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Philosophical Topics, Volume 49, Number 2, Fall 2022, pp. 17-34 (Article)

Published by University of Arkansas Press



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Beyond the Information Given: Teaching, Testimony, and the Advancement of Understanding

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ABSTRACT. Teaching is not testimony. Although both convey information, they have different uptake requirements. Testimony aims to impart information and typically succeeds if the recipient believes that information on account of having been told by a reliable informant. Teaching aims to equip learners to go beyond the information given—to leverage that information to broaden, deepen, and critique their current understanding of a topic. Teaching fails if the recipients believe the information only because it is what they have been told.

Electrons have negative charge; Napoleon was defeated at Waterloo; *Homo sapiens* evolved from *Homo erectus*; Paris is the capital of France. So we were taught; so, in consequence, many of us learned. In the literature on the epistemology of testimony, it is taken for granted that the teaching of such facts consists in testimony (see Adler 2002). It is widely held that we came to believe, indeed to know, that electrons have negative charge because a teacher who knew that fact testified—that is, told us—that it was so, and we properly uptook his testimony. This, epistemologists say, is obvious. Indeed, Nickel and Carter consider such classroom-gleaned knowledge to be ‘paradigmatically proper testimonial knowledge’ (2014). I will

argue that, paradigmatic or not, this is incorrect. Teaching and testimony are distinct. Although both testimony and the teaching of matters of fact involve conveying information, they function differently. Their epistemic profiles diverge. Here I am concerned not so much about how this bears on the epistemic character of testimony as how it bears on the epistemic character of teaching and of the learning that results from being taught. In making my argument, I draw on familiar pedagogical practices. I take it for granted that those practices properly align with their ends.

TESTIMONY

As standardly used in epistemology, the term ‘testimony’ denotes a type of intentional information transfer. We human beings perforce rely on one another for information that we cannot get for ourselves. Testimony emerged as a way to efficiently and systematically convey such information. In the prototypical case, an informant imparts information to an audience with the aim of having it believed. The act of testifying is successful only if the audience believes the information as a result of the informant’s intentionally imparting it. So far this concerns only the cause of coming to believe. Testimony is epistemically significant because the testifier not only imparts information, she makes it reasonable for the audience to believe that information. Testimony conveys epistemic entitlement. The testifier not only presents the information as true, she vouches for it. If she is to be trusted, then unless they have defeaters, the audience can come to know (or at least be justified in believing) the information thus conveyed.

The structure of the testimonial exchange should be spelled out more fully. Let S be the testifier, H be the recipient, and p be an informative statement. In an epistemically felicitous case of testimony,

- 1) S knows that p .
- 2) S presents herself as someone who knows whether p .
- 3) S asserts that p .
- 4) S intends that H believe that p in consequence of her asserting that p .
- 5) H hears or reads S ’s assertion.
- 6) H correctly grasps the content and force of the assertion. (That is, he both understands the content and understands that the utterance or inscription is an assertion rather than some other speech act.)
- 7) H recognizes that S is presenting herself as someone who knows whether p .
- 8) H takes S ’s assertion as sufficient reason to believe that p .

Then: since p is true (which follows from the fact that S knows that p),
if H has no defeaters
and comes to believe that p on the basis of S 's say-so,
 H knows that p .

In that case, H 's knowledge that p is grounded in the fact that he properly uptakes the information that p from a knower.

Giving directions is often presented as a quintessential case of conveying knowledge via testimony. Suppose Sally tells Harry that Alewife Station is on the Red Line. She is, and presents herself as, an epistemically competent informant. She supplies the information in a way that makes it plain that she takes herself to know what she is talking about. Grasping the content and force of her utterance—that is, appreciating that her utterance is an assertion to the effect that Alewife is on the Red Line—Harry takes her at her word. Since there is nothing sinister about the encounter and nothing tentative about Sally's utterance—nothing, that is, that would or should lead Harry to fear being misled—her assertion gives him good reason to believe that Alewife is on the Red Line. Her assertion is true and he has no defeaters, so he knows that Alewife is on the Red Line. Testimony like this is an everyday means of coming to know.

