

# **Theory and Practice in the Design and Conduct of Graduate Medical Education**

Brian David Hodges, MD, PhD, FRCPC and Ayelet Kuper MD, DPhil, FRCPC

Brian David Hodges is Professor in the Department of Psychiatry, Faculty of Medicine and the Department of Theory and Policy Studies, Ontario Institute for Studies in Education, University of Toronto; Director, Scientist and Richard and Elizabeth Currie Chair in Health Professions Education Research, Wilson Centre for Research in Education, University Health Network/University of Toronto; and Vice-President Education, University Health Network, all in Toronto, Canada.

Ayelet Kuper is Assistant Professor in the Department of Medicine, Faculty of Medicine, University of Toronto; Scientist, Wilson Centre for Research in Education, University Health Network/University of Toronto; and Staff Physician, Division of General Internal Medicine, Sunnybrook Health Sciences Centre, all in Toronto, Canada.

Corresponding Author: Brian David Hodges, 190 Elizabeth Street, R. Fraser Elliott 1-410, Toronto, Ontario M5G 2C4, Canada.

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## **Abstract**

Medical education practice is more often the result of tradition, ritual, culture, and history rather than of any easily expressed theoretical or conceptual framework. This paper explains the role of theory in the design and conduct of graduate medical education.

The authors outline three groups of theories relevant to graduate medical education: bioscience theories, learning theories, and sociocultural theories:

Bioscience theories are familiar to many medical educators but are often misperceived as truths rather than theories. Theories from such disciplines as neuroscience, kinesiology and cognitive psychology offer insights into areas such as memory formation, motor-skills acquisition, diagnostic decision-making and instructional design.

Learning theories, primarily emerging from psychology and education, are also popular within medical education. Although widely employed, not all learning theories have robust evidence bases. Nonetheless, many important notions within medical education are derived from learning theories, including self-monitoring, legitimate peripheral participation, and simulation design enabling sustained deliberate practice.

Sociocultural theories, which are common in the wider education literature but have been largely overlooked within medical education, are inherently concerned with contexts and systems and provide lenses that selectively highlight different aspects of medical education. They challenge educators to reconceptualize the goals of medical education, to illuminate maladaptive processes, and to untangle problems such as career choice, interprofessional communication and the hidden curriculum.

Theories make visible existing problems and enable educators to ask new and important questions. The authors encourage medical educators to be more reflective about the theories that guide their educational practices.

# **Theory and Practice in the Design and Conduct of Graduate Medical Education**

Theories provide complex and comprehensive conceptual understandings of things that cannot be pinned down: how societies work, how organizations operate, why people interact in certain ways. Reeves et al., 2009 (p. 631)<sup>1</sup>

## **What Is Theory?**

Theory is like gravity: profoundly linked to our experience of life, but also more conceptual than material and therefore largely invisible. Gravity has been present throughout human existence, but it was not until Newton described gravitational *theory* that humans had a conceptual language to discuss its nature and use. Gravity was, of course, used in practice long before it was formulated in theoretical terms. However, only with the advent of scientific theory could an in-depth understanding of gravity be harnessed for research and development.

Theories of many kinds play a role in medical education and practice. Yet, as with gravity prior to Newton, practice in medical education is more often the result of tradition, ritual, culture, and history rather than any easily articulable theoretical or conceptual framework. Practices are reproduced and passed down without being anchored to theories that explain why certain approaches lead to effective education. The rise of formal studies in medical education, with burgeoning research, journals, and international conferences, raises new questions about the relationship between theory and practice.

In medical education, as in other scientific fields, there is the promise of improving practice by basing it on theory and evidence. Bordage has argued that all research and development in medical education should be based on a theoretical framework.<sup>2</sup> However, there is a risk of

developing an artificial split between theory and practice—relegating the former to ivory tower theoreticians and the latter to in-the-trenches practitioners. Albert and colleagues argue that knowledge generation based on theory can serve both researchers and practitioners but that the nature and control of that investigation, its funding, format and dissemination, differ depending on the intended audience.<sup>3</sup> Stokes, in *Pasteur's Quadrant*, suggests that research should emphasize both the development of theory and the use of new knowledge to improve practice.<sup>4</sup> Pasteur's own research simultaneously led to the development of germ theory and to the means to pasteurize milk. It is in this spirit that we write our paper: to explore the relationship between theory and practice in a way that advances both theoretical understanding and the effectiveness of practice for an audience of educators (including clinical teachers, administrators and researchers) interested in graduate medical education. To accomplish this aim, greater attention must be paid to the theoretical literacy of medical educators so they can articulate continuously the link between theory and practice.

