

History and the Mental Health Crisis: Preparing University Students to Live with Uncertainty through Authentic Research and Metacognition

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A MENTAL HEALTH CRISIS is sweeping across our college and university campuses. The 2017 American College Health Association *National College Health Assessment* survey of 26,139 undergraduates at fifty-two U.S. institutions of higher education found that 61.4% reported suffering from “overwhelming anxiety” over the preceding twelve months, 22.9% experienced difficulty in sleeping, 40.1% “felt so depressed that it was difficult to function,” and 12.9% had “seriously considered suicide.”¹ Graduate and professional students reported similarly staggering mental health concerns in a 2017 American College Health Association survey of 14,311 students at sixty-seven U.S. campuses: 57% of graduate students reported suffering from “overwhelming anxiety,” 36% from severe depression, and 6% had “seriously considered suicide” over the preceding twelve months.² These statistics appear generally to reflect international trends. Using clinically- validated scales, a 2018 survey of 2,279 graduate students enrolled in 234 institutions in twenty-six countries across all academic disciplines found that 41% “scored as having moderate to severe anxiety” and 39% “scored

in the moderate to severe depressive range,” compared to 6% of the general population.³ Undergraduate and graduate student women reported a significantly higher incidence of mental health issues than men, while first-generation and underrepresented students were least likely to seek help.⁴ Among both undergraduate and graduate students enrolled in American colleges and universities, anxiety was by far the most commonly reported mental health problem.⁵

Those students who sought treatment from their campus mental health professionals often had to wait for care. As Paul Barreira, former Director of Harvard University Health Service, commented in December 2018, Harvard could not hire enough counselors to meet its students’ needs:

Here we have 45 full-time-equivalent clinicians, or 55 people, for 20,000 students. That’s like one clinician for every 400 students. We’re overwhelmed, and that should tell us that the system is broken—that our approach to this has been wrong and needs to be rethought. And there are many programs that aren’t as fortunate as we are.⁶

This was a serious understatement. At underfunded public universities, the situation is much more dire: only five of the twenty-three campuses in the California State University system met the minimal standard set by the International Association of Counseling Services of one mental health counselor for every 1,500 students in 2018; on many CSU campuses, each counselor served 4,000 students. Nationally, across all public and private universities, the 2013 average ratio of mental health professionals to students was 1 to 1,600.⁷ A 2015 study of 43,210 undergraduates at seventy-two colleges across the U.S. estimated that only 20% to 40% of students struggling with mental health issues received treatment, with treatment rates lowest in large, public, non-residential institutions.⁸ Dr. Barreira’s call for wider faculty engagement with the mental health crisis on America’s college and university campuses seems both justified and urgent.⁹

As faculty advisors and mentors, we certainly all can and should learn to ask, listen, and direct troubled students to seek professional help. These students’ inability to learn, to “form and maintain good relationships with others,” and to “cope with and manage change and uncertainty” make “their debilitating psychological pain” the responsibility of all college and university educators.¹⁰ As professors, our genuine expressions of concern might at least warm any lingering “chilly climate” in our lecture halls.¹¹ Yet the statistics

above reveal that such general concern will not suffice to address the mental health crisis or the inadequate professional resources on our campuses to care for those we might refer. Our engagement as faculty must be deeper and more creative if it is to have any real impact. This paper attempts to open a conversation among historians teaching at colleges and universities across the nation about how we might use our special disciplinary and pedagogical expertise to help our students at all levels understand and deal with their anxiety.

It would be wise at the outset to acknowledge the limits of our possible intervention. First, we must guide suicidal and other severely troubled students to seek immediate professional assistance, and we must continue to press our universities to provide adequate mental health resources for them. We aspire to supplement, not to replace, these essential professional services. Second, we cannot hope to eliminate the anxiety that many students feel as they face the uncertainties of living away from home for the first time, interacting inside and outside the classroom with others with profoundly different life experiences and values, encountering a new level of academic challenges, and facing existential decisions about their future lives and careers. We live in uncertain times. The political polarization and incivility of our public discourse may well increase stress for many, and particularly for our students living on various sorts of borders. We must understand and respect the judgment of those who tell or show us that they feel too fragile to grapple with any or all these issues.¹² As faculty, we cannot remove our students' anxieties about the future. But perhaps we can use our content and pedagogical knowledge to prepare our moderately anxious students to live more comfortably with uncertainty.

The Neuroscience of Emotion and Learning

Theories of cognitive and epistemological development among college students offer some guidance as we seek to chart a course of action. According to the prevalent structural developmental theories, many college students move through three distinct cognitive stages marked by very different assumptions about the certainty, sources, and limits of knowledge. Initially, students enter college with a firm conviction that knowledge is the acquisition of clear, correct information conveyed by authorities, and they resist

lessons of ambiguity, complexity, multiplicity, and indeterminacy in favor of sharp dichotomies of “right” and “wrong.” These students often prefer STEM fields, objective tests, and lectures over humanistic disciplines, essays, and discussions—the uncertainty of which makes them “uneasy.”¹³ In the second stage of cognitive development, many college students recognize the existence of multiple or opposing views even among authorities, but see no way to judge between competing claims or resolve controversies beyond individual intuition. Alternately bewildered by the uncertainties that had displaced their earlier absolutist faith and encouraged to think independently, these students contend that all arguments and interpretations are just a matter of personal opinion and are thus equally valid.¹⁴ Only toward the end of their college careers (or later) do students start to understand that the social construction of meaning across all disciplines demands that they make judgments and act on intellectual commitments consonant with the evidence within specific contexts. Cognitive disequilibrium or dissonance between epistemological beliefs and educational experience sparks movement along this sequence, but development may be discontinuous or even recursive. The transition between each stage, varying in duration and difficulty for individual students, is often marked by resistance, discomfort, and anxiety.¹⁵

Recent studies in neuroscience support and complicate these cognitive developmental theories. Starting with the fundamental insight that all knowledge is physically embodied in the brain, neuroscience stresses the interactions and integration of mind, body, and environment.¹⁶ Learning and memory are largely unconscious physiological processes, part of a complex of systems in which approximately 100 billion nerve cells, or neurons, encode external stimuli and internal signals into electrochemical signals that are transmitted through 100 trillion synapses connected in multiple, parallel, nonlinear, distributed, and dynamic networks throughout the brain.¹⁷ Learning occurs within established neural structures in the brain, as learners connect new information to existing neuronal networks and memory traces. These established neuronal networks, created in response to past sensory experience and consolidated into long-term memory, cannot be removed on command. On the contrary, consolidated memories can be quite resistant to contradictory evidence or confusing new information, particularly

when it is abstract or conceptual (semantic) rather than physical or sensory (episodic).¹⁸ Frustration and anxiety, compounded by a struggle for or loss of control of the learning environment by the student, may result from this resistance.¹⁹

