

Thinking about Thinking and Emotion: The Metacognitive Approach to the Medical Humanities that Integrates the Humanities with the Basic and Clinical Sciences

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Abstract

Medical knowledge in recent decades has grown prodigiously and has outstripped the capacity of the human brain to absorb and understand it all. This burgeoning of knowledge has created a dilemma for medical educators. We can no longer expect students to continue memorizing this large body of increasingly complex knowledge. Instead, our efforts should be redirected at developing in students a competency as flexible thinkers and agile learners so they can adeptly deal with new knowledge, complexity, and uncertainty in a rapidly changing world. Such a competency would entail not only cognitive but also emotional skills essential for the holistic development of their professional identity. This article will argue that metacognition—“thinking about thinking (and emotion)”—offers the most viable path toward developing this competency.

The overwhelming volume of medical knowledge has driven some medical schools to reduce the time allocated in their curricula to the “soft-option” humanities as they tend to consider them an expendable “luxury.” Vanderbilt University School of

Medicine, Nashville, TN, has moved away from the traditional conception of the medical humanities as “the arts,” composed of art, music, and literature, toward an approach that integrates the humanities with the basic and clinical sciences, based on metacognition. This metacognitive approach to the humanities, described in this article, has three goals: 1) to develop students as flexible thinkers and agile learners and to provide them with essential cognitive and emotional skills for navigating medical complexity and uncertainty; 2) to elicit in students empathy and tolerance by making them aware of the immense diversity in human cognition (and emotion); and 3) to integrate the humanities with the basic and clinical sciences.

Through this metacognitive approach, students come to understand their patterns of cognition and emotions, and in the group setting, they learn to mindfully calibrate their thinking and emotions. They gain a humbling appreciation of the fallibility of the human mind/brain and how cognitive biases and misperception can lead to medical error. They come to appreciate the complex interplay between cognition and

emotion, and the importance of cognitive monitoring and emotional regulation.

In the group setting, students also gain a sense of perspective of their thinking patterns and emotions in relation to those of their peers. Perspective taking and mindfulness engender tolerance and empathy, which ultimately serves as a platform for working collaboratively in teams as medical professionals. Students become aware of the social context in which thinking and learning occur, and this further shapes their professional identity. Thinking, learning, and interacting in the group setting ultimately induces a shift from self-preoccupation and an individualistic approach to knowledge toward an appreciation of collective cognition and empathy towards others.

In this article, I describe the metacognitive approach to the medical humanities at Vanderbilt University School of Medicine and how it is designed to develop students as agile learners and flexible thinkers with the mindful capacity for cognitive and emotional monitoring and regulation. Thinking and learning in the group setting of the colloquium ultimately also fosters the student’s professional identity.

Introduction

In a rapidly changing world of increased complexity, medical educators should direct efforts at developing in students a competency as flexible thinkers and agile learners with the capacity for navigating this complexity and its contingent uncertainties. Such a competency would entail not only cognitive but also emotional skills essential for the holistic development of the students’ professional identity.

This article will argue that metacognition—“thinking about

thinking (and emotion)”—offers the most viable path toward developing this competency. In this article, I describe the metacognitive approach to the medical humanities at Vanderbilt University School of Medicine (VSUM), Nashville, TN, and how it is designed to develop students as agile learners and flexible thinkers with the mindful capacity for cognitive and emotional monitoring and regulation. Thinking and learning in the group setting of the colloquium ultimately also fosters the student’s professional identity.

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The Conundrum of the Humanities in Medical Education

The germane role of the humanities in medical education remains a topic of ongoing controversy. As the volume and complexity of medical knowledge continues to surge, some educators may view the humanities as an expendable luxury and reduce the time in the medical curriculum allocated to these disciplines. Others may see a vital role for the humanities in eliciting and nurturing in students the essential Hippocratic qualities of caring and empathy. The humanities are frequently taught in medical schools to provide a rehumanizing counterbalance to the burdensome weight of scientific knowledge that students must memorize to pass their examinations, or as Bleakley¹ says: “as compensation for an overdose of science.” Be this as it may, the humanities and sciences are usually still taught in medical schools and universities as “silo” disciplines. Separating the sciences and humanities into what Snow² famously called “the two cultures” has, however, created a false dichotomy in knowledge.

The College Colloquium at VUSM seeks to integrate the sciences and humanities into a unified tapestry of knowledge. The colloquium is based on the premise that there are not “two cultures” but only a single “culture” of knowledge that is mediated through cognition and the human brain. The intellectual framework of the colloquium has its foundations in metacognition, a higher order of human cognition that is less formally referred to as “thinking about thinking.”³⁻⁵ Thinking and metacognition, or thinking about thinking (and emotion), happen in the brain, the physical manifestation of the mind, which is the epicenter of our cognitive processes, our consciousness, as well as our sense of morality.⁶ However, modern neuroscience now disputes whether the brain and mind are separate entities (a discussion beyond the scope of this article). Panksepp and Biven, in their landmark book *The Archaeology of Mind: Neuroevolutionary Origins of Human Emotions*, write that “modern neuroscience ... has revealed that it is no longer useful to distinguish between the mind and the brain, although we surely must distinguish between types of minds and types of brains.”^{7p8}

With the ongoing increase in knowledge, medical education will be impelled to abandon the clichéd fire hose image of filling students with factual information toward a competency-based approach that develops students into agile learners and flexible thinkers. Students possessing this competency will have a deeply enhanced understanding of how the mind works.⁸ They will come to have a keen sense of what they know and do not know, be more adept at navigating complexity and dealing with uncertainty, and they will be more skilled at asking the “right” questions. Moreover, with a sense of their own cognitive fallibility and of the brain as a fallible biologic organ, such students will likely be more circumspect and humble about their learned knowledge. They will be mindful of the context and the social setting of their learning, and (as will be argued) will also be more adept at regulating their own emotions. Such cognitive skills, monitoring, and mindfulness will have a positive impact on their well-being as well as their ethical sensibility and sense

of professionalism. For these reasons, we at VUSM view metacognition as the foundation of the colloquium and as an emerging competency that students should begin developing early in their medical education.