Many terms could be used to frame this discussion; in the first few paragraphs we have employed several of them. Terms such as *theory*, *conceptual framework*, *epistemology*, and *paradigm* have different but related meanings, as do the words *practice* and *praxis*. However, we have left aside discussion of these terms' nuanced meanings and deliberately lumped them together to improve accessibility for the non-specialist reader. We have used theory to represent what Reeves and colleagues have called a “complex and comprehensive conceptual understanding” of how things work.<sup>1</sup> Similarly, we use have used *practice* to represent *doing*—teaching, learning, creating, interacting, leading, governing, and all the other activities that

collectively make up education. The interested reader can find a more detailed glossary of these terms in one of our previous publications.<sup>5</sup>

### **What Kinds of Theory Are Useful to Graduate Medical Education?**

Far from being ivory tower concepts debated by armchair theorists at great remove from ‘real’ clinical and educational settings...theories are very useful ways to analyse the nature of medical schools and the roles people play within them, in the service of imagining and enacting anything from a minor change to a radical reform.

Kuper and Hodges, 2010 (p. 39)<sup>6</sup>

There are hundreds of theories. They range from local to global, from small scale to large. There are grand theories and circumscribed theories, theories tied to disciplines (economics, sociology, biology, physics), to approaches (critical theory) and to schools or movements (psychoanalysis , Marxism). There are popular theories, discredited theories, over-applied theories and little-known theories. In preparation for this paper, we reviewed the literature on theories of medical education. Searching appropriate databases with the terms “theory” and “medical education” yielded diverse abstracts illustrating the enormous breadth of the existing literature. Approaching theory in this way, however, would be daunting for a medical educator. Consequently, in this paper we have presented a few broad groups of theories that are useful to discussions of graduate medical education.

For the purposes of this paper we have classified theories into three large groups: bioscience theories, learning theories, and sociocultural theories. Table 1 presents a list of theories, clustered into groupings, and provides comments about their application to graduate medical education. In the bioscience cluster, theories arising directly from neuroscience, kinesiology, and even genetics

have relevance for medical education because of their focus on how the human brain learns. At the other end of the spectrum, sociocultural theories from sociology, anthropology, economics, and other disciplines provide useful perspectives on why we have medical schools at all and how they function vis-à-vis the larger societies in which they operate. Our divisions between these clusters are not sharp; clustering theories at all is simply a shorthand way of helping readers understand differences in their history and nature. For example, while we have located cognitive psychology within the biosciences, it is commonly used as a foundation for many learning theories. Other areas of psychology, such as social psychology, draw on broad social perspectives and thus could be classified under sociocultural theory. Our groupings are simply a means of organizing a very large range of theories for the purpose of approaching a daunting body of literature, not a coherent conceptual framework of their own.

## **Bioscience Theories: Powerful, Often Taken for Granted**

Theories arising from bioscience are the most familiar to medical educators because medicine itself has long given priority to biomedical models of practice and research. Bioscience theories—theories arising in disciplines focused on the biological substrate of life (e.g., biochemistry, genetics, neuroscience)—are so familiar that it is easy to forget that they are theories, not truths. It is often only when one long-held understanding is displaced by another that the theoretical, and therefore tentative, nature of bioscience theories becomes visible. Famous examples of this include the shift in the accepted etiology of gastric ulcer disease from stress to bacteria, the rejection of the notion of parenting style causing schizophrenia in favour of the dopaminergic hypothesis, and the discredited aluminum theory of Alzheimer's disease. A great majority of the developments in medicine that we believe to be true are actually based on

theoretical assumptions and imperfect evidence that may be swept away by new research leading to more explanatory theories.

Because bioscience approaches are so dominant in medicine, they are not often articulated as theory *per se*. The pervasiveness of such “theories” can lead to the impression that no particular theory is being used. Thus physicians and medical educators sometimes have difficulty identifying the nature of theory itself.<sup>7</sup> The social sciences have a stronger tradition of explicitly articulating what theory is, debating which theories are relevant to which contexts and questions, and studying the history and evolution of theory itself. Social scientists therefore have more experience in thinking about the role and utility of different theories. However, by also thinking about the theoretical basis of bioscientific knowledge, we can gain a deeper understanding of the utility of theory for medical education.

### **Bioscience Theories and Medical Education**

...there have been numerous books, journal articles, policy studies, and stories in the media about how our emerging understanding of brain development and neural function could revolutionize educational practice.

Bruer, 1996 (p. 4)<sup>8</sup>

Fundamental bioscience theories arising from domains such as biomolecular medicine and genetics may initially appear to offer little to medical education. However, it is striking how often the concept of genetic determinism is applied to discussions about medical school and residency admissions, wherein endless debates occur about attributes appropriate for medical education and practice. These arguments are sometimes based on notions of fixed, inherent, and



presumably genetic human characteristics. A study by Garfinkel and colleagues, for example, rooted in the presumed existence of biologically determined personality traits, looked at the relationship within a group of psychiatrists between their level of sociopathy (as measured by the Minnesota Multiphasic Personality Inventory) and their later sexual abuse of patients.<sup>9</sup> They found that, although certain traits may be associated with unprofessional behavior, the influence of context was so strong that trying to base decisions on predetermined traits risked unethical practices. Whereas links between personality and later behavior can be shown in many domains and although genetic determinants of human behaviors undoubtedly exist, environmental contexts shape behaviors to such an extent that genetic contributions alone cannot be isolated. Thus, although biological, genetic, and other deterministic theories have relevance to complex behaviors, their tacit use in the admissions process belies the importance of context; they are probably, for the moment, a bridge too far to be useful for medical education.