Several aspects of this exchange are worth noting. First, Harry's acquisition of knowledge here is not cognitively costly. He did not have to do much to gain epistemic entitlement to the information Sally conveyed. Nor did Sally have to do much to convey the information and the epistemic entitlement to it.¹ Perhaps significant effort was required for the original source of the information to come by it in the first place. But the transfer from Sally to Harry was easy. Second, the epistemic affordances Harry gains are fairly narrowly circumscribed. He can use the very bit of information he gleaned with confidence. If he wants to go to Alewife, he can hop on the Red Line. He can responsibly transmit the information to another inquirer. He can draw trivial inferences from it. His knowledge that Alewife is on the Red Line is secure even if he knows virtually nothing else about local geography or public transportation. To be sure, he might know a lot more. And the new information may be valuable to him precisely because it fills an irksome gap in his overall knowledge of the Boston subway system. But he knows the fact even if it makes a minimal contribution to his cognitive economy. It is fully in order even if it is just an isolated bit of knowledge. Third, when asked, "How do you know?" he can and should answer, "Sally told me." Apart perhaps from the assurance that he had no defeaters, nothing more is required for this answer to be epistemically adequate.

To say that the affordances of testimonial knowledge are narrowly circumscribed is not to suggest that the content conveyed by testimony need be sparse or

1. It does not follow that the acquisition of testimonial knowledge is never costly. It may take considerable effort to interpret and/or assimilate the information imparted (see Malfatti 2020). My point here is simply that it is not always costly.

simple. Testimony is not restricted to conveying isolated factoids. The content of a testimonial utterance or inscription may be extended and complicated. Tattletale Timmy testifies that Mary did not eat her spinach and Billy did not drink his milk and José did not tie his shoes and. . . The content of Timmy's testimony is logically complex, having the form of a conjunction: $a \ \& \ b \ \& \ c \ \& \ . . .$ Typically, in giving directions spatial and perhaps temporal order is significant as well. Sue tells Marty that to get to the station he should go straight for four blocks, then go left for a block. The order matters. The recipient of the testimony is to go straight prior to turning left. Here the form is: $a \ \text{before} \ b$. In yet other cases, testimony conveys dependence relations (see Greco 2020). The fire marshal testifies that the fire was caused by faulty wiring (Pritchard 2010, 81). Here the form of the testimonial content is: $a \ \text{because} \ b$.

Nor, of course, is there any limit on the length of testimony. Via testimony, a foreman could, for example, convey to a technician exactly what switches need to be flipped in exactly what order to operate a complicated machine. It is very complicated, so the testimony, including diagrams and illustrations, would run to many pages. Nevertheless, the testimony is circumscribed in that the extent to which it would equip and entitle the technician to go beyond the information it contains may be severely limited. His testimony-based knowledge would be fully in order if, because he had been told, he knew that the value displayed on a certain monitor must stay between 630 and 760 and knew which switch needed to be flipped if it went higher. But the testimony would not need to give him any idea what would happen if the value exceeded 760 or why its staying within the prescribed limits matters. Nor would it need to provide knowledge of what magnitudes the various dials measured, why their measurements were important, or how they or the mechanisms they were connected to worked.

Inasmuch as testimony may be long and complicated, the claim that it is narrowly circumscribed may seem surprising. But the limit in question is not a matter of constraining the breadth or complexity of the information conveyed, it is a matter of restricting the audience's epistemic resources for going beyond that information.

Such circumscribed knowledge is epistemically valuable. We may not want or be able to find something out for ourselves or be in a position to personally supply substantive justification for facts we seek to know. Often we have no incentive to go beyond the information given. Then our cognitive and practical goals are met by an isolated bit of reliable information. Testimonial knowledge plays a vital role in the division of cognitive labor.

TEACHING AS TESTIMONY?

Once we acknowledge that testimony can impart extended information conveying logical structure, spatiotemporal order, and dependence relations, it may seem obvious that the teaching of factual material consists in testimony. The teacher delivers a factual lecture, testifying about a topic such as the role of the cotton gin

in the perpetuation of American slavery or the life cycle of the hissing cockroach. In so doing, she states facts that she knows. The students, being recipients of her testimony, come to believe the facts imparted. This, it is held, is what occurs in successful teaching in disciplines like history, the social sciences, and the natural sciences. Let us call these fact-focused disciplines. I will have more to say about this characterization below. If this conception of teaching is correct, then so long as the lecturer knows the facts she imparts and the students have no defeaters, when they believe what she says, they know it. This model is held to apply across grade levels. The fourth-grade teacher imparts simple facts; the university professor imparts subtle, complex, nuanced facts. But in all cases, the knowledgeable lecturer testifies and the successful students uptake that testimony.

On standard views, testimony transmits epistemic entitlement.² This is consonant with epistemic reliabilism (see Goldman 1999). If the recipient acquires the information from a reliable informant and has no defeaters, he knows. It might seem that the testifier must have the level of entitlement she transmits. She cannot, via testimony, bring it about that her recipient knows that *p* if she does not know that *p*. Nor can she bring it about that her recipient is justified or warranted in believing that *p*, if she is not justified or warranted in believing it. She might, of course, spark an insight in a listener, enabling him to know because he, independently, had the justification she lacked. But this would not be testimonial knowledge, for in such a case, although she prompted him to know, she did not convey knowledge to him. This seems obvious. You cannot transmit what you do not have.