Structure and Rationale of the College Colloquium

I developed and innovated the College Colloquium in a more comprehensive form at a previous medical school and adapted it at VUSM as a course consistent with the goals of its new curriculum (Curriculum 2.0 introduced in 2013). Curriculum 2.0 at VUSM was designed in part to cope with the rapid growth in medical knowledge and complexity that can no longer be comprehensively accommodated in the curriculum, and instead to provide students with a more individualized and customized approach to their education. Curriculum 2.0 at VUSM reduces the basic science component of the traditional US medical curriculum from 2 years to about 15 months in length, and shifts the bulk of the clinical clerkships from third year to the second year of the curriculum. The third and fourth years are devised as an individualized learning plan in which students can tailor their education in the direction of their choice of medical specialty. The goal of the colloquium is to develop students to be more agile learners and flexible thinkers. In place of traditional rote memorization, students are taught to become competent conceptual thinkers and to develop a scientific and holistic understanding of how the mind works. The colloquium is situated in the 4 “colleges” that comprise the “learning communities.”

These “college” learning communities are designed to provide an environment in which students can interact in smaller groups, in a trusting space among peers and mentors, to hone their thinking and emotional skills and in which they can also develop and nurture their professional identity. Two college mentors oversee each college and serve as advisors to the students in their college and as facilitators during discussions in the colloquium. In the college community, students learn to trust one another and to develop their cognitive, emotional, and collaborative skills as medical professionals.

The College Colloquium meets for two to two-and-a-half hours each week. The first half hour is devoted to a “context talk,” a short talk delivered to the class by the course directors or associated faculty experts. The context talks are designed to provide a context around the required readings by placing the week’s colloquium topic in a broader learning and intellectual framework, and by posing challenging questions for discussion in the ensuing within-college discussions. Rather than leaving the context of learning implicit, the context talks situate the colloquium topics in the setting of their scientific and sociocultural/ethical interrelationships. The role of the expert teacher is not to provide answers, but to be challenging and to open up exploratory avenues for students to navigate in the participatory and trusting setting of their colleges.

After the talk, students break up into their separate colleges to discuss the assigned readings and possibly questions triggered by the context talk. The colloquium as a course starts with foundational readings and discussions on topics in metacognition

Selected Readings in Meta/Neurocognition Assigned in the College Colloquium at Vanderbilt University School of Medicine

Books

- Schulz K. *Being Wrong: Adventures in the Margin of Error*. New York, NY: Harper Collins; 2010.
- Quirk ME. *Intuition and Metacognition in Medical Education: Keys to Developing Expertise*. New York, NY: Springer; 2006.
- Montgomery K. *How Doctors Think: Clinical Judgment and the Practice of Medicine*. Oxford, UK: Oxford University Press; 2006.
- Siegel D. *The Mindful Brain*. New York, NY: WW Norton; 2007.
- Hall S. *Wisdom: From Philosophy to Neuroscience*. New York, NY: Knopf; 2010.
- Doidge N. *The Brain That Changes Itself*. New York, NY: Penguin Books; 2007.
- Kahneman D. *Thinking Fast and Slow*. New York, NY: Farrar, Straus and Giroux; 2011.
- Churchland P. *Braintrust: What Neuroscience Tells Us about Mortality*. New York, NY: Knopf; 2010.
- Taylor JB. *My Stroke of Insight: A Brain Scientist's Personal Journey*. New York, NY: Viking; 2006.
- Berns G. *Iconoclast: A Neuroscientist Reveals How to Think Differently*. Boston, MA: Harvard Business Review Press; 2010.
- Colvin G. *Talent is Overrated: What Really Separates World-Class Performers from Everybody Else*. New York, NY: Penguin; 2008.
- Ramachandran VS. *The Tell-Tale Brain: A Neuroscientist's Quest for What Makes Us Human*. New York, NY: WW Norton; 2011.
- Spiro H, Peschel E, Curnen MGM, St James D. *Empathy and the Practice of Medicine*. New Haven, CT: Yale University Press; 1993.
- Damasio A. *Self Comes to Mind: Constructing the Conscious Brain*. New York, NY: Vintage Books; 2012.

Articles

- Gladwell M. Most likely to succeed: how do we hire when we can't tell who's right for the job? [Internet]. New York, NY: The New Yorker; 2008 Dec 15 [cited 2014 Jul 31]:[about 15 p]. Available from: www.newyorker.com/magazine/2008/12/15/most-likely-to-succeed-2.
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- Tierney J. Do you suffer from decision fatigue? [Internet]. New York, NY: The New York Times; 2011 Aug 17 [cited 2014 Jul 31]:[about 10 p]. Available from: www.nytimes.com/2011/08/21/magazine/do-you-suffer-from-decision-fatigue.html?pagewanted=all.
- Lucey C, Souba W. The problem with the problem of professionalism. *Acad Med* 2010 Jun;85(6):1018-24. DOI: <http://dx.doi.org/10.1097/ACM.0b013e3181db51f>.
- Charon R. The patient-physician relationship. Narrative medicine: a model for empathy, reflection, profession, and trust. *JAMA* 2001 Oct 17;286(15):1897-902. DOI: <http://dx.doi.org/10.1001/jama.286.15.1897>.
- Epstein RM, Siegel DJ, Silberman J. Self-monitoring in clinical practice: a challenge for medical educators. *J Contin Educ Health Prof* 2008 Winter;28(1):5-13. DOI: <http://dx.doi.org/10.1002/chp.149>.

and critical thinking, and in subsequent semesters proceeds to topics in professionalism, medical ethics, leadership, and health care systems. (See Sidebar: Selected Readings in Meta/Neurocognition Assigned in the College Colloquium at VUSM, which presents examples of the kinds of readings prescribed for the foundational colloquia on metacognition.)

For promoting open communication and for generating a sense of community, the seating arrangement of the student (and mentor) participants in the colloquium is important. The students sit together with their mentors in a circle facing each other across an open space. (No electronic devices or social media are allowed.) The college mentors facilitate the discussions. Students are required to submit and to disseminate a carefully considered question on each of the week's readings to the college the evening before each colloquium, to drive discussions and to give the student practice in formulating creative questions.

Most medical humanities courses in the US, it appears, are not summatively assessed, and many are not even required courses. This is fairly well known among directors of medical humanities programs and is also frequently discussed at conferences on medicine humanities, such as the Project to Rebalance and Integrate Medical Education (PRIME) conference in 2012. Requiring attendance and assessing such courses, it is commonly thought, may further alienate students. Paradoxically, however, such tentativeness may compound the perception of the humanities as being a soft option and inferior to the basic science courses. Like the science courses at VUSM, the colloquium is a required, fully assessed, and evaluated course. Rather than having a separate examination, essay-style questions from the colloquium are integrated into the science end-block examinations. The questions are aimed at assessing whether students have intellectually integrated and assimilated the context (rather than just the content) of the readings into their own thinking and can communicate their thinking clearly. As attributed to William Osler, who spoke of absorbing readings: "It is much simpler to buy books than to read them and easier to read them than to absorb their contents."