Yet attempting to eliminate or reduce emotions in the educational process would be counterproductive, because emotional experiences are ubiquitous, strongly influence behavior, and play a crucial role both in learning and in the creation and consolidation of memories. Generated for the most part unconsciously in neural systems that mediate interactions with the environment, emotions motivate behavior related to fundamental problems of survival. Whether they remain unconscious or become conscious feelings, emotions powerfully shape cognition—far more than conscious thought can control emotional reactions.²⁰ Chemical neuromodulators from the brain's positive and negative emotional centers produce some of the strongest enhancements for the growth of new synapses (a complicated process called neuroplasticity) and changes in neuronal networks that spark learning and modulate memory.²¹ Episodic memories linked to emotional experiences, particularly those that activate stress hormones, are the most vivid and enduring.²² Further, the deepest learning appears to follow active sensory experiences that produce confusion and uncertainty.²³ If we wish our students to advance more quickly along the cognitive trajectory toward accepting multiplicity and living with uncertainty, it appears that we must provide active sensory experiences rich in complexity and contradiction, while also helping students to understand and manage the resistance, frustration, and anxiety that often accompany such cognitive dissonance.

History and Uncertainty

Like other humanistic disciplines, history's epistemology and content are rich in complexity, multiplicity, and ambiguity. Twenty-first-century historians routinely include multiple perspectives and voices from the past in crafting our interpretations. Yet if history sets students adrift in a sea of possible interpretations, it also provides an anchor, as historians insist on supplying evidence to support our interpretations—even as we recognize that historical evidence is fragmentary and incomplete. Our epistemological orientation and

methods would appear to be ideally suited to help students appreciate complexity and indeterminacy without developing a nihilistic relativism that dismisses all interpretations as equally valid or invalid.

Further, our historical lessons can help students to contextualize contemporary economic uncertainty, social conflict, political polarization, and existential angst. History can teach them that failure and struggle are necessary (if painful) parts of life, through examples of wrenching paradigm shifts that ultimately enhanced our understanding of the physical world, or failed social and political revolutions with never-ending reverberations, or intellectuals (such as William James, Frank Lloyd Wright, Jane Addams, Henry James, or many others diagnosed with neurasthenia or “Americanitis” near the turn of the twentieth century) whose prolonged struggle with anxiety or depression led to stunning insights and emboldened others to confront their own demons.²⁴ Through the nascent history of emotions, students can situate their feelings within the shifting emotional dimensions of life in different times and places, the historical tensions between emotional expression and control, and the social and discursive construction of emotional experience “by particular interpretive communities.”²⁵ History can help our students steer between a naïve faith in inevitable progress and a desperate belief that nothing ever changes. It can guide them toward an appreciation of the creative power of uncertainty.

We must not allow our pedagogy to undermine these historical lessons about the value of uncertainty. As cognitive neuroscience has demonstrated and numerous experiments in STEM fields have confirmed, for deep learning to occur, our students must actively experience confusion and uncertainty as well as hear or read about it.²⁶ If we want them to weigh fragmentary evidence to decide between contradictory interpretations, we must not steer them firmly and inevitably toward the one we favor. We must decenter authority, even at the sacrifice of our own. Our classrooms must be lively sites of conflicting interpretations, informed by different perspectives among our students as well as among scholars, and not resolved at the end of the hour or the week or even the semester with an affirmation of one interpretation or perspective. We must disrupt the master narrative often promoted by textbooks and inadvertently reinforced by quizzes, examinations, and discussions guided toward predetermined ends. We must not offer beautiful, seamless lectures that mask our own

uncertainties and gaps in our knowledge; we must demonstrate that teaching, like learning, involves experimentation, risk, and failure. Indeterminacy must mark our pedagogy as well as our content.²⁷

Our students must also engage with these historical lessons of uncertainty outside of class, after the bell rings and the semester ends, if their learning is to be consolidated into long-term memories.²⁸ We must encourage them to connect past and present, feelings and thoughts, and their learning with their lives—without becoming overwhelmed by anxiety. Over the past two years, I launched two pedagogical experiments, varying in duration, design, and intensity, in my university history courses to address this crucial yet difficult task of extending students' cognitive development within and beyond the boundaries of the classroom. The first experiment immersed students in authentic, experiential learning involving uncertainty and cognitive dissonance, while providing a safe environment for taking epistemological risks. The second deepened and extended students' learning beyond individual assignments and courses through the development of habits of self-awareness, reflection, abstraction, and planning for self-regulated future learning.

“I Am a Postcolonial Subject”: Authentic, Embodied Research

Students in my upper-division and graduate courses encountered uncertainty most profoundly by engaging in semester-long, authentic historical research. For almost all the undergraduates and many of the graduate students, this was their first experience in conducting research that was not predetermined and predigested. To encourage risk-taking and to lessen their anxiety about failure (often most acute among the graduate students), I lowered the stakes by pledging at the outset that I would reward them for trying something new (whether a method, a type of source, a question, or an argument), even if it did not work out well. Those with similar topics formed small research groups (ideally, six to eight members) which met in the last few minutes of class and communicated virtually each week to share working bibliographies, to discuss evidentiary problems and brainstorm possible interpretations, and to read one another's draft questions, arguments, exposition and development sections, and conclusions. This followed a research process that I designed to

balance the freedom of content with a scaffolded structure. Toward the end of the semester, each research group created and delivered a thematically coherent collaborative presentation, within which individual group members presented their most compelling findings to the whole class. These smaller communities of scholars within a large class provided additional support networks for the more anxious students, and safe spaces in which all could experience cognitive confusion and growth.

Many students found the freedom to choose their own research topics for the first time quite challenging. Each of my courses provided only a very basic framework to guide this choice: for example, in a “Twentieth-Century Intellectuals and Society” course, students could select any Cold War or postcolonial intellectual from around the world; in “History of Childhood,” each student identified a central theme within one of four autobiographies to contextualize in relation to Chinese, Mexican, African American, or Eastern-European Jewish children in twentieth-century America. I responded to students’ anxious queries about whether a specific topic would work with a cheerful, “We’ll find out!” and offered ideas for possible connections that occurred to me as I would to a colleague, neither promising success nor demanding compliance with my suggestions. I expressed my hope that their research would reach beyond my areas of expertise and perspective, teaching us all something new. As they formulated research questions and searched for primary sources, some of which challenged or complicated their original hypotheses and most cherished convictions, students recognized and at times agonized over their inability to locate the truth about the past. Those who could not find sources had to modify their topics or approaches and learned that failure and changes of direction are a normal part of historical research. Their faith in the fixity and solidity of historical knowledge was shaken.