Neuroscience, by contrast, offers useful theoretical notions for education. LeBlanc, for example, looks at how activation of the hypothalamic–pituitary axis during stress significantly affects everything from drug dose calculations to decision making and collaboration in simulated learning environments.<sup>10</sup> Here, concepts from neurophysiological theory have propelled a program of research with implications for medical education ranging from the effectiveness of learning in a simulated environment to understanding how clinicians interpret a complex situation as either a threat or a challenge.<sup>11</sup> Similarly, emerging neuroscience theory about attention and memory formation has contributed important understanding of how students work with, represent, and retain information during learning. Recent research, for example, has cast

doubt on multitasking, something almost ubiquitous in clinical settings, being adaptive in relation to memory formation.<sup>12,13</sup>

A third area in which bioscience theory has been applied to medical education arises from kinesiology. Research by Carnahan and colleagues,<sup>14, 15</sup> for example, draws on theories of motor control to understand motor learning in technical skills. Theories from basic motor learning have been used to inform the design of regimens for acquiring technical skills. For example, Fitts and Posner's model of automaticity and skill expertise has long dominated the literature of surgical education.<sup>16</sup> Ericksson and colleagues' notion of deliberate practice and expertise has served as the basis for the development of simulation programs and of competency-based curricula<sup>17</sup>; more recently Guadagnoli and Lee's challenge point framework has influenced thinking about model fidelity in simulated settings increasing in tandem with growing expertise.<sup>18</sup>

Since the 1950s, many psychologists and psychometricians have joined the ranks of medical schools. From early on these researchers engaged in significant advocacy to legitimize their expertise and their importance to medical education.<sup>19</sup> Perhaps as a result, psychological theories have arguably had, the most dominant presence of all bioscientific theories in medical education. For example, there is a long history of studying cognitive decision-making, including how knowledge is structured for learning, recalled later, and employed in practice. Research programs such as those of Patel and colleagues,<sup>20</sup> Norman and colleagues,<sup>21, 22</sup> Schmidt and colleagues,<sup>23</sup> and many others build on cognitive psychological theories and have widely influenced the design of medical education and the choice of pedagogical approaches – one famous example being the published debate between Colliver and Norman about the theoretical basis (or lack thereof) for

problem-based learning.<sup>24, 25</sup> Theories from cognitive psychology continue to offer important foundations for the design of educational courses, programs, and tools. For example, Gruppen summarized the implications of cognitive theory for ambulatory care education, underscoring the importance of context in learning, the need for students to have “transferable knowledge” to function in ambulatory settings, the importance of balancing depth and breadth of knowledge, and the role of prior knowledge in diagnostic decision making and problem solving.<sup>26</sup>

The emergence of multimedia technologies has led to the growth of new theoretical research in a branch of cognitive psychology that studies conceptual models of learning. For example, the cognitive theory of multimedia learning posits that people learn differently from words and from pictures based on having separate channels for processing them. Because the capacity to process information in working memory is limited, meaningful learning requires appropriate cognitive processing that includes both textual and visual images. Mayer provides nine evidence-based approaches to guide the design of multimedia learning materials and resources in line with this theory.<sup>27</sup> At a time when graduate medical education is enthusiastically embracing myriad Web-based approaches, including e-learning, social media, and hand-held devices, it is particularly important to ensure that the use of these tools is grounded in theory and not simply driven by enthusiasm (or marketing pressure) for new technologies and gadgets. van Merrieenboer<sup>28</sup> is one of several authors<sup>29, 30</sup> who use cognitive load theory to understand how to design educational programs and materials, in particular those using multimedia and simulation. He developed guidelines for instructional design based on this theoretical model of human cognitive architecture that implies that learners cannot attend to too many sources of stimuli at one time and that the goal of education (particularly simulation training) is to automate some cognitive

and motor processes to increase learners' available attention and therefore cognitive and motor ability.<sup>28</sup> Dubrowski has applied the theory of cognitive load to problems in simulation-based training of technical and other skills.<sup>31</sup>

Although debates about the effectiveness of various modes of learning are rarely couched in biological terms, the effectiveness of various kinds of media (including social media), classroom approaches and testing methodologies can be approached through the lens of bioscience, building on theories about how the brain functions. While it is certain that many new technologies will be implemented in graduate medical education, Carnahan and colleagues have underscored the importance of asking theory-driven questions about the utility of new approaches and testing new educational models experimentally, rather than simply evaluating their practical use in the same population to which findings will be applied.<sup>32</sup>