The Meta/Neurocognitive Approach Integration of the Humanities with the Basic and Clinical Sciences

The overemphasis on factual knowledge in medical education has a stifling effect on learning and thinking. Philosopher Nussbaum insists that education should teach us not to be just passive assimilators of facts but to be expert thinkers: "[E]ducation is not just about the passive assimilation of facts and cultural traditions, but about challenging the mind to become active, competent, and thoughtfully critical in a complex world."^{9p18}

Medical students and trainees have a tendency to overemphasize and value the importance of factual knowledge. Many seem to consider a sound command of factual medical knowledge as the hallmark of the outstanding physician. From this perspective, students may perceive the humanities as subjective or a soft option compared with the objective sciences and therefore may relegate the humanities to an inferior standing.

The lopsidedness between the sciences and the humanities in the medical curriculum is antithetical to the notion of medicine as both a science and an art, and runs counter to a culture of producing well-rounded empathetic physicians. Bleakley et al argues that the humanities have a vital role to play in the process of learning the medical sciences: “[W]e see potential for learning medicine as imaginative and aesthetic science where medical humanities is reformulated as the process or perspective that creates the conditions of possibility for such learning of science to occur.”^{10p200}

Analogously, just as the humanities can have a vital role in creating the conditions for the effective learning of science, so too can the rigors of the scientific method be brought to enlighten the humanities. For example, investigators have used medical imaging to study how the brain processes stories and literature. Research shows that a group of neurons in the brain known as mirror neurons are involved in the processing of stories. These neurons also play a role in empathy. One therefore sees that the sciences and humanities are part of an integral field of human knowledge. Harvard biologist Wilson¹¹ refers to this integration of human knowledge as “consilience.”^b

The colloquium aims to redress this curricular imbalance between the sciences and humanities. The metacognitive approach—increasingly informed through neuroscience—provides the intellectual framework and focusing lens for integrating the sciences and humanities. The colloquium runs in parallel each week with the science curriculum allowing for a bidirectional integration of subject matter between the colloquium and science courses. For example, course content on the genetics of breast cancer may be included in a colloquium session, “How We Perceive,” to illustrate pitfalls in perception that can occur in reading a diagnostic mammogram. A science course on genetics conducted in parallel might include content from the colloquium about the ethics of genetic diagnosis and/or a discussion on how the mind navigates the kinds of cognitive complexity seen in genetics, such as the problems this complexity might pose for effective thinking and learning or the uncertainties entailed in genetic complexity that may result in mistakes and medical error.

The colloquium challenges the notion of the “two cultures” as separate cultures and instead attempts to integrate the humanities and sciences into a unified medical curriculum. Kulasegaram et al¹² recently suggested that “cognitive science” (“cognitive activity occurring within learners”) should serve as the vehicle for integrating the basic and clinical sciences. The metacognitive approach, especially as informed by modern neuroscience, provides the most tenable approach to breaking down silos of knowledge in medicine and science, and to integrating the humanities and sciences in the medical curriculum.

Metacognition as an Interplay of Cognition and Emotion

Quirk defines *metacognition* as “the ability to think about one’s thinking and feelings and to predict what others are thinking.”^{13p4} A substantial body of literature from the neurosciences and cognitive sciences has challenged the assumption

that cognition and emotions are processed along separate noninteracting pathways in the brain.⁷ Instead, there is a major interplay between cognition and emotions, and neither can be understood in isolation. Neurobiologist Damasio argues that “when emotion is entirely left out of the reasoning picture ... reason turns out to be even more flawed than when emotion plays bad tricks on our decisions.”^{14pxii} Cognition affects emotion, and emotions in turn shape cognitive processes such as perception, memory, learning, and decision making. In medicine, we have underestimated the complex interplay between cognition and emotion in effective decision making and how this interplay underlies a sizable component of medical error.^{7,15-17}

The metacognitive approach of the colloquium therefore encompasses the study of not only cognition but also the emotions. At VUSM, we examine the complex interconnections between cognition and emotion with a focus on the role of emotions in the lives of patients and physicians. Thus, the metacognitive approach enhances not only students’ thinking and learning skills but also develops their professional identity by including topics that affect the students’ emotional lives, such as emotional regulation, coping and resilience, and empathy. Specific sessions in the colloquium are devoted to each of these and additional similar topics.

Metacognition, Neuroscience, and Cognitive Fallibility

The study of metacognition has traditionally fallen under the disciplines of philosophy and psychology. Advances in neuroscience and neuroimaging have more recently shed light on the biology of brain function during a variety of specific cognitive tasks, transforming the field of metacognition into neurocognition. Many of the topics and required readings in the colloquium therefore derive from writings and research in neurocognition. We at VUSM thus term this emerging field *meta/neurocognition*. A selection of readings is shown in the Sidebar: Selected Readings in Meta/Neurocognition Assigned in the College Colloquium at Vanderbilt University School of Medicine.

Modern neurobiology is providing the impetus for unifying previously disparate fields of knowledge. In *The Marketplace of Ideas*, Menand¹⁸ of Harvard University suggests:

The most important intellectual development in the academy in the 21st century has to do with the relationship between the life sciences—particularly neurobiology, genetics, and psychology—to the fields outside the natural sciences, such as philosophy, economics, and literary studies.^{18p19}

Neurobiology is integrating the sciences and humanities. Fields of investigation previously falling mostly in the realm of philosophy and psychology, such as perception, learning, and decision making, we can now examine using the rigorous methods of science.¹¹ To some, this reductionism may be unappealing, but as Wilson¹¹ forcefully argues in his book

... there is a major interplay between cognition and emotions, and neither can be understood in isolation. ... In medicine, we have underestimated the complex interplay between cognition and emotion in effective decision making and how this interplay underlies a sizable component of medical error.

Consilience: The Unity of Knowledge, science can actually enhance our appreciation of the humanities. As a further manifestation of how the metacognitive approach integrates the humanities with the basic and clinical sciences, students in the colloquium will simultaneously in the curriculum learn about brain anatomy and function as well as neuroscience and pathology.

Through the study of neurocognition, students become aware that the brain does not record reality like a camera. Instead, it constructs models of the world that are sufficiently effective for survival. As neuroscientist Eagleman states:

One of the most pervasive mistakes is to believe that our visual system gives a faithful representation of what is "out there" in the same way that a movie camera would.^{19p24}

... [B]rains reach out into the world and actively extract the type of information they need.^{19p30}

The brain doesn't need a full model of the world because it merely needs to figure out, on the fly, where to look, and when.^{19p27}

Colloquium sessions on perception, learning, decision making, and medical error impress on students the brain's cognitive fallibility and proneness to error. Such an awareness of the brain's cognitive fallibility is generally humbling. It instills in student learners a mindfulness about their own potential for being "wrong"¹⁹ about their beliefs, their perspectives on the world, and their decisions. For many students, this realization is initially unsettling. They begin to worry about their own potential for medical error as they progress to their clinical years. This realization, however, also impresses on them the relevance to their education of the colloquium's metacognitive approach and the importance of mindfulness and ongoing cognitive and emotional monitoring.

