Problem-based learning	Howard Barrows, Henk Schmidt	1975 ³
Content or case specificity of clinical expertise	Arthur Elstein, Geoff Norman	1978 ⁴
Progress testing	Cees van der Vleuten	1982 ⁵
Key-feature items to assess clinical competence	Geoff Norman, Georges Bordage, Gordon Page	1984 ⁶
Faculty development in medicine	Kelley Skeff, Yvonne Steinert	1984 ⁷
Clinical teacher knowledge and reasoning	David Irby	1991 ⁸
Longitudinal Integrated Clerkships	Lori Hanson, David Hirsh, Ann Poncelet	1992 ⁹
Hidden curriculum	Frederic Hafferty	1994 ¹⁰
Mini-Clinical Evaluation Exercise	John Norcini	1995 ¹¹
Outcome and competency-based education	Jason Frank, Ronald Harden, Carol Carraccio	1996 ¹²
Teaching and assessing professionalism	Richard and Sylvia Cruess, Brian Hodges	1997 ¹³
Interprofessional education	Scott Reeves, Hugh Barr	1998 ¹⁴
Simulation technology	Barry Issenberg, William C. McGaghie, Amitai Ziv	1999 ¹⁵
Multiple-Mini Interview selection method	Kevin Eva	2004 ¹⁶
Entrustable Professional Activities	Olle ten Cate	2005 ¹⁷
Programmatic Assessment	Cees van der Vleuten, Lambert Schuwirth	2005 ¹⁸
Learner burn-out and depression studies	Tait Shanafelt, Lotte Dyrbye	2005 ¹⁹
Relating education to clinical outcomes	David Asch	2009 ²⁰

¹(Barrows & Abrahamson, 1964), ²(Harden et al., 1975), ³(Barrows & Mitchell, 1975; Barrows & Tamblyn, 1980; Norman & Schmidt, 1992), ⁴(Elstein et al., 1978; Norman et al., 1985), ⁵(Verwijnen et al., 1982), ⁶(Bordage & Page, 2018; Bordage & Page, 1987), ⁷(Skeff et al., 1984; Steinert, 2000), ⁸(Irby et al., 1991), ⁹(Hanson & Talley, 1992; Poncelet & Hirsh, 2016), ¹⁰(Hafferty & Franks, 1994), ¹¹(Norcini et al., 1995), ¹²(Carraccio et al., 2002; Frank & Jabbour, 1996; Harden et al., 1999; McGaghie et al., 1978), ¹³(Cruess & Cruess, 1997; Hodges et al., 2011), ¹⁴(Barr, 1998; Reeves et al., 2013), ¹⁵(Issenberg et al., 1999; Ziv et al., 2000), ¹⁶(Eva et al., 2004), ¹⁷(ten Cate, 2005), ¹⁸(van der Vleuten & Schuwirth, 2005), ¹⁹(Dyrbye et al., 2005), ²⁰(Asch et al., 2009; Asch et al., 2014).

3.2 Integration

Integration pertains to the consolidation of new findings within and across disciplines. Of the exemplary advances shown in Table 1, many had significant impact in a wider community, such as problem-based learning (Loyens et al., 2012). Some advances, such as the introduction of Patient Management Problems for the assessment of clinical reasoning skill (by Christine McGuire and colleagues) were abandoned (Norman, 2011) and replaced by newer methods after research had revealed inadequacies. But Key-Feature items (more or less their successor) (Bordage & Page, 1987) would have

never been introduced without this precursory grounding. This example of consolidation is a testimony of a self-developing scholarly tradition in medical education.

Consolidation has translated in a steady proliferation of dedicated health professions education scholarship units that build a tradition of research (Davis et al., 2005). In the 1980s such units were just few in North America and Europe, but in 2000, North America had 61 units (Albanese et al., 2001) and in 2020, there are countless units in several countries worldwide. The Society of Directors of Medical Education Research currently lists 78 members directing such units. These typically employ scientists, scholarly educators and administrative leaders, involved in research, faculty development (teaching) and service (Varpio, Gruppen, et al., 2017; Varpio, O'Brien, et al., 2017).