## **Learning Theories: Common, Useful, Variable Evidence Base**

Clinical effectiveness and efficiency in medicine for patient benefit should be grounded in the quality of medical education. In turn, the quality of medical education should be informed by contemporary learning theory that offers high explanatory, exploratory and predictive power.  
Bleakley, 2010 (p. 849)<sup>33</sup>

Learning theories are popular and useful for medical education generally and for graduate medical education specifically. Such theories emerge from a range of different disciplinary traditions, primarily psychology and education. Mann has recently published a helpful overview of learning theories commonly applied to medical education.<sup>34</sup> Her review focuses on learning

theories in five categories: behaviorist, cognitivist, humanist, social, and constructivist. We recommend Mann's classification to those interested in further in this area.

Although learning theories are widely employed, their evidence base is not equally robust. Some appear to operate more as metaphors about learning than as true theories. Norman has sharply critiqued one of the most commonly cited learning theories of all: adult learning theory:

Adult learning theory, first described by Malcolm Knowles in the early 1970s, is based on a number of apparently self-evident axioms about how adults learn. The fundamental assumptions remain largely untested, and a critical analysis suggests that they may be largely a product of the environment in which adults find themselves rather than of any innate differences between adults and children [...] Uncritical reliance on the principles of adult learning may have detrimental consequences, particularly in the domain of maintenance of competence.<sup>35(p 886)</sup>

Eva and Regehr,<sup>36</sup> among others, compare several different theories in an effort to understand why self-assessment and self-direction—the central constructs at the heart of adult learning theory—are problematic in many studies. Simply put, self-assessment and self-direction appear not to be evidence-based constructs. By contrast, notions such as self-monitoring<sup>37</sup> and directed, self-guided learning<sup>38</sup> rest on a stronger theoretical base and therefore have greater promise for the design and assessment of graduate medical education. The nature and function of the related notion of feedback, another ubiquitous but under-theorized construct in medical education, has also begun to be explored. For example, theory-based research has shown robust differences related to the timing of the provision of feedback and its variable effects on learning.<sup>39</sup>

In her review, Mann argues that too much attention has been focused on learners as individuals, noting that the most robust learning approaches are based on theories that view learning as “intimately tied to context and occurring through participation and active engagement in the

activities of a community.”<sup>34(p60)</sup> She highlights social cognitive theory and situated learning theory as strong bases on which to design medical education. Within these theories, the notion of legitimate peripheral participation provides a way of understanding how learners move from the periphery of a practice community (as observers of professional activity) to more central participation and responsibility. These theoretical perspectives direct attention away from the assessment of decontextualized individual traits and toward analyzing learner behaviors and participation in practice settings. The emphasis is on collective learning, not only in groups or teams but also by whole institutions. Weaving together the outcomes of educational programs with those of healthcare institutions requires measures well beyond the assessment of knowledge on written tests or of skills on an objective structured clinical examination. Rather, the important indicators of learning at an institutional level are patient outcomes and other systems-level indicators. For graduate medical education, the implication is that teaching and assessing students based on lists of decontextualized skills and areas of knowledge are less important than focusing on resident learning and the evolution of resident competence in actual practice settings. For example, the work of Kennedy and colleagues on progressive independence uses several different theories to explore another crucial but generally taken-for-granted aspect of learning in healthcare institutions.<sup>40</sup>

Similarly, Kneebone has marshaled learning theory to purposefully design simulation-based learning in technical domains.<sup>41</sup> Kneebone argues, on the basis of theoretical research, that simulations should allow for sustained, deliberate practice in a safe environment, that recently acquired skills must be consolidated within a defined curriculum that includes regular reinforcement, that simulations should include access to expert tutors, and that simulations

should map onto real-life clinical experience. The implication is that simulation in graduate medical education should be neither an add-on nor an entirely self-directed activity, but must rather be thoughtfully and systematically embedded in the design of both learning and practice. The lack of a theoretically informed approach to most simulation training may help to explain emerging findings of failure to learn in simulated environments.<sup>42</sup>

## **Sociocultural Theories: Underutilized, Complex, Valuable**

Social science theories can be used to explore how particular modes of medical education are constructed, examine unexplored assumptions about their nature and function, and make visible implications and adverse effects of the way they have come to be.