Critical Thinking, Cognitive Flexibility, Learning Agility, and Mindfulness

Critical Thinking and the Shape of Thought

Medical students in general are academic high achievers, having scored at the top of their class in college examinations and in medical school admission tests. Yet they are generally not trained as critical thinkers. Critical thinking as a discipline is seldom taught in US schools and colleges. Kuhn,²¹ in her book *Education for Thinking*, writes:

Many students are unable to give evidence of more than a superficial understanding of the concepts and relationships that are fundamental to the subjects they have studied ... [I]t is possible to finish 12 or 13 years of public school education in the United States without developing much competence as a thinker.

Critical thinking is defined by Paul and Elder²² as "the art of analyzing and evaluating thinking with a view to improving it." In the colloquium, we emphasize the "deliberate practice" (see Sidebar: Deliberate Practice) of critical thinking both as an intrinsically important skill, and to emphasize that the humanities are no less rigorous as intellectual disciplines than the sciences.

Sessions on critical thinking include topics on the pitfalls of logic and the analysis of various forms of cognitive heu-

Deliberate Practice

This term was coined by Ericsson et al¹ in an article titled "The Role of Deliberate Practice in the Acquisition of Expert Performance" to describe "expert performance as the end result of individuals' prolonged efforts to improve performance while negotiating motivational and external constraints. In most domains of expertise, individuals begin in their childhood a regimen of effortful activities (deliberate practice) designed to optimize improvement. Individual differences, even among elite performers, are closely related to assessed amounts of deliberate practice. Many characteristics once believed to reflect innate talent are actually the result of intense practice extended for a minimum of 10 [years]."

Reference

1. Ericsson KA, Krampe, RT, Tesch-Römer C. The role of deliberate practice in the acquisition of expert performance. *Psychol Rev* 1993 Jul;100(3):363-406. DOI: <http://dx.doi.org/10.1037/0033-295X.100.3.363>.

ristics and biases. Students learn to distinguish "straight" from "crooked" thinking, how to recognize the multifarious forms of cognitive bias, and how the quality of their thinking has an impact on medical error and the effective practice of medicine. Included in the readings for these sessions are seminal works by Kahneman,²³ Kahneman and Tversky,²⁴ Gardner,²⁵ and de Bono,²⁶ as well as physician-authors, such as Gropman¹⁵ and Montgomery,¹⁶ who discuss how physicians think and the kinds of cognitive errors physicians make.

Besides critical thinking, students are also taught about the uses and abuses of intelligence testing.²⁷ The colloquium emphasizes that intelligence is not a monolithic human attribute but that there are "multiple intelligences" as described in Gardner's²⁵ *Frames of Mind: The Theory of Multiple Intelligences*. Having excelled in college examinations and in standardized tests, medical students frequently hold a monolithic view of intelligence—the fast and analytical type that Gardner terms *analytical intelligence*. They are surprised but often also encouraged to learn about Gardner's other equally valid forms of intelligence that include kinesthetic, music, linguistic, intrapersonal, and interpersonal intelligences.

Students in the colloquium also discuss the pros and cons of group thinking and, in small groups, engage in exercises in creative thinking. One such creative thinking exercise is de Bono's²⁶ "six thinking hats," in which individuals in small groups assume different thinking roles according to the color of the hat they are given to wear.

As a further example of integration between the humanities and sciences, specific colloquium sessions focus on the biology of the brain and how specific neuropathologies can shape patterns of thinking. For instance, we assign readings on how brain stroke can distort thinking and personal identity (eg, Taylor,²⁸ *My Stroke of Insight*); the effects of Alzheimer disease on memory and identity; and the biologic correlates of autism and other mental disorders. In addition, we explore the biologic basis of imagination and how imagination drives

creative thinking.²⁹ The objective of these colloquia is to make students aware that thinking emanates from a biologic organ, the brain, an organ that is fallible and prone to its own pathologies, as with all biologic organs.

These colloquia thus serve to make students aware that thinking cannot be taken for granted but is the product of a fallible biologic organ. Thinking as a “product” or emanation of the brain is constrained, and our thought processes are subject to error. In medicine, this translates more specifically into medical error—a topic further explored in dedicated colloquium sessions. In view of these biologic constraints on cognition, it becomes evident to students that a higher order of thinking to cultivate is “cognitive flexibility.”

Cognitive Flexibility and Learning Agility

The concept of cognitive flexibility has been well studied, although there is no consensus on a precise definition. Dennis and Vander Wal³⁰ suggest a general definition that entails as a core component “the ability to switch cognitive sets to adapt to changing environmental stimuli.” The authors developed an instrument, the Cognitive Flexibility Inventory, which is designed to measure three components of cognitive flexibility: “1) the tendency to perceive difficult situations as controllable; 2) the ability to perceive multiple alternative explanations for life occurrences and human behavior; and 3) the ability to generate multiple alternative solutions to difficult situations.” Dennis and Vander Wal³⁰ use this inventory to determine cognitive flexibility as a coping mechanism to assess the ability of individuals to “successfully challenge and replace maladaptive thoughts with more balanced and adaptive thinking.”^{30p242-3}

In the colloquium, we use cognitive flexibility to determine how rigidly students adhere to their beliefs and/or preconceived notions and ideas, as well as their capacity to gain new insights and willingness to change their mind. We have applied the Cognitive Flexibility Inventory to assess and monitor whether students change in their capacity to think more flexibly and adaptively (see the later section, Evaluation of the College Colloquium).

An analogous term, *learning agility*, pertaining to flexibility in learning, was coined by Lombardo and Eichinger³¹ to connote the “the willingness and ability to learn from experience, and subsequently apply that learning to perform successfully

under new or first time conditions.” To function effectively in a world of uncertainty and complex medical knowledge, the physician of the future will, we at VSUM postulate, need to have the capacity for “cognitive flexibility” and be an “agile learner.” These skills are therefore deliberately cultivated and nurtured in the colloquium.

The discussion format of the colloquium encourages students to learn from the perspectives of their peers and mentors, and to integrate this learning into their own experience. The course impels students to develop the flexibility to adapt their own thinking and perspectives to the particular contexts (see Sidebar: Mobile Mind).