The rest of the research process underscored and deepened these initial lessons in historical indeterminacy. Engaging with the work of other scholars in order to join a live historiographical debate exposed the meta-discourse of contestation so often hidden in lecture courses and textbooks. These lessons in the politics and fragility of all constructed historical narratives were driven home as students presented drafts for peer review and heard different and even contradictory analyses of their evidence and critiques

of their conclusions. Overcoming their resistance to alternative interpretations, deciding which of the peer critiques to heed, and strategizing how to incorporate the insights from other students' research on related topics without losing their own voices as they revised, presented yet another series of challenges. Experiential learning convinced the most adamant objectivists that disciplinary perspectives, political views, and temperaments shape historians' judgments as they weigh fragmentary or contradictory evidence and decide among only partially satisfying interpretations.

Rather than lamenting the indeterminacy of historical research, I urged my students to embrace the freedom to shape their projects around their passions and to engage in embodied research, defining topics and exploring issues that intersected with their own or their families' lives and experiences. Modeling this approach, I confided that my interest in the history of childhood developed with the birth of my children, and that the twentieth-century intellectuals on our syllabus mirrored my own intellectual passions and journey in college.²⁹ We also practiced embodied discussion and writing throughout the semester: my students in both of these flipped courses kept individual reading journals of their thoughts and reactions (emotional as well as intellectual), and drew on these in our weekly seminar discussions, which strove to connect social/political contexts, individual lives, and texts. We ventured beyond the classroom together to attend theatrical, musical, dance, and visual arts events, and we allowed our multiple, personal, and often contradictory interpretations of these embodied performances to illuminate our more traditional historical sources. In our class discussions, we experimented with surrounding and interpreting our primary sources with diverse analytical methods to connect personal and political bodies and experiences (drawing on poststructuralist, feminist, and critical race theories) that might enlarge historians' palettes and advance embodied research. Finally, each small research group created and enacted a collaborative performance (such as dramatizing scenes from a memoir or role-playing their intellectuals in a real or imagined encounter) to frame and contextualize their individual research presentations; when a performance revealed personal dimensions of their topics that the group had not yet recognized or addressed, I introduced interdisciplinary research on embodied knowledge to validate and underscore their discoveries.³⁰

The students of color studying twentieth-century intellectuals and society with me in the Fall 2018 term felt both the desire and resistance to connect their lives and learning quite intensely. Many of these students met with me privately to voice their doubts and to be reassured that drawing on their own and their families' life experiences to interpret their postcolonial research subjects (and vice versa) would enrich our historical understanding. As the ethnically diverse group studying postcolonial intellectuals around the world presented their research-in-progress near the end of the semester, I noticed that each of them approached (but stopped just short) of discussing areas that connected directly with their lives. At the close of their group presentation, I commented that I sensed that they wished to focus on those areas and encouraged them again to do so, which they did with considerable success in their final papers. Even more remarkably, they also spoke of their personal and family histories as they presented their research to the university president, provost, deans, and faculty during a unique Open Conversation that we hosted for the university community in lieu of a final examination two weeks later. One Mexican American student noted, "It has been one of the few times where I actually accepted a challenge from a professor" and added that he had enjoyed sharing his stories: "I take pride in my background despite often being confused in which particular group I belong." Another first-generation Mexican American, the first in her family to attend high school and "usually guarded when it comes to my personal life," was grateful for "the opportunity to write something meaningful to me. I want you to know I am turning in a piece of my soul."³¹

These students were acutely conscious of the multidimensional transformation they had undergone. As a first-generation Mexican American senior commented after juxtaposing Gloria Anzaldúa's life and borderland theories with her own personal experiences on national and gender borders, "Never in all my 31 years had I felt so affirmed." Uncovering parallels between Deborah Miranda's *Bad Indian* and her own sense of dispossession and dislocation in her daily movements around our campus, a Kumeyaay senior reflected, "I feel like I grew as a scholar and a person this semester." Midway through his research on the relationship between decolonization and Filipino identity, a Filipino junior realized, "I am a postcolonial subject." A graduate student documenting the gentrification of his

neighborhood and exploring his own complicity in the displacement of working-class residents addressed the issue of anxiety directly: “I remain in existential dread about my life path, but have a new slew of fun & fascinating questions to work out, too, which is honestly the kind of thing that probably most sustains me anyways.”³²

Notably, those students who had resisted authentic, embodied research the longest also recorded the most significant growth. An African American senior wrestled with his own “conflicted feelings” for the first time in an academic setting as he connected Frantz Fanon’s psychology of terror with the contemporary experiences of African Americans, and “found that I have a lot to say about...how I was able to find my own identity and be comfortable in my own skin.” Noting, “I really opened up personally in this paper, which is something that I have never really done before. I am proud of how it turned out,” he explicitly tied this affective process to his cognitive development: “I do not believe I have ever been more cognitively stimulated as I have been in this course.” Another senior, who analyzed a Mexican sculptor’s images of scarred bodies to interpret the violence in his undocumented immigrant father’s life, wrote that this was “the first time I incorporated personal emotion into class work” and concluded simply, “It has been a very important semester for me.” After considerably more urging, seven of the eleven students in this postcolonial group decided to present their embodied research at the university’s Student Research Symposium the following semester, and four won research awards. One took first place in the statewide student research competition. Four of the undergraduates applied to graduate school to continue their explorations, despite the uncertainties surrounding that decision. For these students, conducting authentic, embodied historical research was a transformative experience that reached well beyond one course and one semester.

“To Gain a Greater Understanding of Myself”: Metacognition as a Path to Self-Knowledge and Control of Anxiety

To enhance and solidify these lessons in living with uncertainty, students in all my courses engage in frequent, ungraded metacognitive reflections. As they turn in a research prospectus or draft, complete an in-class activity, or prepare for a final essay examination, my students pause to reflect on what and how they have learned, the

strengths and weaknesses of their work, and what they wish to change or improve in the future. Like all authentic reflection, these exercises in exploring their own cognitive processes reinforce students' learning through retrieval, elaboration, and generation as they recall and invest recent memories with new meaning and context, and visualize alternatives.³³ They also enhance students' self-awareness and sense of responsibility and control of their learning, helping them to recognize the limits of their current knowledge, learn from their errors, and chart a path to future growth. If they become habitual, metacognitive reflections prepare students at all levels to face the future with greater confidence, to accept failure as a part of learning, to manage their anxiety, and to live with uncertainty.