Kuper and Hodges, 2010 (p. 39)<sup>6</sup>

Many medical educators today are making good use of learning theories to provide context for their research and to recommend educational program design. However, in another paper reviewing the use of theory in continuing medical education, Mann asked a challenging question: How much has educational theory helped us?<sup>43</sup> She argues that the answer is mixed; in some instances theory has indeed been helpful to inform educational practice. At the same time, a great deal of theoretical work has been difficult to apply or has proved to be of questionable validity (as with adult learning theory). She notes that “an emerging area of theory that may hold great opportunity for practitioners...comes from anthropology and sociology and the study of sociocultural learning.”<sup>43(pS28)</sup> Similarly, Bleakley argues that a mismatch exists between the broad range of theories offered in the wider education literature and the relatively narrow range of theories privileged in medical education.<sup>44</sup> He suggests, like Mann, that currently dominant learning theories are limited in that they address how *individuals* learn, yet fail to explain how

learning occurs in “dynamic, complex and unstable systems such as fluid clinical teams.”<sup>44</sup>(p150)

We agree with Mann’s and Bleakley’s assessments and suggest that it is important for postgraduate medicine to look to sociocultural theories, which by their nature are concerned with context and systems.

Sociocultural theories have been, until recently, largely unknown to medical educators.

Researchers outside medicine have sometimes studied medical education within this paradigm; this phenomenon produced, for example, classic medical sociology texts about acculturation in medical school by eminent sociologists like Becker and colleagues<sup>45</sup> (*Boys in White*) and Merton and colleagues<sup>46</sup> (*The Student-Physician*) who were not themselves engaged in medical education. Medical educators themselves, however, have rarely known enough about sociocultural theories to enable their application to the development of medical education. This is now changing as sociologists, anthropologists, political economists, and others with expertise in the social sciences and humanities are entering the field of medical education research, bringing with them a wide variety of perspectives, approaches, and theories from their home disciplines.

At first glance such theories and perspectives, which often address large-scale societal questions, may appear vague and distant from the practical concerns of clinical teachers. However, sociocultural theories can be intensely practical. They can provide lenses that selectively highlight different aspects of medical education, allowing each to be addressed in turn. For example, some theories call attention to structural issues, enabling a close examination of the positive and negative effects of legislative or policy contexts and constraints on medical education. Others hone in on social relations between and within groups, exposing to scrutiny the



cultural, social, or interpersonal aspects of medical education. Many such theories are *critical*, which means that they highlight the effects of power, bringing attention to inequities that might otherwise go unnoticed. Sociocultural theories make certain previously invisible things visible; newly visible problems can then be studied and newly visible solutions can be implemented.

Sociocultural theories can, in this way, eventually lead to a wholesale reimagining of medical education. In *Medical Education for the Future*, for example, Bleakley and colleagues use several critical theories to argue that medical education as a practice must be reoriented toward a patient-focused, democratic future.<sup>47</sup> They contend that the staunchly individualistic *hero-doctor* is no longer the professional ideal, but rather that the purpose of medical education is to develop medical professionals who can participate in dispersed social networks that form and reform to accomplish clearly defined healthcare tasks. They describe how modernist, sterile, and sequestered classrooms should be replaced by flexible, human-scale spaces embedded in the complex messiness of real-world healthcare. Further, they suggest that the artificial separations of classroom and clinic and of simulated and real experiences should be dissolved. The implications for graduate medical education are significant. Although new competency frameworks in the United States and Canada emphasize roles beyond medical expertise, Bleakley's analysis suggests that such competencies as collaboration, communication, advocacy, and systems-based practice should be embedded in real workplaces and not sequestered in academic half-days and classroom learning environments. Furthermore, learning about these dimensions of competence makes visible such entities as social networks, team dynamics, and the changing role of doctors and other health professionals in society. Bleakley highlights the

particular utility of such theories as actor network theory and cultural-historical activity theory and how these approaches can be used to reconceptualize the goals of medical education.<sup>47</sup>

Sociocultural theory can also be used to ask very pragmatic questions about medical education.

For example, feminist and antiracist theories, which make visible inequities due to gender, religion, race, and/or sexual orientation, have a great deal to offer for understanding and addressing one of graduate medical education's biggest problems: the hidden curriculum.<sup>48-50</sup>

While a student can be prepared for excellent communication, collaboration, empathy, and patient-centered attitudes through years of formal training, just a few minutes in a work environment that does not model these behaviors will rapidly lead to their extinction. We may teach residents to respect other health professionals in a simplistic way, but if they are never exposed to thinking about the power disparities, hierarchy, and boundary struggles that exist between professions they will have no way of interpreting, much less ameliorating, these dynamics in the workplace.<sup>51</sup> Thus, using sociocultural theories to decode toxic learning environments (something often unearthed during accreditation processes) can illuminate maladaptive practices and the hidden curriculum.