Integration also speaks to the cross-fertilisation of different domains of sciences. Health professions scholarship has hugely benefited from the social sciences. Norman has qualified the contributions made by scholars with a non-medical background as made by “immigrants” in the health professions domain, such as psychologists, sociologists, and psychometricians, adapting their skills to serve HPE (Norman, 2011). Only few of these remained outside observers; rather, PhD level social scientists were hired by medical schools, and integrated in their communities in close collaboration with medical and biomedical experts. The number of journal article titles combining “medical”, “education”, and “theory” has exponentially grown in the six decades since 1960 (3→7→11→31→96→195) (Google Scholar). The integration made a further step in what Norman called “third generation” scholars, not immigrants but medically trained, and supplemented with HPE scholarship training in a new, own tradition of dedicated HPE Masters and PhD education, with its pros (being highly specialised without an ivory tower stance) and cons (with limited depth of experience and background in other disciplines) (Norman, 2011). Another important influence regards the methodology of research. HPE research has seen a significant increase of qualitative studies (Kennedy & Lingard, 2006; Thompson-Burdine et al., 2021), reflecting the awareness of the limitations of controlled experiments (Norman, 2003; Regehr, 2010).

Are there limitations of Boyer’s sense of integration with regards to health professions education scholarship? One hallmark of maturation of a professional domain, the establishment of specialised journals, paradoxically shows a hesitation to integrate with other disciplines. Comparatively very little about health professions education is published in journals of the social sciences. HPE scholars may be less inclined to read and publish in these journals, and readers of these journals may be less interested in HPE. The largest community of educational scholars is arguably the American Educational Research Association (AERA), with an annual meeting that brings together 10,000 to 15,000 scholars. HPE scholars are represented in AERA, but interact largely within one division of it, that of *The Professions*, dominated by HPE scholars. On the

other hand, some topics may simply be better represented in the HPE literature than in other educational literature. As an example, van Dijk et al., searching for frameworks of university teaching tasks, identified 46 in an extensive literature review, 18 of which pertained to the medical faculty and 6 to other health professions including nursing, dentistry, pharmacy and midwifery (van Dijk et al., 2020).

To conclude, integration has happened internally, through consolidation of innovations and findings, but integration with other disciplines has been limited.

3.3 Application

In health professions education scholarship, research and development go hand-in-hand. *Application* is a core characteristic. The vast majority of scholars involved in HPE research have roles in education, either as clinicians, as teachers, or both; as course or programme directors or as administrative officers. HPE researchers are very often active teachers, active faculty developers or active curriculum and course developers. Many scholarly HP educators have initially built a career in patient care and developed as scholarly educators only at a later stage as a second career.

The reason why the application criterion of scholarship in HPE may be stronger than in other higher education domains is a clear societal desire for high quality health care. Health care affects everyone, and requires societal trust to operate, a trust that primarily focuses on care providers and their presumed education. The many reports, across several decades, advocating for improvement of medical training led Christakis to conclude in 1995 that they all *“articulate a specifically social vision of the medical profession, in which medical schools are seen as serving society [...] with a remarkable consistency, [...] to better serve the public interest, to address physician workforce needs, to cope with burgeoning medical knowledge, and to increase the emphasis on generalism”*, signalling a repetition of similar recommendations since 1910 (Christakis, 1995, p. 708), conclusions that easily extend to subsequent calls for medical education reforms after 1995 (Cooke et al., 2010; Frenk et al., 2010; Irby et al., 2010).

Health professions education scholarship is an exemplar of an applied science and cannot be viewed as a pure science because of its continuous focus on application. Of all current publications in the major HPE journals, the majority are not research reports, but perspective articles, guidelines, and reviews. They serve to advance education and are highly useful, and show that application is central to the HPE scholarly domain.

3.4 Teaching and scholarly communication

Boyer's fourth criterion of scholarship is *Teaching*, or, interpreted more broadly, the communication of knowledge, insight, and discovery, to the community at large and to junior generations of scholars. Not only the number of journals and publications increased significantly; local, national and international conferences in medical education – virtually non-existent before 1970 – increased rapidly (Table 2).

Table 2: Major international HPE conferences

Conference	Hosted by	attendees*
AMEE conference	Association of Medical Education in Europe	3,808
Ottawa conference	Association of Medical Education in Europe	~1,000
IAMSE conference	International Association of Medical Science Educators	660
APMEC conference	National University of Singapore in international collaboration	1,421
ICME conference	Riphah International University Pakistan in international collaboration	908

*2019; 2018 for biennial Ottawa conference.

The largest international HPE society is the Association of Medical Education in Europe (AMEE). Its annual conference has grown since its inception in 1973 into a global conference with a majority of attendees from outside Europe (Wojtczak, 2013). AMEE offers a variety of other services to foster the quality of medical and health professions education (journals, webinars, certificate courses, resources including guidelines and reviews, awards, prizes and small grants, fellowship member options). Their website lists 37 smaller active national and international societies and associations for medical or health professions education (www.AMEE.org). Many of these also hold annual national or regional conferences, some exceeding international conferences in size.