Although the National Research Council called for "an emphasis on metacognition" across all disciplines in 2000, very few college and university instructors appear to have heeded this call.³⁴ Those who do include metacognitive assignments (mostly in STEM fields) often link them to formative assessments before a course unit or to "minute papers" at the end of a lecture. They tend to focus on procedural knowledge, such as students' understanding of specific tasks, and whether they know how to select the appropriate cognitive strategies to complete them.³⁵ For example, before a class session, students might be asked what they already know about the topic or how they could best prepare for the class. Before a quiz or exam, students respond to questions about their intended study strategies, the time they will allot to studying, and assessments of their current understanding of the course material. After a class session, students might try to summarize the content or the most confusing or "muddiest point"; after an objective test, they compare their responses with the correct ones provided on an answer key and analyze the source of their errors and how they could improve their test preparation strategies. Midway through the course, they might reflect on whether they are being systematic and organized in studying, or on what other learning resources or supports they could use.³⁶

Instructors in large STEM classes often embed metacognition in low-stakes graded assignments to induce students to complete them, but do not attempt to read or respond to them, although theorists stress the benefits of frequent feedback. Even so, metacognitive writing assignments and quiz self-corrections have improved test performance for both high- and low-achieving students in several

individual STEM courses, and one study found that metacognitive awareness correlated positively with overall academic success, as measured by self-reported grade point averages.³⁷ Further, as one comprehensive review of the research across STEM fields and levels concluded, students who can better understand and control their learning environments “typically learn more with less effort and report higher levels of academic satisfaction,” particularly in courses that feature multiple instructional strategies. Metacognition is a “central aspect of advanced cognitive development” and may even compensate for cognitive limitations in individual learners.³⁸

My metacognitive assignments differ from those described above in asking students to reflect explicitly on their feelings as well as their thoughts, and to compare their past experiences with their current learning as they plan for future growth. These emphases accord with neuroscientists’ findings about the crucial linkage of cognition and emotion in the anterior cingulate cortex, the apparent center of metacognition in the brain. Very recent research on this relatively unknown part of the brain indicates that its exceptionally large neurons orchestrate connections between emotional, sensory, decision making, and motor areas of the cortex. Thus, the metacognitive process might foster both cognitive and affective development by assisting us to “know what we think and how we feel about it” as well as “what we feel and what we think about that,” and to plan our future “executive” decisions and actions around this cognitive and affective self-knowledge.³⁹

As the first-year students in my Fall 2017 flipped General Education course on “American History to Reconstruction” prepared for their final essay examination (for which I gave them several possible essay prompts in advance), they responded in their online journals to two identical series of metacognitive queries spaced one week apart: “Which of the essay questions do you feel most confident about and why? Which do you feel most anxious about and why? What can you do to feel more confident about those questions?”⁴⁰ I encouraged the students to review their first set of answers in their online journals before writing the second set, and to comment on any changes they detected. I read each student’s reflections and offered brief comments, mostly to note positive changes or to suggest alternative study strategies. Although these metacognitive reflections were ungraded, 81 of my 148 students in Fall 2017 completed them, on the promise

that I would structure our review sessions around their responses and choose the final examination questions based on their input. By their own report, both the metacognitive reflections and the prospect that I would consider their preferences increased first-year students' sense of control of the learning environment and significantly reduced their anxiety going into their first college final examination.

After completing the essay examination, these students were invited to write a metacognitive wrap that addressed both their cognitive strategies and their feelings: "How did your preparation for this essay examination differ from the way you have studied for an exam in the past? How did those changes in the way that you studied affect your learning, and your feelings of confidence or anxiety? What did you learn about yourself and your learning that you can apply in the future?" The incentive for students to complete this metacognitive wrap was entirely intrinsic, but many did so immediately after reclaiming their phones and before leaving the final examination room. They seemed eager to share their relief and gratitude (and for some, surprise) that I actually had considered their preferences in selecting the essay questions that appeared on the final examination, and that they had felt "really ready" to write their final essays.⁴¹

Similarly, as my upper-division and graduate students turned in drafts of parts of their research papers for peer review, they wrapped them in metacognitive reflections. With slight variations from week to week, I asked about which aspects of their draft they felt most proud, about which they felt most anxious, and about how they could best meet the challenges of their research project and realize its full potential. At the end of the semester-long process, as they turned in their final research papers, they also reflected on what they considered most and least successful in their research and writing, how these processes differed from their previous experiences, and what they had learned about themselves as scholars and writers that might shape their future lives and learning.

Most of the students' thoughts reproduced in this article were voiced initially in written metacognitive reflections that punctuated and reinforced their other coursework. If they seem unusually self-aware and articulate, it is because they practiced these cognitive skills regularly. As they became more comfortable with metacognition and each other, my students also shared their reflections orally and spontaneously during and outside of class, which opened the

floodgates for other students' revelations about their thoughts and feelings. At the end of our semester together, I invited my students to reflect on the value and development of their metacognition itself (essentially, thinking about thinking about thinking). Many wrote that this was the most novel, transferable, and transformative aspect of their semester's learning.

First-year students in particular lauded their first experience with metacognition as "actually super beneficial" in helping them "to think critically about how I learn personally and create realistic goals for myself on how to succeed," to "visualize your goals for this subject which leads to a better chance in completing them," to "recognize where growth is available and feel more confident...because it shows me that I can do it if I practice enough," and to "make a goal of improvement." Metacognitive reflections allowed one particularly anxious student "to gain a greater understanding of myself." Feeling overwhelmed at times by the pace of their own cognitive change during their first semester in college, they were grateful to be "able to slow down and assess where I am," to trace "how I have changed from the beginning of this semester," and "to see how far I have come and how much I have learned!" As one student confessed:

Personally, I don't often take time to reflect upon things and having a built-in system really encouraged me to reflect on my overall goals in this class but also on other things in my life. I was able to think about my progress and what I still wanted to work on. This was really beneficial to me because I would most likely not take the time to do this on my own.

Some explicitly related a reduction in their level of anxiety to metacognitive reflections: "They are helpful because they let you get out all of your thoughts about something somewhat pressuring or stressful." Together, these cognitive and affective benefits made metacognition for students "one of my favorite activities" and "my new favorite thing!"⁴²

Indeterminacy and Creativity

The essay by modernist composer Morton Feldman entitled "Predeterminate/Indeterminate" recounts a moment of tremendous uncertainty in twentieth-century music, when "various elements (rhythm, pitch, dynamics, etc.) were decontrolled" and lost "their

initial, inherent identity.” Traditional formal relationships and compositional unity became impossible, letting loose apocalyptic predictions among modernism’s critics: “It follows then, that an indeterminate music can lead only to catastrophe. This catastrophe we allowed to take place. Behind it was sound—which unified everything.”⁴³

In strikingly similar terms, cognitive scientists describe the “Cartesian anxiety” awakened in many by the collapse of cognitive realism and René Descartes’ mind/body dualism upon which it depends:

The anxiety is best put as a dilemma: either we have a fixed and stable foundation for knowledge, a point where knowledge starts, is grounded, and rests, or we cannot escape some sort of darkness, chaos, and confusion. Either there is an absolute ground or foundation, or everything falls apart.⁴⁴