Jennifer Lackey presents a vignette that raises a serious challenge to this view. Her protagonist is Stella, a devout fundamentalist Christian who teaches fourth grade in a public school. She believes in the truth of creationism and the falsity of evolutionary theory. But being a responsible teacher, Stella considers it her duty to teach her students the theory that best answers to the evidence, not the theory that is supported only by her own personal faith. She therefore gives a reliable lecture in which she asserts “Modern-day *Homo sapiens* evolved from *Homo erectus*.” Stella does not believe—hence does not know—it. But, it seems, her students who take her at her word come to truly believe that *Homo sapiens* evolved from *Homo erectus*. It is at least very tempting to say that they come to know it (Lackey 2008, 48).

Lackey maintains that this vignette discredits the view that testimonial knowledge is grounded in the transmission of beliefs. She contends that whether Stella believes is irrelevant; what matters is the reliability of the content Stella conveys. If Lackey is right, it is possible for testimony to impart knowledge even if the testifier does not know. Robert Audi disagrees. He maintains that students who acquire their beliefs from teachers like Stella in fact do not know. Such a teacher is

2. Whether recipients are default entitled to believe testimony or need evidence of the trustworthiness of the testifier is a matter of controversy (see Burge 1993; Fricker 1987). I set this debate aside since both sides agree in taking it that felicitous testimony transmits entitlement.

a hypocrite, he suggests. She would teach whatever the school wanted her to teach, regardless of what she thought about its epistemic standing. That being so, her students ought not to take her word. Alternatively, he suggests, a teacher like Stella might be unduly credulous. In that case, she suffers from a cognitive dysfunction that renders her epistemically untrustworthy. Either way, the students fail to know, for they ought not take her word (Audi 2006, 30).

Federica Malfatti (2019) extends Lackey's challenge, considering whether testimony that is not believed can be a vehicle for conveying understanding. In Malfatti's vignette, Stella's counterpart is Lilith, a climate science teacher who does not believe in anthropogenic climate change. Nevertheless, via Lilith's teaching, her students come to understand the theory and as a result accept the reality of anthropogenic climate change. They are able to appeal to it to explain, for example, why glaciers are receding and sea levels are rising. The issue, it seems, concerns conveying or imparting or bringing about epistemic entitlement, whether that entitlement is a matter of knowledge or of understanding. If Audi is right that Stella's students do not know, Lilith's students do not understand.

Since Stella and Lilith are imaginary, we can credit them with any traits we like. But we ought not too quickly disparage their moral or intellectual character. Perhaps they are constructive empiricists (see van Fraassen 1980). They restrict, and think they ought to restrict, their teaching to theories that are as far as we can tell empirically adequate. Let us call such theories evidentially adequate. Since the theories in question fill the bill, they can in good conscience teach those theories. Each opts to teach the evidentially adequate theory of her subject that is most widely accepted by the relevant scientific community or examination board.³ It is, they think, epistemically permissible to teach any evidentially adequate theory, and it is practically beneficial to their students to teach the one that is generally accepted in the relevant venues.

One might wonder whether this stance is sufficient to bring it about that the students know that *Homo sapiens* evolved from *Homo erectus* or understand why anthropogenic climate change is causing glaciers to recede. I am not sure.⁴ But the problem verges on a skeptical worry. For constructive empiricism accommodates all the evidence there is. That evidence is not conclusive. Still, it is widely recognized that we can know and understand on the basis of less than conclusive evidence. A constructive empiricist who favors the alternative that happens to be true may be in as good a position to know as any other epistemic agent who believes the truth on less than conclusive evidence. Stella, of course, does not know, for she does not believe. But fourth graders are apt to be naive realists. Perhaps her lesson

3. Strictly, the most they can say is that the theories are empirically adequate given the available evidence. That is narrower than full empirical adequacy. But it suffices for their teaching to be epistemically responsible.

4. If we deny that Stella's constructive empiricist stance enables her realist students to know, then we have to deny that van Fraassen can teach quantum mechanics to scientific realists. Such a denial would be both epistemically arrogant and empirically false.

gives them sufficient reason to believe. And since the claim is true and grounded in the evidence, if they believe on the basis of her teaching and have no defeaters, they know. Although the relation of understanding to belief is less straightforward, it is plausible that Lilith's students understand if they reflectively endorse the thesis that anthropogenic climate change is real and that it accounts for phenomena like the rise in sea levels and the melting of glaciers. Audi's reservations then need not discredit Lackey's and Malfatti's claims.