While the object of educational scholarship includes teaching, teaching new generations of scholars is something different. The first generations of HPE scholars with a medical background have trained themselves in educational methods or spent time to obtain an advanced degree in schools of educational or social sciences. In the 1990s, advanced academic degree programmes began to be offered by units of health professions education scholarship, and serious attention for teacher careers in medical schools emerged (Irby & O'Sullivan, 2018). The establishment of dedicated professorial chairs and associate professor positions in health professions education, providing an alternative career opportunity for clinical and non-clinical faculty members (Alexandraki & Mooradian, 2011), and the establishment of Academies as educational communities within medical schools for early career or distinguished educators (Irby et al., 2004) has further fostered this. Master's and PhD programmes enable this continued professional development in scholarship: The number of master's level programmes

in HPE increased from 7 in 1996 to 76 in 2012 (Tekian & Harris, 2012) and 139 in 2020 (www.faimer.org) and the number of structured doctoral programmes was calculated to be 24 in 2014 (Tekian, 2014) and 26 in 2020 (www.faimer.org). The numbers of students trained in these units also expanded significantly. As an example, the number of active PhD students at Maastricht University's School of Health Professions Education increased in the past decade from 25 to 100 (van Merriënboer, n.d.); expanded international collaborations foster such increases as programmes become less and less confined to one location (University of California San Francisco School of Medicine website). Measured by productivity per medical school, i.e. considering the size of the country, Canada and the Netherlands have shown the highest relative research productivity across the past decade and a half, and often provided senior authorships on journal articles (Table 4). Senior (last) authorships may be interpreted as a sign of international research mentorship (Table 3).

Table 3: Publications during the period of 2006–2019 in four journals according to the country of the first author

	USA	CA	UK	NL	AUS/ NZ	Others	Total
Journal data a-d = total 2006–2011*	1,778	423	603	239	187	555	3,785
Journal data 2012–2019							
a. Medical Education 2012–2019	247	277	215	103	155	128	1,145
b. Academic Medicine 2012–2019	1,732	257	35	62	22	49	2,163
c. Medical Teacher 2012–2019	384	204	286	123	154	317	1,468
d. Adv.Health Sci.Educ. 2012–2019	100	146	54	90	56	105	559
total 2006–2019	4,241	1,307	1,193	617	574	1,154	9,086
Mean per year	302.9	93.4	85.2	44.1	41.0	82.4	649.0
Percentage of total	46.7	14.4	13.1	6.8	6.3	12.7	100.0
Number of medical schools**	197	17	61	8	27	2,571	2,881
Relative Publication Productivity	21.5	76.9	19.6	77.1	21.3	0.4	3.2

*Jaarsma et al., 2013.

**WFME/Faimer World Directory of Medical Schools, 2018; Rizwan et al., 2018.

Table 4: First and last authors of publications during 2006–2011 according to nationality

	USA	CA	UK	NL	AUS/ NZ	Other
Publications with first author from this country	4,241	1,307	1,193	617	574	1,154
Publications with last author from this country	2,182	808	505	423	328	485
Relative difference	0.51	0.62	0.42	0.69	0.57	0.42

In some countries, such as the Netherlands, professorial chairs include the formal right and expectation to supervise doctoral students in their domain of expertise, individually or in structured programmes. In health professions education, the increase of such chairs has had a catalytic effect of increased numbers of PhD students in HPE, which, combined with government funding of university research based on PhD graduations, may explain the prolific production of health professions education research in the Netherlands (Jaarsma et al., 2013).

Boyer's *teaching* criterion, no doubt, has been met, not only locally, but also at the international level.

4 Conclusion and outlook

The analysis of the development and current status of health professional education scholarship would undeniably qualify it as meeting all of Ernest Boyer's criteria of mature scholarly discipline. HPE scholarly units can become academic departments and a relevant question is then, where in universities such departments or units belong (Varpio, Gruppen, et al., 2017). Rather than in faculties or departments of social or educational sciences, schools in the health professions have established and hosted such units and should host them. Being situated at close vicinity to the practice of health care seems to have been a critical condition for these units to flourish, combined with the insights of the social sciences (Schmidt & Mamede, 2020). HPE research should be best conducted by scholars with a mindset to approach what it is to *think, act and feel* like a physician, nurse or other health professional, in other words to possess, or at least sympathise, with professional identities in health care (Cruess et al., 2014).