The perspectives of certain iconic sociocultural theorists also make it possible to untangle specific problems faced in graduate medical education. For example, Bourdieu's social capital theory could be used to better understand the differences and competitiveness of medical schools and residency programs in terms of attractiveness to applicants, reputation, and admission rates.<sup>52</sup> Neo-Marxist theories, which focus on capital and class structures, could be used to understand connections among remuneration, practice patterns, and—of great concern to

postgraduate education—career choice.<sup>53</sup> Foucault's theory of discourse and his notion of normalization bring to light (and thus allow to be addressed) the constraints on what is possible to say, think, and be as a student or teacher in educational and healthcare institutions. For example, a Foucauldian perspective has been used to study how power operates in objective structured clinical examinations, where pseudo-empathy can emerge,<sup>54</sup> and to grapple with the implications of using physicians as opposed to standardized patients as examiners.<sup>55</sup>

At the level of social relations, Bakhtin's theories of language and his notion of utterance,<sup>56</sup> and Smith's theorizing of the inter-subjective creation of meaning,<sup>57</sup> offer approaches to understanding and teaching interpersonal communication, including communication within patient-physician and/or trainee-consultant dyads. These sociocultural theories can help us understand why training in interprofessional communication and team-based collaboration, for example, frequently fails. While pragmatic communication skills or collaboration skills may be learned, if the forces of professional hierarchy, power differentials, and identity are ignored the skills may never be employed, or worse, the very opposite of the intended pedagogy may be conveyed as a hidden curriculum.

## **Putting Theory to Work in Graduate Medical Education**

Theory can help people move beyond individual insights gained from their professional lives to a situation where they can understand the wider significance and applicability of these phenomena. Good theory based research is immediate, insightful, and applicable in practice.

Reeves et al., 2008 (p. 634)<sup>1</sup>

There is nothing so practical as a good theory.

Lewin, 1951<sup>58</sup>

Theories enable educators to make visible existing problems and to ask new and important questions, both of which can inform everyday practice. In this light, the dichotomy between academic/theoretical knowledge and applied/practical work is artificial. Knowledge and practice are not separate. Indeed, practice is impossible without some kind of conceptual framework and working with theory is as much about becoming aware of the assumptions that animate our choices and behaviors as it is about a deliberate search for new theories to apply. It is said that in psychotherapy, patients treated by therapists with a theoretical understanding of their problem have better recovery rates. Interestingly, it may be less important *which* theoretical model the therapist holds than that s/he does hold one.<sup>59</sup> It seems probable that simply holding a theoretical framework is helpful for educators as well, since having a theoretical framework allows for a reasoned choice of action that can be justified to oneself and discussed with others. Rees and Monrouxe quote Leonardo da Vinci as saying “He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast.”<sup>60(p334)</sup>

Just as medical educators encourage medical trainees to be reflective about their actions and the reasons for them, we encourage medical educators to be more reflective about the theories that guide their educational practices. A medical educator who feels strongly about a particular approach to learning and teaching (e.g., a pedagogical method, assessment framework, or model of student development) should think about what theoretical notions underlie his/her beliefs and behaviors, whether a particular theoretical framework could be used to better articulate those beliefs and behaviors, and to what degree others have examined the value of that particular theoretical perspective.

Sometimes theoretical perspectives can be in tension.<sup>61</sup> However, the goal of medical educators should not be to choose one *best* theory above all others. Our belief is that medical educators should avoid paradigm wars and disciplinary sniping. Successful examples of theoretical harmony already exist in the literature of medical education. For example, a recent national consensus process led by one of us (BDH) identified, classified, and illustrated a range of theoretical perspectives on the much-debated construct of professionalism. The goal was not to reduce down the multitude of perspectives on professionalism to a simple consensus but rather to illustrate the plurality of ways in which the construct can be understood, taught, assessed, and researched.<sup>62</sup> Addressing professionalism at the individual level calls upon theories related to personality or cognitive attributes. Social interactionist theories inform the structure of teaching and role modeling related to the interpersonal dimensions of professionalism. Finally sociocultural theories can explain the political and economic drivers of institutional behavior and culture and how behaviors are shaped by hidden curricula, thereby using a sociocultural framework to teach about professionalism. Kennedy and colleagues used a similar approach to compare and contrast what theories from counseling psychology, cognitive psychology, kinesiology, and sociology offer to improve our understanding of the phenomenon of progressive independence in clinical training.<sup>40</sup>

Sociocultural theory is particularly applicable to graduate medical education because it is deeply embedded in workplace settings. In his book *The Profession of Medicine*, Eliott Friedson argued decades ago that physician behavior is far more influenced by the nature of the workplace than by anything doctors learn as students.<sup>63</sup> Recent calls for medical education reform, including the

Carnegie Foundation's post-Flexnerian *Educating Physicians*,<sup>64</sup> the American Medical Association's *Initiative to Transform Medical Education*,<sup>65</sup> and the Association of Faculties of Medicine of Canada's *Future of Medical Education in Canada* project,<sup>66</sup> all demand greater attention to learning contexts, workplaces, and the roles of physicians in the societies to which they are accountable. Thus, while bioscience and learning theories will continue to be very important in medical education research and practice, underutilized sociocultural theories, with explanatory power at the level of the environments in which medicine is learned and practiced, may be particularly informative in responding to these calls for reform and redesign of postgraduate medical education.