Stella and Lilith are not pedagogical outliers. Philosophy professors regularly teach theories that we do not believe. It might seem that in doing so, we implicitly embed our claims within an "in the theory" operator in the way that a literature professor discussing *Hamlet* embeds a claim like "Gertrude was Hamlet's mother" within an "in the story" operator. Then, with "in the theory" tacitly assumed, a professor who does not endorse platonism might responsibly utter "the forms are prior to and independent of their material instantiations." Following de Regt and Dieks (2005), Malfatti distinguishes between understanding a theory and understanding a range of phenomena via that theory (2019). It might seem that in teaching a theory that we do not endorse, we simply aim to convey an understanding of the theory but not an understanding of the phenomena via the theory. Arguably this works for historians of science teaching Ptolemaic astronomy or phlogiston theory. But philosophy professors do more than explicate; we routinely mount defenses for the theories we do not accept. We adduce reasons—sometimes very powerful reasons—for the views we discuss. Moreover, we draw out implications that go beyond the texts. Nor do we restrict ourselves to reasons found in (or tacitly assumed by) the text or its author. Sometimes we strengthen a position by introducing resources that were unavailable to the thinker we are talking about. Thus, for example, we might draw on twentieth-century discussions of the failure of logicism to strengthen Kant's argument that ' $7 + 5 = 12$ ' is a synthetic a priori truth. In so doing, we maintain that there is more to be said in favor of the theory than its author was in a position to say. A professor who does not believe that there exist synthetic a priori truths could in good conscience make such a move. She might go on to attempt to dismantle the Kantian position. Even so, a student might be impressed with the move and unconvinced by the dismantling. Then, if indeed mathematical truths are synthetic a priori truths, the student might come to know or at least reasonably believe that they are. Giving the strongest possible explication and defense of the theories we discuss is what philosophy professors are supposed to do. The principle of charity requires it.

We might defend this strategy by maintaining that we build up a theory we reject only to knock it down. In that case, if my students emerge believing on the basis of my lecture that mathematics consists of synthetic a priori truths, I failed, at least with the 'knock it down' step. For I believe no such thing. But it is not obvious that I failed. In any case, if this is our rationale, it is not a very good one. Why should we bother? "Here's a ridiculous view; here's why it doesn't work." This sounds like an idle exercise or a parlor game rather than a valuable

pedagogical strategy. What do we think is to be gained by encouraging our students to seriously entertain views that we reject? I believe there is a good answer to this question, but it is not one that those who construe lectures as extended testimony can provide.

In any case, some philosophy professors take pains to refrain from knocking down the views they discuss in their lectures. Rawls was notoriously fair-minded in his courses on the history of moral philosophy and the history of political philosophy (see Rawls 2000, 2008). He never said, “Here’s why my theory is better,” even though he, if any of us, was entitled to make such a claim. If our goal is to transmit the truth, wouldn’t it be preferable to simply present and argue for the view that we take to be true? Many philosophy professors hope and expect that students will fail to believe a theory that they personally reject but defend in their lectures. Still, a student may believe it, and justifiably believe it nonetheless. Not all of us consider ourselves to have failed if she does.

Lackey’s vignette is widely held to create a serious problem for belief transmission theories of testimony. Stella’s students evidently emerge from the lesson knowing that modern-day *Homo sapiens* evolved from *Homo erectus* even though Stella does not. I agree. But this does not call for a revision in or rejection of belief transmission views of testimonial knowledge. Nor do the epistemic achievements of Lilith’s students call for a revision or rejection of belief transmission views of testimonial understanding. For the students’ epistemic successes are not products of testimony. The assumption that teaching that conveys information is testimony and the assumption that the resulting learning consists in acquiring testimonial knowledge are unfounded. They do not square with our pedagogical practices or their goals.

TEACHING

John Greco takes lecturing in fact-focused disciplines to consist in testimony. To be sure, he recognizes that even in such disciplines, education involves more than imparting information. He attempts to accommodate the residue by assigning the various components of a fact-focused course distinct pedagogical functions. In particular, he maintains, science labs have a very different pedagogical function from lectures. In science courses, he says, “the purpose of a lab component is not to learn the results of experiments, but to learn how to run experiments. That is, the purpose is to teach the kind of knowledge-how necessary to be a practitioner in the discipline” (2020, 142). It is reasonable to teach the sort of know-how needed to be a practitioner in a discipline to those who intend or aspire or are in training to become practitioners in the discipline. On Greco’s view then, lab courses for science majors and graduate students in the sciences make sense. But high school science courses and gen-ed science courses required of many undergraduates have lab requirements as well. Most of the students taking such courses

have no intention of becoming practitioners of experimental science. This raises the question of why the labs are considered cognitively valuable for such students. Is there any epistemic justification for a lab science to be one of the general education requirements at a university?