The growth of health professions education scholarship activities and interest since the mid-20th century (journals, publications, conferences, HPE research and development centers, scholars) has out-paced similar developments in other higher education domains. In other traditional university faculties, such as Science, Law, Humanities, Social Science, Economics, domain specific educational scholarship hardly exists. They may have a "journal of X education" but usually not a scholarly community. As an example, in a recent elaborate article on the cognitive challenges of teaching in the *Journal of Economic Education*, not one of the 126 citations referred to an economic education source, not even to a paper in the journal itself (Chew & Cerbin, 2021). While mathematics education and teacher education have journals and scholarly communities, their focus is not primarily on the education of mathematicians and educational scientists but on primary and secondary education. One may wonder why the education of medical doctors and other health professionals has proven such a fertile soil for scholarship. Likely, it is the need for a well-trained health care workforce with

extensive knowledge and skills that is virtually undisputed among members of any society. This visibility of health professionals with their societal impact, professional esteem, and clarity of occupations, now combined with insights from educational theory and research methodology that lacked 70 years ago, may have established the ground for this domain-specific educational scholarship.

Speculating what HPE scholarship will look like in the future must take the expected developments of the object of this scholarship into account. Healthcare will definitely change, not only because of scientific and technological advances, but also because of demographic and epidemiologic changes (Wachter, 2015; Woolliscroft, 2020). Demographics, artificial intelligence, genomics, regenerative medicine, and precision medicine have been called disruptors of current healthcare (Woolliscroft, 2020). The recent disruption by the Covid-19 pandemic has stirred further thinking about the future of health care and education, e.g. to include tele-healthcare provision, bringing new demands for training and assessment (Wijesooriya et al., 2020). A recent international survey among 51 health professions thought leaders revealed significant upcoming developments, in competency-based, time variable education; in simulation; in methods and criteria for selection for undergraduate and postgraduate education; increased global collaboration and exchange; more focus on skills in prevention, and interprofessional, team-based and community-based care and on a changing relationship with patients (O'Brien, Forrest et al., 2019). The continuous super-specialisation and fragmentation of the medical domain poses threats to education that must be dealt with. Calls for more integrated, coherent, holistic, systematic approaches to biology, health care and its education can be found in the literature.

While these will all affect the work of health professions education scholars, HPE scholarship in itself will likely continue to show quantitative and qualitative development. In their analysis of the future of medical education, Bleakley et al. (Bleakley et al., 2011, p. 222–225) elaborate a five-point agenda for improvement of medical education research (slightly amended): (1) a focus on conceptual questions and clarifications and deciding on what counts as evidence, (2) building programmes of systematic research rather than conducting just opportunistic studies, (3) more rigorous outcome-based research, (4) building better expertise in combined qualitative and quantitative (mixed methods) research and (5) creating a productive dialogue between the academic and clinical communities. The quality of research is increasing, if measured by the number of knowledge syntheses, methodology guidelines and theory papers that have appeared in the past decades. While review studies have exploded in medical education (Maggio et al., 2021), rigorous replication studies, rather than reinventing wheels, appear infrequently, as is the case in biomedical sciences (Ioannidis, 2017). Bleakley's recommendations remain valuable and may be supplemented with a stronger faculty development focus to breed future generations of scholars.

Asclepius would be surprised to know how his symbols of snake and rod as well as the obligation to teach in Hippocrates' oath have led to a lively community of scholarly educators several millennia later. The common pursuit, then and now, for the best qualified health professionals has not changed. While researchers and scholars develop visions suggesting that the ultimate goal of a competent health care workforce may be attainable and fuel the continued innovation in medical education, it may be the *pathway* rather than an attainable endpoint that characterises scholarship. While "the competent health professional", molded by optimal education, may seem a Holy Grail, the quest for it is served by scholarship according to Boyer's criteria. The pathway shows ups and downs (Touchie & ten Cate, 2016), and the interest of schools, hospitals and regulatory bodies in this competent workforce, has led, in the words of Woolliscroft, to "unintended consequences" of financing, efficiency, and legal constraints (Woolliscroft, 2020). Scholars are needed to discern these consequences and recommend routes to overcome them. This amalgam of dynamics is bound to keep challenging future scholars to create and test ongoing innovations in health professions education, to the benefit of learners, teachers, clinicians, patients and society.

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