If the mind creates the world even as the world creates the mind, in dynamic interdependence “via the living body,” there is no longer any fixed origin or foundation of knowledge; world and self, body and mind, reason and emotion, objectivity and subjectivity all lose their stability as independent, opposing poles. The realist’s “craving for an absolute ground,” manifested in dualistic oscillations between “opposed subjective and objective poles” of mind and world, emotion and reason, is irreparably undermined by the emerging paradigm of interdependent, dynamic embodied cognition—and its fluid unity might be this new paradigm’s ultimate promise. Escaping Descartes’ error, long inscribed in hierarchical social and epistemological/metaphysical dualisms, may free us to explore the complex interplay of feelings and thought, and open a liminal space for embodied creativity of all kinds.⁴⁵

Our students’ psychological distress reveals their anxiety about the “darkness, chaos, and confusion” accompanying the collapse of stable epistemological categories and cognitive certainty that they experience during their undergraduate and graduate years. As their mentors and teachers, perhaps we can play a greater role in guiding them to the discoveries just beyond the “catastrophe” they fear when “everything falls apart.” Historical content and epistemology, reinforced by “decontrolled” pedagogical experiments with authentic, embodied research and metacognition, might help our students to embrace the creative possibilities of indeterminacy, and learn to live more comfortably in an uncertain world.

Notes

This article is dedicated to my daughters, Anna Kornfeld Simpson and Sara Kornfeld Simpson, with profound gratitude for their encouragement and wisdom.

1. American College Health Association, *American College Health Association-National College Health Assessment II: Reference Group Undergraduates Executive Summary Fall 2017* (Hanover, MD: American College Health Association, 2018), 18, 5, 14.

2. American College Health Association, *American College Health Association-National College Assessment II: Reference Group Graduates Executive Summary Spring 2017* (Hanover, MD: American College Health Association, 2017), 14.

3. Theresa M. Evans, Lindsay Bira, Jazmin Beltran Gastelum, L. Todd Weiss, and Nathan L Vanderford, "Evidence of a Mental Health Crisis in Graduate Education," *Nature Biotechnology* 36 (March 2018): 282-284. Forty percent of the respondents were in science or engineering, and 56% in the humanities or social sciences (p. 282).

4. According to the National Alliance on Mental Illness, women are twice as likely to experience depression as men; see Darcy Gruttadaro and Dana Crudo, *College Students Speak: A Survey Report on Mental Health* (Arlington, VA: National Alliance on Mental Illness, 2012), 6. The Center for Collegiate Mental Health, *2016 Annual Report* (Publication No. STA 17-74, January 2017), summarizing mental health treatment sought by 150,483 students at 139 college and university counseling centers among its 400 institutional members in 2016, reported that 63% of those treated were women, 68% were white, and only 22.5% were first-generation students (pp. 13-16). Whether these self-reported statistics are skewed by response bias is unclear, but they are consistent across multiple studies.

5. The much greater incidence of anxiety—almost 20% higher—among American students at all levels is the most significant difference from the international situation presented in Evans et al., "Evidence of a Mental Health Crisis."

6. Colleen Flaherty, "A Very Mixed Record on Grad Student Mental Health," *Inside Higher Ed*, 6 December 2018.

7. Mimi Bommersbach, "The CSU Needs to Respond to the Growing Crisis in Delivering Student Mental Health Needs," *Special Report: Counselors* (California Faculty Association, October 2017); International Association of Counseling Services, "Statement Regarding Recommended Staff to Student Ratios," February 2019.

8. Sarah Ketchen Lipson, S. Michael Gaddis, Justin Heinze, Kathryn Beck, and Daniel Eisenberg, "Variations in Student Mental Health and Treatment Utilization across U.S. Colleges and Universities," *Journal of American College Health* 63, no. 6 (2015): 388-396.

9. Flaherty, "A Very Mixed Record." The Johns Hopkins University, *Task Force on Student Mental Health and Well-Being* (February 2018), similarly concluded that "improving student mental health must be a university-wide effort" involving "students, faculty, and staff at all levels" (p. 5).

10. Paul Barreira, Matthew Basilico, and Valentin Bolotnyy, “Graduate Student Mental Health: Lessons from American Economics Departments,” Working Paper, Harvard University, 4 November 2018, 9.

11. Ernest T. Pascarella et al., “Women’s Perceptions of a ‘Chilly Climate’ and Their Cognitive Outcomes during the First Year of College,” *Journal of College Student Development* 38, no. 2 (March-April 1997): 109-124; Daniel W. Salter, “Exploring the ‘Chilly Classroom’ Phenomenon as Interactions between Psychological and Environmental Types,” *Journal of College Student Development* 44, no. 1 (January-February 2003): 110-121.

12. Elif Shafak, *Three Daughters of Eve* (New York: Bloomsbury, 2017), powerfully dramatizes the dangers of pushing psychologically fragile students (particularly those who must overcome personal or cultural barriers to attend college) beyond their expressed limits to shed the “mantle” of certainty (p. 248).

13. In a classic statement of this cognitive position, one college student struggled to articulate his anxiety over epistemological uncertainty: “I don’t particularly care for humanities, English or stuff. There’s a lot of—the answers are—they can vary. There’s no right or wrong answer. I like things where there’s a right answer. Like in chemistry, there’s a right answer, but in other classes there’s not. I guess it could be easier if there’s not a right answer, but I feel uneasy in classes like that.” Marcia B. Baxter Magolda, *Knowing and Reasoning in College: Gender-Related Patterns in Students’ Intellectual Development* (San Francisco, CA: Jossey-Bass, 1992), 106. Another student concluded without a trace of irony, “Science is not a creation of the human mind.” Mary Field Belenky, Blythe McVicker Clinchy, Nancy Rule Goldberger, and Jill Mattuck Tarule, *Women’s Ways of Knowing: The Development of Self, Voice, and Mind* (New York: Basic Books, 1986), 216.

14. Multiplicity and uncertainty strike some students as an epistemological earthquake: “I don’t set anything that I feel in cement, which is what I did before. I’ve found that my foundations completely crumbled out from under me, and I had to rebuild them for myself.” Baxter Magolda, *Knowing and Reasoning in College*, 137. Isolation and solipsism may result: “Everything’s relative; there’s no truth in the world—that sort of thing. So I’ve decided that the only person that you can really depend on is yourself. Each individual has their own truth. No one has the right to decide, ‘This has to be your truth, too.’” Baxter Magolda, *Knowing and Reasoning in College*, 136.