There is. The main function of the labs is not to equip students with the know-how of practitioners. It is not like teaching apprentice chefs how to make a roux or teaching fledgling bassoonists how to shape a reed. Nor is it to get students to learn the results of experiments. The function of the lab component in a science course is to exemplify the way the science produces results that are epistemically acceptable—show how and why such results afford evidence for the theories they support, and show why the norms the experiments are subject to are epistemically appropriate. Students learn what evidence can be generated for the theories they are being taught, how that evidence is generated, and how and to what extent it supports the theories. They learn why intersubjective agreement and replicability of results are epistemically important. They may learn how difficult it is to generate good evidence. The understanding they gain through the course (lectures, labs, discussion sections, problem sets, etc.) is not simply a matter of testimonial knowledge; nor is the information gleaned from the course properly credited only or even mainly to the information imparted in the lectures. The labs enable students to see for themselves and show for themselves why the theoretical claims are acceptable. Good courses are designed to be seamless wholes. They meld lectures, discussions, reading assignments, problem sets, student reflections, term paper assignments, perhaps various types of project-based learning. They merge group work with individual assignments. This is so from the earliest grades through graduate school. The goal is that the various components form a mutually supportive structure so that taken together they afford a broadened and deepened understanding of the subject matter.

Not all fact-focused courses have labs. History courses do not. But a good history course is not restricted to imparting factual information about, as it might be, the defeat of the Spanish Armada, or the political consequences of the Kansas-Nebraska Act. It also teaches students what sort of evidence there is for historical claims, what qualifies certain items to count as evidence, and why and to what extent such evidence is trustworthy. It teaches how to responsibly weave well-supported judgments of historical fact into an overall understanding of a historical episode. Greco might maintain that a history lecture involves some claims that convey information via testimony and other claims that perform other functions. Maybe so. A lecturer might assert, “The Kansas-Nebraska Act became law in 1854.” This seems the sort of fact that students might come to know via testimony. And if the students came to believe it entirely because the lecturer said so, they would have testimonial knowledge of that fact. But parsing claims on the basis of their putatively separate functions is unlikely to do justice to their educational role. An effective lecture is typically an interwoven tapestry of first- and second-order, factual, evidential, and epistemically normative claims.

Greco's conception of teaching as testimony is what Paolo Friere calls the *banking model*. In the banking model, Friere maintains, teachers in effect open students' heads and pour in the information they want their students to have. They deposit the information in their students' minds and withdraw it as needed (Friere 2000, 72). Teachers *impose* a view of things on their students. They dictate what the students should believe. Friere's main concern is political. He argues that the banking model prevents the politically oppressed from recognizing the depth and character of their oppression. No doubt he is right. But the objectionability to the banking model is more extensive than he acknowledges. The model not only oppresses the politically disempowered; it also oppresses the children of the powerful. For the banking model stifles thought. Rather than teaching students how to think, it specifies what they should think. The reason they should believe that p is simply that they were told to believe it. The objectionability is not grounded in the idea that the information imparted to the students is false or unjustified, although it may be. The objectionability lies in its circumventing students' epistemic autonomy.

It might seem that in identifying Greco's orientation with the one Friere disparages I overlook something crucial. Greco holds that the teachers and professors he is talking about impart the truth. There is, one might think, nothing wrong with seeking to bring it about that one's students believe what is true. Friere's grievance is that the oppressors are imparting falsehoods to the oppressed. Indeed, they are imparting morally pernicious falsehoods. Obviously that is an important difference. But I do not think it is the whole story, and it may not even be the main part of the story. Teachers of matters of fact want their students to believe what is true. And there are often specific truths that they want their students to learn. But they do not want the students to believe these facts simply because they were told to. Knowing the truth is, educationally, not enough. As Emily Robertson says, "Educators should seek not merely to *transmit* knowledge, but to also put students into a position where they can, to some extent, decide what to believe. It would be a poor education that transmitted a fixed body of facts without also developing the resources for arriving at new beliefs and evaluating old ones" (2009, 17).