Cognitive flexibility includes such mental attributes as the capacity to see the world from different perspectives and the capacity to be sufficiently flexible to change one’s mind. It entails the ability to recognize one’s cognitive biases and to see how the subjectiveness of one’s beliefs can obfuscate clear thinking. Cognitive flexibility is also an inherent quality of agile learning that the colloquium promotes as an emerging competency in medical education.

As a consequence of the battery of tests medical students have taken, they may tend to overvalue factual knowledge over the nuanced, conditional, and contextual processes of thinking. Students in the colloquium may be perturbed to learn that “facts” are not immutable but that medical knowledge churns over and changes, and its veracity is constantly reevaluated. Robinson³² showed that medical knowledge doubles every 5 years and that approximately 90% of medical information becomes worthless and of little value in about 10 years from the date of publication.

The emphasis in medical education on factual information is misguided and can constrain cognitive flexibility and suppress curiosity. In her acclaimed essay, “Curiosity,” Fitzgerald suggests how the weight of factual knowledge in medical education can stifle student curiosity: “Medical education itself suppresses the expression of curiosity, emphasizing examinable facts rather than more ineffable thought processes in order to provide reproducible experiences for students.”^{33p71}

Mindfulness and Mindful Learning

The colloquium seeks to amend this static approach to knowledge. Instead, we encourage students to be flexible, skeptical, and curious. To this end, a key attribute cultivated in the colloquium is mindfulness. Siegel has defined mindfulness “in its most general sense [as being] about waking up from a life on automatic and being sensitive to novelty in our everyday experiences.”^{34p5}

Students in the colloquium discuss readings on mindfulness in medicine and the qualities of mindful learning.³⁴⁻³⁶ In contrast to the learning of static facts and absolutes, mindful learning encompasses the ability to think in terms of conditions and contexts. In his book, *The Mindful Brain*, Siegel describes this difference between mindful learning and the learning of factual knowledge as follows:

When our minds lock onto something as being absolute, it enters our memory stores in a very different form from the way it would were we to be tentative about the contexts and conditions in which what we just learned might apply. ...

Mobile Mind

Berger uses a similar term, *mobile mind*, which Quirk¹ paraphrases as a “skill set that involves respecting/embracing multiple human values and orientations—even those that are different from one’s own.”

Berger (quoted in Quirk¹) uses the term *mobile mind* to connote the metacognitive concept that entails “a ... cosmopolitan way of thinking—broad-mindedness, or an openness to environment around us, including a sensitivity to differences and respect for others.”

Reference

1. Quirk M. Intuition and metacognition in medical education: keys to developing expertise. New York, NY: Springer Publishing Company, Inc; 2006.

[We] can take a “fact” and create a rapidly accessible node of neural firing patterns ... but with conditional statement, that neural nodal point must have far more intricately established connections for it to meet the criteria for inclusion into the scaffold of knowledge. ... [T]he conditional presentation of mindful learning engages a more complex set of neural associations, making it accessible in the future for retrieval in more flexible and adaptive ways.^{33p232-3}

Mindfulness and mindful learning are antidotes to the absolutes of factual learning and serve to sustain curiosity and cognitive flexibility. It would seem intrinsically valuable for physicians to cultivate these attributes of mind to effectively navigate the immense complexity of medical knowledge and the associated uncertainty in diagnosing and treating patients. The dynamism and flexibility associated with conditional, mindful learning in contrast to the rote learning of factual knowledge trains physicians to know what they do not know, to ask the right questions, and ultimately to make better-informed decisions.

Professionalism and Professional Identity

Medical educators have tended to view professionalism as being driven primarily by particular behaviors. As a result, the focus on improving professionalism in medical schools has been on identifying undesirable behaviors with the aim of eliminating these behaviors. Quirk^{13p82} points out that this focus on defining and evaluating behaviors associated with professionalism “does not adequately ensure the depth of understanding necessary to deal with the new professional challenges for generations of physicians to come.” Whether this approach has been effective yet is doubtful because unprofessional behavior in medicine has not appreciably declined over the years.

Professionalism in medical schools is frequently approached in a manner that is static and prescriptive. What is needed instead is a dynamic mindset that is aimed at understanding the root causes of behavior and that encourages behavioral self-monitoring, reflection, and emotional regulation. Wear and Castellani³⁷ propose a dynamic view of professionalism and suggest that professionalism should be viewed not as a series of isolated behaviors or personality character traits but instead as “an ongoing self-reflective process involving habits of thinking, feeling, and acting.”

The understanding of professionalism has been problematic in part because of our incomplete understanding of the scientific underpinnings of behavior. Neurocognition offers a unique opportunity to understand the specific drivers of human behavior more accurately and scientifically, and it provides a more methodical and humanistic approach to modifying unprofessional behavior.

Professionalism: Respectful Disagreement and Perspective Taking

As individuals, we each hold differing perspectives of the world. As German philosopher Arthur Schopenhauer³⁸ famously

said, a danger of individuals rigidly adhering to their own perspectives, is “Every man takes the limits of his own field of vision for the limits of the world.” A premise of the colloquium is that students and trainees will function more effectively in teams if they develop the capacity to view social contexts and medical situations from different perspectives. This ability to hold different and contrasting perspectives is an attribute of metacognitive capacity and skill.^c

The colloquium exposes students to the variegated perspectives of their mentors and peers.^d In addition, students receive ongoing explicit or implicit feedback on their own views and behaviors during colloquium sessions. The thoughts, opinions, and beliefs they express are further validated or negated in varying degrees by their college peers. Students will inevitably compare their perspectives with those of their peers and quite likely modulate or recalibrate their perspectives. (As argued later in the Mindfulness, Self-Monitoring, and Emotional Regulation section, this change in perspective also ultimately leads to behavior modification and emotional self-regulation.) Quirk refers to this capacity as “collective perspective taking” and associates this capacity with emotional self-regulation:

An essential capability of professionalism is acceptance of one’s role and regulation of role-related behaviors within the group. ... Collective perspective-taking and self-regulation capabilities are often how high-profile professions are judged “from the outside” by the public.^{13p85-6}

Collective perspective taking instills in students a respect for the views and opinions of their peers and others (see Sidebar: Mobile Mind). In the colloquium, we encourage students to engage in vigorous debate and to disagree with each other in a respectful manner. The term we use in the colloquium is *respectful disagreement*. Allowing students the intellectual and emotional space to respectfully disagree with each other’s ideas and beliefs is essential for critical and creative thinking and is important in their development as medical professionals. In medical practice, these future physicians will find themselves disagreeing with colleagues, coworkers, and patients. Students therefore need to develop the skill to disagree in a professional and respectful manner and to calibrate their thinking against the thinking of their colleagues.