To illustrate links between theory and practice, we have taken three familiar graduate medical education objectives (learning technical/clinical skills; learning team collaboration; gaining progressive independence) and contrasted practices that are *aligned* or *not aligned* with the bioscience theories, learning theories, and sociocultural theories presented in this paper (Table 2). For each we have provided a reference used in this paper. These references were chosen, not because they specifically address the practice elements included in the table, but because they describe or utilize a theoretical perspective that would be consistent with engaging with or understanding each particular practice. Our goal in providing these elements is twofold: to illustrate the range of bioscience theories, learning theories, and sociocultural theories that can be brought to bear on practical problems, and to illustrate how authors have used theory to understand or evaluate similar, if not precisely the same, practices.

## How Does a Medical Educator Learn to Use Theory?

*Medical education journals, once content to publish descriptions of innovative pedagogical methods or simple quantitative studies, are now turning to deeper theoretical questions including ontological and epistemological inquiries into the nature of health professional education.*

Hodges, 2005<sup>61(p613)</sup>

Theory, by its nature, is conceptual and explanatory and therefore built on layers and layers of scholarly work, research, writing, and debate. Theories are dynamic, evolving, and always at risk of being disproven. Engaging with theory, understanding its conceptual dimensions, and mastering the intellectual basis of its fundamental concepts is not an easy task. Certainly, doctoral education requires engaging theory through in-depth study and is one way of learning to think, write and work with theory. Medical education journals, conferences, and even day-to-day engagement with colleagues in medical education seem to demand an ever-increasing theoretical fluency. Graduate education is of course neither realistic nor necessary for all medical educators. Nevertheless, anyone setting out to master a theoretical approach should understand that such mastery is going to take some work. Extensive reading is required. To use theory in practice is to be able to articulate what one believes about education and the nature of the evidence that supports those contentions, as well as to recognize and embrace discussion and debate with others who hold different, but no less theoretically informed, points of view.

Bleakley and colleagues have argued that, whereas early twentieth century structural reforms in medical education revolved around a scientific imperative, today's reorientation of medical education around sociocultural axes requires the development of a corps of medical educators and clinical teachers with a strong grasp of theory, sustained by well-developed pedagogical and research skills.<sup>47</sup> The source materials that medical educators of the future will need to read, they argue, are not simply those that describe methods for teaching, assessment, or research, but

rather those that help medical educators to deepen and transform their thinking in conceptual ways. The need for faculty development to support this process is evident.

This short review of the nature and use of theory in postgraduate medical education was created to make the topic more accessible, to illustrate the links between theory and practice in medical education, and to provide resources for further reading (see Table 3). Mastering one or more theories is not a simple task, and medical education has lacked guideposts to help educators and administrators. We hope that this paper goes some distance in showing the way forward.

## **Acknowledgements and Disclosures**

### **Acknowledgements**

The authors are grateful to Elisa Hollenberg for her assistance with the literature search for and editing of this manuscript.

### **Funding/Support**

The authors received an honorarium for writing this paper from the Josiah Macy Jr. Foundation that commissioned this work. One of the authors (BDH) also received a travel allowance to attend and present this work at the Josiah Macy Jr. Foundation Conference entitled ‘Reforming Graduate Medical Education to Meet the Needs of the Public’ held in Atlanta, Georgia in May 2011.

### **Other Disclosures**

None

### **Ethical Approval**

Not Applicable



## **Disclaimers**

None

## **Previous Presentations**

This paper was commissioned for and presented at the Josiah Macy Jr. Foundation Conference entitled 'Reforming Graduate Medical Education to Meet the Needs of the Public' held in Atlanta, Georgia in May 2011.

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**Table 1. Examples of different kinds of theory and their application to postgraduate medical education (PGME)**

<b>Cluster</b>	<b>Theory</b>	<b>Example of a Relevant Issue in PGME</b>	<b>Hypothetical Example of a Specific Intervention in PGME</b>
<b>Bioscience theories</b>	Personality/genetic theory	Characteristics for admissions to residency training	Predicting conduct/misconduct in future practice using personality traits
	Motor learning/control theory	Learning complex motor tasks and technical skills	Using distributed rather than massed feedback to support motor learning
	Neurophysiological theory	Effects of stress on learning and performance	Addressing levels of stress to optimize learning in simulations
	Cognitive theory of multimedia learning	Design of learning formats and resources	Structuring learning tools and formats for optimum learning and retention with multiple media
	Cognitive load theory	Design of simulation and multimedia learning modules	Reducing cognitive load to allow for better performance in practice
<b>Learning theories</b>	Adult learning theory (including critiques)	Role of self-assessment and self-directed learning	Avoiding unstructured self-direction by using directed, guided self-learning
	Situated learning theory	Awareness of learning context	Incorporating workplace features into educational design
	Social cognitive theory	Role of social networks in learning	Paying attention to the development of social relationships in learning
<b>Sociocultural theories</b>	Critical theories	Attention to the hidden curriculum arising from the effects of power inequities, hierarchies, and socialization	Addressing the hidden curriculum by making visible and mitigating hierarchies and power differentials and by improving the socialization processes
	Political-economic theories	Attention to economic and political factors that drive behavior	Making visible/altering economic and political drivers of professional behavior