The speech act that conveys testimony is called *telling*. Let us call the speech act we use in lecturing *professing*. It consists in putting forth a proposition or other representation for serious cognitive purposes (see Elgin 2017). So, for example, a biology teacher professes that the Krebs cycle figures in the oxidation of glucose when she includes that claim in her lecture. A history teacher professes that the Greeks won the battle of Marathon when he includes that claim in his lecture. Professing is different from telling, even when the same fact is conveyed. For successful uptake is different. As we saw, a stereotypical case of acquiring testimonial knowledge consists in getting directions from someone. Jed wants to know how to get to the zoo; Judy is happy to impart the requisite information. Jed uptakes that information and follows her instructions. To make the case comparable to a standard lecture, let us suppose that the route is fairly complicated. After a few min-

utes, and a few turns, Megan asks, “Why do we turn left here?” Jed’s epistemically appropriate answer is, “She said we should turn left on Grove Street.” Jed knows where to turn because and only because a reliable informant told him where to turn. That’s plenty good enough. Compare this to the case of a student taking an exam, writing an essay, or answering a question in class. Suppose the question is:

What is the function of the Golgi apparatus?

or

What caused the extinction of the dinosaurs?

or

What tribe dominated the southern plains in the nineteenth century?

followed by the instruction “justify your answer.” A student who gave the correct factual answer, but justified it by saying, “Ms. Winthrop said so,” would not do well. If the lecture’s function were to convey knowledge via testimony, “She said so” would be an entirely adequate justification. It would probably be an epistemically stronger justification than whatever the student could adduce by way of evidence. Evidence is merely indicative whereas, if Ms. Winthrop knows, her testimony affords a compelling, indeed (barring defeaters), a conclusive reason to believe. To pass an exam, write an acceptable essay, or answer the question appropriately, the student is expected to display an understanding of the relevant facts, as well perhaps of the methodological and normative considerations that justify the answer. It is not enough that she can cite the identity of the authority or expert who imparted them. She should provide evidence that bears on what makes the claim true (or true enough), not just reasons why we should think it is true (or true enough). The students are expected to provide cogent justifications to support their claims. This suggests that the learning that is a product of teaching is subject to internalist—that is, evidentialist—constraints (see Robertson 2009). If Goldman is right that testimonial knowledge is externalist, this is an epistemologically important difference.

Still, it is worth noting that going internalist about testimony would not bridge the gap. An internalist about testimony, such as Fricker (1987) or Adler (2002), maintains that trust in the content of testimony is grounded in the recipient’s drawing on (typically tacit) evidence about who qualifies as a trustworthy testifier. If this is right, we credit the information imparted because we credit the informant. In that case, however, the answer to “How do you know?” or “What makes you think so?” remains “She said so.” The dichotomy between teaching and testimony remains.

Well-designed exams test for what educators think the students ought to have mastered. Criteria for assessing exams align with the designers’ desiderata. These points are uncontroversial. So requiring students to justify, explain, or show their work indicates that the test designer does not hold that the goal of the course (or unit, or lesson, or program) is primarily or exclusively the acquisition of particular bits of information. And the refusal to accept “the teacher said so” as an answer indicates that the goal is not primarily or exclusively the acquisition of bits

of knowledge. Rather, in asking students to explain, justify, or show their work, we indicate that our goal is for them to learn to think with and about the topic in ways that reflect the methods, goals, and standards of the discipline. According to Dewey, “All which the school can or need do for pupils, so far as their *minds* are concerned . . . is to develop their ability to think” (Dewey 1916, 152). He holds that bits of knowledge are resources to think with. If this is right, we see why philosophy professors do not treat students’ disagreement with what we said in our lectures as evidence that we failed. If we have taught our students to think well enough that they can mount a serious, well-framed, well-supported defense of their conclusions, we have achieved an important pedagogical objective whether they agree with us or not.

Obviously, the reasons students can adduce vary with subject and grade level. We would not expect Stella’s fourth graders to display the same sophistication as graduate students in evolutionary biology, when asked about the origins of the human species. But we would expect even fourth graders to adduce reasons bearing on both evolution in general, and the relation of *Homo erectus* to *Homo sapiens*. To be sure, an answer to such a question (even if not one expected of a fourth grader) might discuss how experts know. Nevertheless, a satisfactory answer would not consist of simply deferring to an expert.