Professionalism: Identity and Leadership

Disagreeing with one’s peers and going against the group can take courage. This topic is explored in the colloquium. In a session on “How We Perceive/Misperceive” we assign readings by neuroscientist Berns,^{39p83-105} in which he describes imaging experiments based on the well-known findings of Solomon Asch in the 1950s. These studies showed how individuals, rather than disagreeing with the group about their own valid perceptions, will change their mind and adopt an incorrect perception to conform with the group opinion and allay their fears of opposing and being ostracized from the group. Challenging a group takes courage, a core quality of leadership. A leader would do best knowing when to conform with, and when to challenge, the group.^{e40} Understanding, through neurocognition, the origins of the fear associated with

Collective perspective taking instills a respect for the views and opinions of their peers and others (see Sidebar: Mobile Mind).

challenging the group can be empowering to the individual and works to diffuse such fears associated with courageous leadership. Thus, the neurocognitive approach of the colloquium is ultimately also an education in leadership. Such group skills are central to working in medical teams and to the student's developing professional identity.

Cognitive Diversity, Empathy, Mindfulness, and Emotional Regulation **Cognitive Diversity and Empathy**

A major objective of the colloquium is to make students aware of the immense diversity in human cognition (or cognitive "wiring"). The realization of such diversity triggers a mind shift in the individual's self-centeredness toward an other-centeredness, leading to a deepening in tolerance and empathy.

In her book *Not for Profit: Why Democracy Needs the Humanities*, philosopher Nussbaum suggests how essential to the humanities is this ability to view the world from the perspective of a "person different from oneself":

Citizens cannot relate well to the complex world around them by factual knowledge and logic alone. ... [W]hat we can call the narrative imagination ... means the ability to think what it might be like to be in the shoes of a person different from oneself, to be an intelligent reader of that person's story, and to understand the emotions and wishes and desires that someone so placed might have. The cultivation of sympathy has been a key part of the best modern ideas of democratic education.^{9p95-6}

A key function of the metacognitive approach to the humanities is therefore to help students relate to the world through the eyes, emotions, and perspectives of others. This capacity elicits and nurtures in medical students the essential professional quality of empathy. Students often remark on how their perspectives change during the colloquium, rendering them more tolerant to alternate viewpoints and empathic toward others.

Mindfulness, Self-Monitoring, and Emotional Regulation

Students in the colloquium receive from their peers and mentors direct and indirect feedback on the views and opinions they express in discussions, and on their general conduct. Such

feedback from others can be a major impetus for behavior modification, but it is nonetheless usually sporadic and can also be misconstrued. For this reason, self-monitoring is an essential skill for effective behavior modification. Epstein et al define *self-monitoring* as "an ability to attend, moment to moment, to our actions; curiosity to examine the effects of those actions; and willingness to use those observations to improve behavior patterns and patterns of thinking in the future."^{41p5}

Self-monitoring is, however, also susceptible to misjudgment. As Epstein et al write in their seminal article, "Self-Monitoring in Clinical Practice: A Challenge for Medical Educators":

[Self-assessment] requires the ability to distinguish high quality data from imagination and projection. The task is difficult because the mind is ultimately both the object and the instrument of assessment, and our mental processes embed idealization directly within our self perceptions.^{41p6}

Nonetheless, Epstein et al⁴¹ suggest that self-monitoring provides a solution to the problem of integrating internal and external data to assess personal performance and improve learning. It enables physicians and trainees to follow and assess their own learning and mental processes for the purpose of improving clinical practice.

The deliberate practice of mindfulness that is nurtured and explored through readings in the colloquium is one of the main vehicles through which students accomplish such self-monitoring. Through mindful practice, as Epstein⁴² describes it, students learn to self-regulate their emotions by bringing to consciousness their deeply held values and knowledge, and then integrating these with new information and perspectives.^f Self-monitoring and emotional regulation are also essential components of the resilience that physicians may need to sustain them through the uncertainties and emotional vicissitudes of medical practice.

David and Congleton coined the term *emotional agility* to describe "the ability to manage one's thoughts and feelings ... in a mindful, value-driven and productive way ... in a complex, fast-changing knowledge economy."^{43p89} The authors expound this concept in the setting of business leadership to describe the ability to apply effective inner strategies to mindfully control negative thoughts and feelings that "sap important cognitive resources" during meetings and management experiences. For purposes of the colloquium, the term provides a helpful link with the concepts of cognitive flexibility and learning agility (discussed earlier) to suggest again how metacognition encompasses the capacity to monitor both cognition and emotion. Of note, Flavell⁴ does not use the terms *emotional regulation* and *emotional agility* but suggests a similar notion when he writes about "monitoring of ... memory, comprehension and other cognitive enterprises."

Narrative Medicine: A Metacognitive Tool for Eliciting and Nurturing Empathy

We introduce the topic of narrative medicine early in the colloquium to emphasize that medicine is not just about science but that the medical narrative is also important (and patients' "stories matter"). Many students are perplexed, and some are irked, to hear that the patient's "story" can at times have a

Narrative Medicine

Rita Charon, MD, PhD, is a major proponent and one of the pioneers of narrative medicine, a field she helped consolidate through her seminal work, *Narrative Medicine: Honoring the Stories of Illness*.¹ Charon distinguishes between "nonnarrative knowledge" and "narrative knowledge" as follows: "Nonnarrative knowledge attempts to illuminate the universal by transcending the particular; narrative knowledge, by looking closely at individual human beings grappling with the conditions of life, attempts to illuminate the universals of the human condition by revealing the particular."^{1p9}

Reference

1. Charon R. *Narrative medicine: honoring the stories of illness*. Oxford, United Kingdom: Oxford University Press; 2006.

higher diagnostic value than test results in attaining a clinical diagnosis. How can a subjective “story” pose a challenge to a lifesaving medical “fact”? (See Sidebar: Narrative Medicine.)

These sessions apprise students of the importance of the patient’s “story,” which may contain critical clues to effective diagnosis. The goal is to develop the student’s *narrative competence*, which Charon⁴⁴ defines as “the ability to acknowledge, absorb, interpret, and act on the stories and plights of others.” In the colloquium, we discuss a wide range of medical narratives (fictional and nonfictional) to give students a sense of narrative structure and to further develop their narrative competence. This competence is further reinforced through the personal narratives from medical practice that students hear from their mentors, and through their own reflective writing (see Reflective Writing: A Tool for Emotional Regulation and Professionalization). Students are often intrigued that listening carefully to patients’ stories and developing their narrative competence can have clinical and therapeutic relevance and should not be regarded as an inefficient use of time in clinical practice.