15. William G. Perry, Jr., *Forms of Intellectual and Ethical Development in the College Years: A Scheme* (Troy, MO: Holt, Rinehart & Winston, 1970), first advanced this dominant model of cognitive development through longitudinal interviews with male students at Harvard College. He grouped six positions commonly held by undergraduates into a hierarchical sequence of three general epistemological attitudes (ascending from dualism to multiplicity to relativism), with another three positions taking shape as a more advanced form of relativism (relativism with commitment) only after graduation. In comparison, Belenky, Clinchy, Goldberger, and Tarule in *Women’s Ways of Knowing*, through extended interviews with ninety female students in six colleges, confirmed and modified this sequential model to include four collegiate epistemological

perspectives (received, subjective, procedural, and constructed knowledge) roughly corresponding to Perry's three stages. Recent studies have probed the nature and timing of the transitions within the developmental sequence: Baxter Magolda in *Knowing and Reasoning in College* covered a five-year longitudinal study of 100 privileged college students and found that only 2% of seniors and 12% of graduates in the most advanced "contextualist" position were able to construct an independent perspective by judging evidence in context (p. 72); Deanna Kuhn, Richard Cheney, and Michael Weinstock, "The Development of Epistemological Understanding," *Cognitive Development* 15, no. 3 (July-September 2000): 309-328, argued that the transitions can be quite extended, and that some individuals might not reach the final developmental stage until well into adulthood. In underscoring learners' resistance to epistemological challenges and discordant educational experiences, Barbara K. Hofer and Paul R. Pintrich, "The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and their Relation to Learning," *Review of Educational Research* 67, no. 1 (Spring 1997): 88-140, suggested that "individuals may retreat to safer, more established positions when in new environments and that there may be affective issues involved, such as the effects of anxiety and negative feelings associated with challenges to strongly held ideas" (p. 122). They called for qualitative studies of the affective dimensions of cognitive development, particularly in potentially recursive or "discontinuous" transitional periods, as well as more racial and cultural diversity in the empirical studies of epistemological and cognitive theories (pp. 129-130, 132). These theories have yet to be tested across varying social and institutional contexts, or among first-generation, working, and other non-traditional students.

16. Hillel J. Chiel and Randall D. Beer, "The Brain Has a Body: Adaptive Behavior Emerges from Interactions of Nervous System, Body, and Environment," *Trends in Neurological Science* 20, no. 12 (December 1997): 553-556. In his "Introduction to the Revised Edition" of Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, revised ed. (Cambridge, MA: The MIT Press, 2016), co-author Evan Thompson notes that over the last twenty years, cognitive science has discovered that "the processes that bring about our experience of the world, including our sense of self, are dynamical, distributed in time and space, and extend across the complex couplings of the brain, the rest of the body, and the environment" (p. xx). Contra René Descartes' pervasive mind/body dualism, this new "embodied cognition paradigm" recognizes that "cognition and world are interdependently originated via the living body" (p. xxvi). George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought* (New York: Basic, 1999), describe the "neural embodiment" of both "perception" and "conception" in the embodied mind: "the very properties of concepts are created as a result of the way the brain and body are structured and the way they function in interpersonal relations and in the physical world" (pp. 36-37). For example, "basic-level concepts depend on motor movement, gestalt perception, and mental imagery, which is carried out in the visual system of the brain"; color concepts are shaped "by such physical parts of our bodies as color cones and neural circuitry";

and “spatial-relations concepts like *front* and *back*” are characterized “in terms of bodily orientation. In these cases, the body is not merely somehow involved in conceptualization but is shaping its very nature” (p. 37).

17. Lakoff and Johnson in *Philosophy in the Flesh* use the term “cognitive unconscious” to emphasize that at least 95% of human thought “operates beneath the level of cognitive awareness, inaccessible to consciousness and operating too quickly to be focused on.” The cognitive unconscious “shapes and structures all conscious thought” by framing “all of our knowledge and beliefs” through an “unconscious conceptual system” that “shapes how we automatically and unconsciously comprehend what we experience” (pp. 10, 13).

18. James E. Zull, *The Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning* (Sterling, VA: Stylus, 2002), notes that “whatever the neuronal networks are in the student brain, a teacher cannot remove them” (p. 101). Correcting or challenging a student’s erroneous information serves only to strengthen it, by reinforcing the existing neuronal networks through repetition. More effective teaching connects with and builds on these existing networks, creating neuronal change (plasticity) through new sensory experiences (p. 115).

19. Cognitive challenges, like physical dangers, may trigger automatic emotional and physical responses initiated by the amygdala, the brain’s emotional center for fear. See James E. Zull, *From Brain to Mind: Using Neuroscience to Guide Change in Education* (Sterling, VA: Stylus, 2011), 71-73.

20. Joseph LeDoux, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (New York: Simon & Schuster, 1996), 125, 12, 17, 19. From his decades of laboratory studies of the functions of the amygdala, LeDoux concludes: “While conscious control over emotions is weak, emotions can flood consciousness. This is so because the wiring of the brain at this point in our evolutionary history is such that connections from the emotional systems to the cognitive systems are stronger than connections from the cognitive systems to the emotional systems” (p. 19).

21. James L. McGaugh, *Memory and Emotion: The Making of Lasting Memories* (New York: Columbia University Press, 2003), 79, 103, 110.

22. Elizabeth A Phelps, “Human Emotion and Memory: Interactions of the Amygdala and Hippocampal Complex,” *Current Opinion in Neurobiology* 14, no. 2 (April 2004): 198-202; Sarah Rose Cavanagh, *The Spark of Learning: Energizing the College Classroom with the Science of Emotion* (Morgantown, WV: West Virginia University Press, 2016), 212; James L. McGaugh, “Consolidating Memories,” *Annual Review of Psychology* 66 (January 2015): 8, 14-15. Drawing on his fifty years of research on the effects of chemicals on memory, McGaugh emphasizes the positive role of stress hormones in consolidating episodic memory: “Stress hormones appear to help create lasting memories of events by influencing amygdala activity over a longer time scale, thus making stronger memories of series of experiences that, together, constitute an event or episode.” McGaugh, *Memory and Emotion*, 110. Prolonged or severe stress, however, can damage the hippocampal system, inhibiting the formation of conscious, semantic memories. LeDoux, *Emotional Brain*, 242-246.

23. Sidney D'Mello, Blair Lehman, Reinhard Pekrun, and Art Graesser, "Confusion Can be Beneficial for Learning," *Learning and Instruction* 29 (February 2014): 153-170, a meta-analysis of twenty-one separate studies, finds a strong positive correlation between confusion and deep learning. See also Ken Bain, *What the Best College Teachers Do* (Cambridge, MA: Harvard University Press, 2004), 27-31.