TEACHING FOR UNDERSTANDING

For a student to learn the material being taught, it is not enough that she come to believe it and believe that it is warranted. The recipient of testimony does both. Unlike the recipient of testimony, the successful student is supposed to accept that p in a way that equips and entitles her to use it as a basis for further reasoning about the subject matter. She should be able to do more than parrot or paraphrase what she has been told, more than draw obvious inferences, and more than follow the exact instructions imparted. She should be able to extrapolate. This might involve identifying other cases of the same or similar phenomena or explaining why this phenomenon is unique. It might consist in projecting into the past or the future, beyond what was explicitly covered in class. It might be a matter of being able to identify and accommodate a suitable range of counterfactuals (see Hills 2016) or to draw fruitful analogies (see Nersessian 2008). Stella’s students can do these things. They can explain why members of *Homo erectus* who had certain traits had an advantage. They can explain why, if the next generation inherited those traits, they would share the advantage the traits conferred, and why over generations their descendants would come to dominate. They can extrapolate, reasoning that the same process occurred in the evolution of modern-day giraffes and squirrels. They can fruitfully speculate that had the environment been somewhat different modern humans (or giraffes) would have evolved to have different traits. Such responses are well within the abilities of fourth-grade students.

Eventually, students should learn to critically evaluate the material they are taught. They should learn to assess the strength of the evidence for the positions in question. That means, learning what counts as a reason in a given discipline, how strong that reason is, and why it qualifies as a reason (see Siegel 1988).

Greco takes understanding to be systematic knowledge, and takes lecturing in fact-focused courses to consist in testifying to the effect that the systematic truth obtains. On this view, testimonial uptake would equip students to recognize and perhaps extract elements of the system. If Timmy knowledgeably testified that $a \& b$, the recipients of his testimony would be in a position to know that a . But such knowledge does not equip the recipients to go much beyond the information given. It would presumably enable them to make trivial inferences. But they would not be equipped to make substantive, ampliative inferences or to draw fruitful analogies. A fundamental goal of teaching, I believe, is precisely to enable students to reason beyond what they have been explicitly told, and beyond what is trivially obvious on the basis of what they have been told. They should be able to use the facts they learn, as well as the methods, orientations, standards, and approaches to stretch the limits of their thinking in epistemically fruitful ways. They should be able to leverage their understanding to gain further understanding. Successful uptake then is more than registering and crediting the information imparted, it involves developing a capacity to exploit that information to engender further understanding.

Although I have spoken about fact-focused disciplines and pointed to a couple of examples, I have not said what makes a discipline fact focused. Aren't all academic courses fact focused? Math courses concern facts about mathematical entities—numbers, sets, functions, and the like. Literature courses concern facts about novels, poems, stories, and the like. Philosophy courses concern facts about knowledge, goodness, reality, and the like. The issue here is not whether the disciplines concern bodies of facts. All serious academic disciplines do. The issue is whether lectures in those disciplines mainly seek to impart those facts. On Greco's view, teaching history or science turns out to be fundamentally different from teaching math or poetry. It is hard to construe a lecture on calculating the area under a curve or a lecture on closely reading a Shakespearian sonnet as aiming to impart truths about matters of fact. The area under that particular curve is not very important. Rather, the point of the lecture is that the strategy used to solve this problem works for a wider range of cases, and its working for that range reveals something significant about a class of curves or a method for calculating areas. Similarly for analyzing a poem. There is, perhaps, some value in focusing on weather metaphors in Shakespeare's *Sonnet 18* for their own sake; but the student is expected to learn more than what this particular sonnet means. She is supposed to learn how to interpret images in Elizabethan poetry and how imagery generally functions in literature, perhaps even how to see the world through the lens that the poem provides. But, Greco seems to think, the natural and social sciences are different. Their main goal is to impart facts.

I disagree. Little teaching in any academic discipline is primarily concerned with imparting facts. If fact-focused courses are courses whose main epistemic objective is to impart facts, there are few if any such courses; if they are courses where the understanding they seek to engender is grounded in facts, all academic courses are fact focused. Understanding a topic, I have argued, consists in grasping and reflectively endorsing a comprehensive, systematically linked body of information in reflective equilibrium where that body of information is grounded in fact, is duly responsive to evidence, and enables nontrivial inference and perhaps action regarding the phenomena the information pertains to (Elgin 2017). Education, I maintain, aims to engender such understanding. This is so from elementary school through graduate school. Let's look at the several conditions.

Understanding should be *grounded in fact*: Elementary education is simplified and schematic. So are many introductory courses in universities. Insofar as the material is simplified, much of it is strictly false. Students learn Newtonian mechanics as a stepping stone to relativity and quantum mechanics. Although Newton's laws are false, they are a valuable way station to a more accurate understanding of physics. The understanding the students gain is grounded in fact, insofar as it is true enough (see Elgin 2017). Middle school science students gain some understanding of the relation of force to mass via $f = ma$, even though the formula is false because it fails to accommodate relativistic effects. Students gain an understanding of a subject, insofar as the divergence of the information they learn from the facts it pertains to is negligible. Eighth-grade physics students and fourth-grade biology students have age-appropriate understandings of their subjects because the relevant physical and biological facts ground that understanding; those facts figure crucially in why the schematic, elementary explanations work as well as they do.