Narrative medicine is also viewed as a vehicle for eliciting and nurturing student empathy. Medical humanities courses generally include literature for this implicit purpose of humanizing students and nurturing empathy. More recently, neuroscience has shed light on how literature, and specifically the act of reading literary narrative, may be implicated in eliciting empathy. Neuroimaging studies have recently shown that the act of reading literary fiction

stimulates parts of the brain such as mirror neurons that are implicated in the empathic response. Reading literary narrative that delves into the lives of its characters and describes the complex social interactions between individuals can serve to simulate empathic responses in the reader.⁴⁵ A rigorous study published in *Science* recently demonstrated that reading literary fiction (compared with nonfiction and nonliterary fiction) evoked a measurable empathetic response in readers.⁴⁶ These studies, moreover, demonstrate how the scientific method can shed light on how the brain processes literature, a humanistic discipline. Such studies again demonstrate how the sciences and humanities should not be viewed as “silo” disciplines (“two cultures”) but as part of a unified field of human knowledge. Such a view validates the approach for integrating the humanities with the clinical and basic sciences in the medical curriculum.

Reflective Writing: A Tool for Emotional Regulation and Professionalization

We view the “deliberate practice” of writing personal and critical reflections as an integral component of the metacognitive approach (see Sidebar: Deliberate Practice). Similar to the recent scientific finding that reading literary fiction can elicit in the reader an empathic response, evidence suggests the act of writing personal reflections can have neurocognitive benefits.⁴⁷⁻⁴⁹ We view the writing of personal reflections also as a way of connecting students with their inner voice and with their innate empathy. Shapiro et al⁵⁰ argue that writing personal reflections increases provider well-being, which includes the enhancement of “emotional equilibrium, self-healing and reducing isolation/restoring a sense of community” (see Sidebar: Two Phases of Reflective Writing).

The reflective writing assignments in the colloquium are usually about a personal experience related to medicine, for instance, the experience of a medical error that occurred during the student’s own care or that of a close friend or family member. However, we also assign critical reflections that include topics on the ethics of specific clinical scenarios as a way of integrating the clinical sciences into the colloquium.

We have developed a specific writing format called APCL (Analysis, Perspectives, Critique, Learning) that jump-starts the creative writing process. The “Perspectives” section of this reflective writing format is in keeping with the colloquium notion of “perspective taking” (discussed in the section, Professionalism: Respectful Disagreement and Perspective Taking). The deliberate practice of writing personal reflections thus reinforces other metacognitive components of the colloquium.

Evaluation of the College Colloquium

Students express a high level of satisfaction with the College Colloquium. Results of an extensive (required) course evaluation demonstrate that 80% to 90% of students rated the College Colloquium as good to excellent. In particular, students valued hearing the perspectives of their peers in colloquium sessions and frequently commented on how this had caused them to reevaluate their own perspectives and beliefs. In addition, they valued hearing the “stories” of peers and mentors, and they commented on the trust that developed in their college

Similar to the recent scientific finding that reading literary fiction can elicit in the reader an empathic response, evidence suggests the act of writing personal reflections can have neurocognitive benefits.

Two Phases of Reflective Writing

Shapiro et al distinguish two phases of reflective writing: the writing phase and the group reading and discussion phase. The writing phase is “individual and solitary, consisting of personal reflection and creation. ... [I]ntrospection and imagination guide learners from loss of certainty to reclaiming a personal voice.”⁵¹

In the first two years of the College Colloquium, reflective writing involves only the writing phase. These reflections are held confidentially between students and their college mentors who provide formative feedback. We consider confidentiality essential for the following reasons: 1) to give the students the space to find their “voice” without the potential anxiety of having to read their reflections to the group and 2) to nurture trust between students and mentors, which is important for molding the identity of the learning communities. Only in later years of medical school, after students have had more contact with patients, do they move to the reading and discussion phase discussed by Shapiro et al: “where sharing one’s writing results in acknowledging vulnerability, risk-taking, and self-disclosure. Listening to others’ writing becomes an exercise in mindfulness and presence, including witnessing suffering and confusion experienced by others.”^{51p231}

Reference

1. Shapiro J, Kasman D, Shafer A. Words and wards: a model of reflective writing and its uses in medical education. *J Med Humanit* 2006 Winter;27(4):231-44. DOI: <http://dx.doi.org/10.1007/s10912-006-9020-y>.

over the course of the colloquium. Students valued the general clinical experience of their mentors and the willingness of their mentors to share their personal experiences from medical practice. The colloquium has therefore functioned as a true learning community.

The following are examples of some of the de-identified positive comments taken from the course evaluations:

- “Colloquium provides a welcome change from the rigorous science we learn and provokes interesting and relevant discussion. The assignments ... challenge our class in important areas that are often overlooked in medical and premedical curricula.”
- “The readings were great. I saved many for future reference and shared them with friends and family.”
- “I loved colloquium discussions. I have always walked away with having heard a new perspective that I hadn't considered before.”

Application of the Cognitive Flexibility Inventory, an instrument for determining student's cognitive flexibility (as mentioned earlier), showed that most students enhanced their inventory score during colloquium. This indicated that they had learned to think more adaptively, to perceive problems from multiple perspectives, and to generate alternative solutions to complex situations. These pilot surveys suggest that the colloquium is achieving one of its major objectives of enhancing students' cognitive flexibility.

Conclusion

In the setting of learning communities, the VUSM College Colloquium presents an innovative approach to teaching the humanities in medical school. Instead of viewing the humanities as separate and isolated from the sciences, the colloquium seeks to integrate these intellectual domains (the “two cultures”) into a unified medical curriculum. Starting with a foundation in meta/neurocognition, the colloquium aims to train students not only in critical thinking but also more broadly to engender the qualities of cognitive flexibility and mindfulness as well as the capacities for cognitive and emotional monitoring and regulation. These qualities, coupled with an awareness in students of the immense breadth of human cognitive diversity, serve to elicit and nurture tolerance and empathy, which are core attributes of the “good” physician.

Bleakley and Bligh contend the following:

Learning is largely a meta-process concerning legitimate access to situated (context-linked) and distributed knowing. This is not to deny the value of one's own store of knowledge, but to place this in the wider and more pressing context of learning how to learn or how to access knowledge.^{51p80}

Metacognition is such a “meta-process” that takes account of this broader continuum of learning to include how we learn and access knowledge, as well as the context and social setting of such learning. The metacognitive approach at VUSM is deliberately situated in the social setting of the colleges (as described earlier) so that students come to appreciate the participatory and peer context of learning, in contrast to the individualistic acquisition of knowledge that mostly occurs in their basic and clinical science courses.