24. David G. Schuster, *Neurasthenic Nation: America's Search for Health, Happiness, and Comfort, 1869-1920* (New Brunswick, NJ: Rutgers University Press, 2011); Paul Stephens, *The Poetics of Information Overload: From Gertrude Stein to Conceptual Writing* (Minneapolis, MN: University of Minnesota Press, 2015), 41. William James popularized the term "Americanitis" for neurasthenia (also called "nervous exhaustion"), with which he suffered by the time he entered Harvard at age 19, to emphasize the "social" roots of "American over-tension" in the rapid pace and overstimulation of modern American life. William James, "The Gospel of Relaxation," in *Writings, 1878-1899*, ed. Gerald E. Myers (New York: Library of America, 1992), 832. See also William James, "What is an Emotion?" *Mind* 9 (1884): 188-205. His insights into the psychology of emotion, informed by his long struggle with depression and thoughts of suicide, opened "the modern era in emotion research" in the view of contemporary neuroscientists according to LeDoux, *The Emotional Brain*, 44. The uncanny anticipation of some aspects of our contemporary mental health crisis in neurasthenia's widespread diagnosis among intellectuals and emphasis on cultural causation makes it a compelling focus of discussion for our students, but the particular examples we select may be less significant than our willingness to acknowledge the historical and contemporary reality and normalize the discussion of mental health struggles. See Sam Wineburg, "Sam Wineburg: Dealing with Depression," YouTube video, 3:12, 31 March 2015, StanfordResilience, <<https://www.youtube.com/watch?v=iPRPI3XXjr8>>, for a courageous attempt to destigmatize the discourse surrounding depression.

25. Peter N. Stearns and Jan Lewis, eds., *An Emotional History of the United States* (New York: New York University Press, 1998), 8.

26. See Zull, *From Brain to Mind*, for the neurobiological importance of active learning: talking, writing, and other forms of action test symbolic language against neuronal patterns generated by a lifetime of sensory experiences, unlocking the knowledge and understanding "hidden within our stored images" (p. 149); the danger of relying on "memorized language as the primary way to define or explain things" is that "we may end up believing that we have the right image, when all we have are the symbols" (p. 150). Scott Freeman, Sarah L. Eddy, Miles McDonough, Michelle K. Smith, Nnadozie Okoroafor, Hannah Jordt, and Mary Pat Wenderoth, "Active Learning Increases Student Performance in Science, Engineering, and Mathematics," *Proceedings of the National Academy of Sciences USA* 111, no. 23 (2014): 8410-8415, a meta-analysis of active-learning experiments in 225 STEM college courses, offers overwhelming quantitative evidence of the superior effectiveness of active learning and concludes: "If the experiments analyzed here had been conducted as randomized controlled trials of medical interventions, they may have been

stopped for benefit—meaning that enrolling patients in the control condition [traditional lecture courses] might be discontinued because the treatment being tested was clearly more beneficial” (p. 8413).

27. Anne F. Hyde, “Plagued by Doubt: Uncertainty as History’s Pedagogy,” keynote address at the Texas Conference on Introductory History Courses, September 28, 2018, Austin, Texas, advances a similar argument about the fundamental mismatch between history’s epistemology and practice of relying on lectures and textbooks. Video of speech at Anne Hyde, “Anne Hyde’s ‘Plagued By Doubt: Uncertainty as History’s Pedagogy,’” YouTube video, 1:32:27, 11 September 2019, historiansorg, <<https://www.youtube.com/watch?v=8zDHIq6LjLQ>>. See also Lendol Calder, “Uncoverage: Toward a Signature Pedagogy for the History Survey,” *Journal of American History* 92, no. 4 (March 2006): 1358-1370; Joel M. Sipress and David J. Voelker, “The End of the History Survey Course: The Rise and Fall of the Coverage Model,” *Journal of American History* 97, no. 4 (March 2011): 1050-1066; Sam Wineburg, *Historical Thinking and Other Unnatural Acts: Charting the Future of Teaching the Past* (Philadelphia, PA: Temple University Press, 2001); and Sam Wineburg, *Why Learn History (When It’s Already on Your Phone)* (Chicago, IL: The University of Chicago Press, 2018), for other trenchant critiques of traditional historical pedagogies.

28. The consolidation of memories depends not only on the intensity of the original emotional experiences, but also on spaced repetition, retrieval practice, and active manipulation, to move the memories from working memory to long-term memory. See Peter C. Brown, Henry L. Roediger, and Mark A. McDaniel, *Make It Stick: The Science of Successful Learning* (Cambridge, MA: Harvard University Press, 2014); Zull, *From Brain to Mind*, 182-184.

29. Belenky, Clinchy, Goldberger, and Tarule in *Women’s Ways of Knowing* locate such “passionate knowing” at the apex of women’s cognitive and epistemological development among constructivists “who enter into a union with that which is to be known” and “learn to use the self as an instrument of understanding” others and the world, “weaving their passions and intellectual life into some recognizable whole” (p. 141). In a remarkable recent example of this approach, Emily Bernard, *Black Is the Body: Stories from my Grandmother’s Time, My Mother’s Time, and Mine* (New York: Knopf, 2019), draws upon the knowledge inscribed on African American women’s bodies (scars of a random knifing, fleeing white rapists, being pelted by rocks in Jim Crow Mississippi, exoticization and invisibility, braiding and flattening hair, creating sisterhood, and intergenerational mothering) in personal and family narratives to recover the complex “choreography of race relations” (p. 168) and identities in America over three generations.

30. Ben Spatz, *What a Body Can Do: Technique as Knowledge, Practice as Research* (London, United Kingdom: Routledge, 2015), starting from the assumption that “mind is an emergent property of body, just as body is the material basis for mind,” defines embodied knowledge as encompassing “everything that bodies can do” or learn: “In addition to the physical, this space of possibility includes much that we might categorize as mental, emotional, spiritual, vocal, somatic, interpersonal, expressive, and more” (p. 11). Drawing on Pierre Bourdieu’s concept of “habitus” as “embodied history,” as well as Judith Butler’s distinction

between individual performance and normative “performativity,” Spatz envisions embodied research as “a continuous and mutually constituting transformation, back and forth, between the two categories of conscious and unconscious knowledge, or what one *has* (knowledge) and what one *is* (identity)” (p. 51). Such “embodied research... opens new pathways in how we live our lives” (p. 165). Similarly, in delineating the powerful, “rejuvenating” impact of neuroscience on embodied research across disciplines, John Cromby, Tim Newton, and Simon J. Williams, “Neuroscience and Subjectivity,” *Subjectivity* 4 (2011): 215-226, argue that “in the humanities and social sciences, scholars are embracing more of the embodied and material dimensions of subjectivity,” as “the turn to affect” informs “interests in emotion, bodies, materiality, performance and practice” and “conceptual development in relation to selfhood, agency and morality” (pp. 217-218). They conclude that the biological and social “continuously interpenetrate” in the multidisciplinary search for subjectivity (p. 224).

31. These students’ caution about revealing their own and their families’ histories was not merely academic; living and working on a campus just sixteen miles from the U.S.-Mexico border, the political discourse concerning walls, deportation, and detention camps was particularly chilling for us in Fall 2018.

32. The comments above and those in the paragraph below were written by undergraduate and graduate students in ungraded reflections at the conclusion of my “Twentieth-Century Intellectuals and Society” course in Fall 2018. Notably, none of the students wrote a negative evaluation of their experience with authentic, embodied research.