This table presents a selection of bioscience theories, learning theories and sociocultural theories which are relevant to postgraduate medical education (PGME). For each theory it provides an example of an issue within PGME to which that theory is potentially relevant and a hypothetical example of a specific intervention which would be supported by that theory.



**Table 2. Examples of postgraduate medical education practices aligned or not aligned with a selection of bioscience theories, learning theories and sociocultural theories\***

	Practices aligned with theory	Practices not aligned with theory
Learning technical/clinical skills: from simulation to bedside	<ul style="list-style-type: none"> <li>• Longitudinal, progressive skills development<sup>15, 28, 31 (BST)</sup></li> <li>• Incremental learning with distributed feedback<sup>14, 41 (LT)</sup></li> <li>• Transfer of skills to real practice setting<sup>18, 41 (BST, LT)</sup></li> <li>• Learning and practicing skills in settings and with human interactions that are culturally consistent with real practice settings<sup>34,44 (SCT)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Excessive stress in simulation<sup>10 (BST)</sup></li> <li>• One-shot training<sup>15, 17 (BST, LT)</sup></li> <li>• No opportunity to transfer skills to real practice settings<sup>18, 41 (BST, LT)</sup></li> <li>• Lack of concurrent feedback<sup>14 (BST, LT)</sup></li> <li>• Too much multimedia<sup>27, 30 (BST)</sup></li> <li>• Left alone to learn in a simulator<sup>42 (LT)</sup></li> </ul>
Learning team collaboration: functioning as an effective member of real teams	<ul style="list-style-type: none"> <li>• Progression from the periphery of teams to active participation<sup>33, 34, 44 (LT, SCT)</sup></li> <li>• Awareness of power/hierarchy and the effects on team function<sup>51,47 (SCT)</sup></li> <li>• Development of identity as a team member<sup>45, 46,47 (SCT)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Team skills learned in isolation from practice<sup>44 (LT, SCT)</sup></li> <li>• No consideration of dynamics of power and hierarchy on team function<sup>51 (SCT)</sup></li> <li>• Exposure to hidden curriculum that devalues team collaboration<sup>48, 49, 50 (SCT)</sup></li> <li>• Development of inappropriate behaviors modeled by teachers or peers<sup>45,48,62(SCT)</sup></li> </ul>
Gaining progressive independence: a focus on graduated competence in real practice settings	<ul style="list-style-type: none"> <li>• Continuity of teaching and mentorship<sup>40,41(LT, SCT)</sup></li> <li>• Learning deliberately structured for progressive independence<sup>40 (LT, SCT)</sup></li> <li>• Linking personal tasks to overall health care goals<sup>47 (SCT)</sup></li> <li>• Skills and performance scaffolded onto a defined knowledge base<sup>22, 26 (BST, LT)</sup></li> <li>• Independent learning supported by training for self-monitoring<sup>37 (LT)</sup> and directed self-guided learning<sup>38 (LT)</sup></li> </ul>	<ul style="list-style-type: none"> <li>• See one, do one, teach one<sup>41 (LT)</sup></li> <li>• Immersed into situations seen as a threat rather than a challenge<sup>11 (BST)</sup></li> <li>• Left alone to self-direct learning<sup>36, 42 (LT)</sup></li> <li>• Short rotations with no development of progressive independence<sup>40 (LT, SCT)</sup></li> <li>• Isolated knowledge and skills learning, unconnected to real healthcare roles<sup>47 (SCT)</sup></li> </ul>

\*Some references use elements of more than one type of theory.

Abbreviations: BST—bioscience theory; LT—learning theory; SCT—sociocultural theory.

**Table 3. Suggestions for Further Reading**

Bioscience Theories and Education	Bruer JT. Education and the brain: a bridge too far. <i>Education Researcher</i> . 1996;26:4-16
Learning Theories and Education	Mann KV. Theoretical perspectives in medical education: past experience and future possibilities. <i>Med Educ</i> . 2011;45:60-68
Sociocultural Theories and Education	Kuper A, Hodges BD. Medical education in societies. In Dornan T, Mann K, Scherpbier A, Spencer J, eds. <i>Medical Education: Theory and Practice</i> . London: Elsevier; 2010.

These suggestions are not meant to be comprehensive, but rather to point the interested reader towards short, accessible introductory works in three different areas of theory that are important for postgraduate medical education.