Some have suggested that the metacognitive approach may be too abstract and premature for first-year medical students. In the context of the personalized curriculum being implemented at VUSM, this approach seems to us highly appropriate for educating the physician of the future. Quirk concludes his treatise on *Intuition and Metacognition in Medical Education* with the following emphatic statement:

The personalized curriculum that is the hallmark of the new paradigm begins in the first year of medical school with the establishment of an infrastructure for thinking that will impact learning, practice and teaching. New evaluation strategies must focus on the achievement of metacognitive as well as cognitive benchmarks and capabilities.^{13p133} ❖

^a Neuroethicist Harris argues that our understanding of the world, of human well-being in the world, and the ethics for maximizing such well-being, should derive not from philosophy but from the scientific study of the brain: “Whatever can be known about maximizing well-being of conscious creatures—which ... is the only thing we can reasonably value—must at some point translate into facts about brains and their interaction with the world at large.”^{6p11}

^b Wilson argues that this unification of knowledge is being spurred by the cognitive neurosciences: “As late as the 1970s most scientists thought the concept of mind a topic best left to philosophers. Now the issue has been joined where it belongs, at the juncture of biology and psychology. ... The cutting edge of the endeavors is cognitive neuroscience.”^{11p99}

^c Siegel considers the connection between multiple perspectives and metacognition, as follows: “Embracing multiple perspectives has the quality of a metacognitive skill. In the study of how we come to think about thinking, there are acquired capacities called representational ‘diversity’ and ‘change’ that enable individuals to sense that each of us may have a different perspective, and that even the viewpoint we have at one time may change in the future. In this metacognitive view we can then see perspective as not only a changing frame of reference but also one that needs to be considered in viewing the situationally embedded meaning of knowledge.”^{34p242}

^d Flavell⁴ refers to the “personal category” of metacognition as “thinking about cognitive differences within people, cognitive differences between people and cognitive similarities among all people.” He views this capacity as one of the “universal properties of human cognition.”

^e Ringleb and Rock describe this dilemma as follows: “[B]eing a good group member involves an awareness of one's thinking, feelings, behavior, and emotions with the ability to alter any one of those to satisfy group standards or expectations. ... Once the circuitry [of the brain] senses that the individual's actions have or may violate group standards and that other group members are evaluating them negatively, the individual needs the self regulatory ability to rectify the situation and re-establish or maintain group status.”^{40p372}

^f “Mindful practitioners use a variety of means to enhance their ability to engage in moment-to-moment self-monitoring, bring to consciousness their tacit personal knowledge and deeply held values, use peripheral vision and subsidiary awareness to become aware of new information and perspectives, and adopt curiosity in both ordinary and novel situations.”^{42p833}

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Glossary

Cognitive diversity: A term indicating the immense differences in brain function and cognitive “wiring” that exists between individuals. It has been estimated that the human brain contains some 100 billion neurons with trillions of synapses interconnecting these neurons. These connections are unique to each brain, resulting in an immense diversity in the way we think and respond to the world. Moreover, these connections are constantly forming and reforming, resulting in enormous plasticity that furthers increases this diversity.

Cognitive flexibility: The ability to switch cognitive sets in order to adapt to changing environmental stimuli.¹ Cognitive flexibility would determine how adaptively individuals can let go of preconceived and untenable ideas and beliefs, and their willingness to change their mind as new insights are gained.

Colloquium: Meaning “talking together” from the Latin *co + loquere*.

Deliberate practice: A concept advanced by Ericsson and colleagues,² referring to a form of practice that is not just routinely repetitive but carefully (“de-

liberately”) and proactively designed to improve performance, entailing focused attention to detail and ongoing feedback (often with a teacher’s or coach’s help). Deliberate practice may be undertaken in intellectual domains such as chess or learning a language, in music, in business-related activities, or in physical activities such as sports.

Emotional agility: A mindful, values-driven, and productive way of managing one’s thoughts and feelings.³

Emotional regulation: The ability to regulate changes in one’s emotions, control negative thoughts, and respond appropriately to a given context, and to modulate excitement, fear, and detachment in the face of challenge.

Learning agility: The willingness and ability to learn from experience and subsequently apply that learning to perform successfully under new or first-time conditions.⁴

Metacognition: Flavell⁵ initially defined this term as “one’s knowledge concerning one’s own cognitive processes and products or anything related.” More broadly, the

term refers to one’s ability to think about one’s thinking and emotions and, to some extent, predict what others are thinking and feeling. Flavell also uses another term, *metacognitive knowledge*, to describe knowledge that “consists primarily of knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises.”^{6p907}

Meta/neurocognition: I use these terms interchangeably to indicate how the field of metacognition is increasingly being informed by scientific findings in neuroscience and neurocognition.

Mindful learning: A concept originally proposed by Langer⁷⁻⁹ in which “learning is offered in a conditional format rather than as a series of absolute truths. ... [Mindful learning] consists of an openness to novelty; alertness to distinction; sensitivity to different contexts; [and] implicit, if not explicit, awareness of multiple perspectives; and orientation to the present.”

Mindfulness: Mindfulness in its most general sense is “about waking up from a life on automatic, and being sensitive to

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novelty in our everyday experiences."¹⁰ (Mindfulness in medicine should be distinguished from mindfulness as a form of meditation that entails an "emptying of the mind.")

Mindful practice: Epstein et al define *mindful practice* as the "conscious and intentional attentiveness to the present situation—the raw sensations, thoughts, and emotions as well as the interpretations, judgments, and heuristics that one applies to a particular situation."^{11p9}

Perspective taking: "A metacognitive capability that demands thinking about another's thoughts and feelings. ... Expert perspective-takers control their interpersonal interactions and relationships through mastery of empathy, patient education, and negotiation."^{12p32}

Professionalism: Professionalism in medical education may be viewed as a competency entailing such attributes and behaviors as responsibility, accountability, honesty, and caring, as well as the appropriate and ethical application of knowledge, in the relationship between doctor and patient.

Professional identity: The values, commitments, responsibilities, and particular contextual behaviors that members of a profession share at the level of the self and the group, and that creates a sense of belonging to the same group. From a metacognitive perspective, Quirk defines professional identity as "collective meta-cognition [that] significantly influences professional behavior ... [and that] requires the capabilities to reflect on, assess, and modify one's values, attitudes and behavior in relation to those of the profession."^{12p83}

Self-monitoring: The "ability to attend, moment to moment, to our actions; curiosity to examine the effects of those actions; and willingness to use those observations to improve behavior patterns and patterns of thinking in the future."^{11p5}

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