33. Brown, Roediger, and McDaniel, *Make It Stick*, 27, 89. Very few college students (approximately 11%) are aware of the efficacy of retrieval practice in improving learning and memory, and few will practice retrieval even after personally witnessing its effectiveness, according to two recent studies: see Jeffrey D. Karpicke, Andrew C. Butler, and Henry L. Roediger III, “Metacognitive Strategies in Student Learning: Do Students Practise Retrieval when They Study on their Own?” *Memory* 17, no. 4 (2009): 471-479; and Jeffrey D. Karpicke, “Metacognitive Control and Strategy Selection: Deciding to Practice Retrieval during Learning,” *Journal of Experimental Psychology: General* 138, no. 4 (November 2009): 469-486.

34. National Research Council, *How People Learn: Brain, Mind, Experience, and School*, ed. John D. Bransford, Ann L. Brown, and Rodney R. Cocking (Washington, DC: National Academies Press, 2000), 21.

35. Deanna Kuhn, “A Developmental Model of Critical Thinking,” *Educational Researcher* 28, no. 2 (March 1999): 16-25, calls this emphasis on procedural self-knowledge “meta-strategic” thinking, and reserves the term “metacognition” for declarative self-knowledge, in which learners ask “What do I know, and how do I know it?” (p. 18). The latter form of meta-thinking may be more important in the humanities.

36. Anat Zohar and Adi Ben David, “Paving a Clear Path in a Thick Forest: A Conceptual Analysis of a Metacognitive Component,” *Metacognition and Learning* 4, no. 3 (December 2009): 177-195; Kimberly D. Tanner, “Promoting Student Metacognition,” *CBE Life Sciences Education* 11, no. 2 (Summer 2012): 113-120.

37. Michelle Mynlieff, Anita L. Manogaran, Martin St. Maurice, and Thomas J. Eddinger, "Writing Assignments with a Metacognitive Component Enhance Learning in a Large Introductory Biology Course," *CBE Life Sciences Education* 13, no. 2 (Summer 2014): 311-321; Nathan V. Dang, Jacob C. Chiang, Heather M. Brown, and Kelly K. McDonald, "Curricular Activities that Promote Metacognitive Skills Impact Lower-Performing Students in an Introductory Biology Course," *Journal of Microbiology and Biology Education* 19, no. 1 (2018): 1-10; Charles Henderson and Kathleen A. Harper, "Quiz Corrections: Improving Learning by Encouraging Students to Reflect on their Mistakes," *Physics Teacher* 47, no. 9 (December 2009): 581-586; Savia A. Coutinho, "The Relationship between Goals, Metacognition, and Academic Success," *Educate* 7, no. 1 (2007): 39-47.

38. Gregory Schraw, Kent J. Crippen, and Kendall Hartley, "Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning," *Research in Science Education* 36, no. 1 (March 2006): 111-139, quotation on 111; David Moshman, "Cognitive Development beyond Childhood," in *Handbook of Child Psychology: Cognition, Perception, and Language*, ed. Deanna Kuhn and Robert S. Siegler, fifth ed. (New York: Wiley, 1998), 947-978, quotation on 963; Marcel V. J. Veenman, Bernadette H. A. M. Van Hout-Wolters, and Peter Afflerbach, "Metacognition and Learning: Conceptual and Methodological Considerations," *Metacognition and Learning* 1 (2006): 3-14.

39. John M. Allman, Atiya Hakeem, Joseph M. Erwin, Esther Nimchinsky, and Patrick Hof, "The Anterior Cingulate Cortex: The Evolution of an Interface between Emotion and Cognition," *Annals of the New York Academy of Sciences* 935, no. 1 (May 2001): 107ff; Zull, *From Brain to Mind*, 274, 280.

40. I space these reflections a week apart, both to entice students to start preparing early for the final and to accord with the findings of cognitive science that spaced practice is more effective in consolidating learning than massed practice. In some cases, the process of consolidation into long-term memory requires several days, as well as sleep—a precious commodity for first-year students during final examinations! See Brown, Roediger, and McDaniel, *Make It Stick*, 49.

41. For more on metacognitive wraps or wrappers, see Linda B. Nilson, *Creating Self-Regulated Learners: Strategies to Strengthen Students' Self-Awareness and Learning Skills* (Sterling, VA: Stylus, 2013), 13.

42. These comments are representative samples from more than 300 ungraded final metacognitive reflections written by students enrolled in my 100-level General Education "American History to Reconstruction" course in Fall 2017 and Spring 2018.

43. Morton Feldman, "Predeterminate/Indeterminate," in *Give My Regards to Eighth Street: Collected Writings of Morton Feldman*, ed. B. H. Friedman (Cambridge, MA: Exact Change, 2000), 35.

44. Francisco J. Varela, Evan Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience*, revised ed. (Cambridge, MA: The MIT Press, 2016), 140.

45. Varela, Thompson, and Rosch, *The Embodied Mind*, 140-143, xxvi. Drawing upon his extensive laboratory experiences with neurological patients, Antonio R. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Putnam, 1994), presents a "somatic-marker hypothesis" that postulates "that human reason depends on several brain systems, working in concert across many levels of neuronal organization," including "lower-level" brain centers "that regulate the processing of emotions and feelings, along with the body functions necessary for an organism's survival. In turn, these lower levels maintain direct and mutual relationships with virtually every bodily organ, thus placing the body directly within the chain of operations that generate the highest reaches of reasoning, decision making, and, by extension, social behavior and creativity. Emotion, feeling, and biological regulation all play a role in human reason. The lowly orders of our organism are in the loop of high reason" (pp. xiii, 200). Yet, Damasio insists, acknowledging that the body "may constitute the indispensable frame of reference for the neural processes that we experience as the mind" (p. xvi) will not "cheapen the ethical principle. The edifice of ethics does not collapse, morality is not threatened, and in a normal individual the will remains the will" (p. xiv). Although "the view of the human spirit" proposed by neuroscience "may not be intuitive or comforting," and Cartesian dualists may regard the complex interactions and interdependence of organism and environment, reason and emotion, body and mind, as "degrading," Damasio resists apocalyptic fears of the "collapse" of reason: "Precisely the opposite should be true: Our sense of wonder should increase before the intricate mechanisms that make such magic possible. Feelings form the base for what humans have described for millennia as the human soul or spirit" (pp. xv-xvi). Viewing the mind as part of "an integrated organism" developing through "the interplay of body and brain" promises to create a new (if as yet indeterminate) unity, in which "love and hate and anguish, the qualities of kindness and cruelty, the planned solution of a scientific problem or the creation of a new artifact are all based on neural events within a brain, provided that brain has been and now is interacting with its body. The soul breathes through the body" (pp. xvi-xvii).



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