The simplifications taught in the early years are not chosen merely because they make things easier. Rather they provide a basis for leveraging understanding. $pV = nRT$, although strictly false, enables students to begin to understand thermodynamics. Students can grasp the importance of the interdependence of pressure, temperature, and volume in a gas. This puts them in a position to realize that and how and why things are more complicated, and how and when and why the additional complications matter. Gas molecules collide with and bounce off one another; they are subject to gravity; they have a variety of shapes and sizes that affect what happens when they collide; and so forth. A good course not only provides age-appropriate information; it also positions and equips students to take the next steps.

Perhaps some understanding is so firmly grounded in particular facts that it is necessary to know (or justifiably believe) those facts in order to understand the subject at all. Given the reliance on simplifications in early education, I am not confident that this is so. But it might be. Maybe one could not begin to understand the French Revolution if one did not believe that the court of Louis XVI was corrupt. If there are such facts, then in order to learn the material, any student of the

subject must be privy to them. A teacher might simply state these facts and warn her students that they won't be able to understand the subject if they do not accept or believe them. If the teacher simply presents herself as a reliable authority and imparts such a fact, then at least at the outset, the students glean it as testimonial knowledge. If so, testimony has a legitimate place in understanding. In effect, the teacher is saying, "Here's a fact that your understanding of the subject must be responsive to. Take my word for it." But as a student's understanding develops, the testimonial status of the knowledge is supplanted by a more holistic justification. The student comes to see how the fact plays a crucial role in a more comprehensive understanding of the topic. And her justification for that judgment of fact becomes dispersed across her understanding of the topic as a whole. Her reasons for believing it no longer rest on the mere fact that her teacher told her.

An understanding must be *duly responsive to evidence or reasons*: The students not only glean factual information about, as it might be, the evolution of species or the Norman Conquest, they learn what counts as evidence for that information. That is, they learn about the importance of the fossil record in establishing well-grounded views about lines of descent or about the primary source documents that afford evidence about the Battle of Hastings. They learn that without such evidence, claims about such topics are unfounded. Eventually, if not in the early grades, they learn why certain disciplines require certain sorts of evidence, why some seemingly relevant considerations do not qualify as evidence, and how investigators gather and assess evidence. In nonempirical fields, such as mathematics and poetry, they learn to identify and assess reasons for and against a claim. The critical point is that students learn what justifies the considerations that the various disciplines endorse. They learn what qualifies as a correct answer to the question: Why should we accept *this*? This is one place where a testimonial model is inadequate. When the answer is "Because Professor Nolan said so," the reason—although reliable—is not suitably connected to the facts. If the topic is the Norman Conquest, the student's reasons for her belief should be grounded in facts about the Norman Conquest. The reasons must be topic related, not merely source related.

Here, too, leveraging is important. Elementary school level standards of evidence provide a basis for refinements. Students who initially thought they just needed evidence for their claims learn that evidence can be misleading; so they learn how to avoid being misled. They learn, for example, that an experimental result must be reproducible; and they learn what counts as reproducing it. They learn that to serve as evidence for a historical claim, primary sources are mandatory, and they learn that a single primary source document should be backed by additional evidence. And so forth.

An understanding *enables nontrivial inference and perhaps action* about the phenomena it bears on. The understanding should enable a student to draw responsible inferences beyond the obvious. This may involve extrapolating to the past or the future; it may involve counterfactual reasoning; it may involve drawing

analogies or disanalogies to seemingly related cases. The inferences in question need not be formal. Often extrapolating beyond the information given takes the form of associative reasoning—projecting one’s insights onto similar (or not so similar) cases. The inferences may also show why something that holds in a given case does not extrapolate to seemingly similar cases. Thus, for example, chemistry students should be able to explain why, despite the fact that most materials contract when they solidify, water expands. That is, they should be able to explain why water is unusual.

Leveraging here is a matter of increasing sensitivity to the scope and power of the inferences drawn. Stella’s students might be able to draw on what they learn about human evolution to speculate about the evolution of other organisms. But if they have also learned about the importance of environmental pressures, they could venture hypotheses about why the evolution of parrots and the evolution of penguins took different paths. As their biological understanding increases, they come to realize that some inferences are limited in scope. Some of the things they learn about one organism can be expected to hold of all other normal healthy organisms; others can be expected to hold only of plants, or only of members of a particular species, etc. Moreover, they learn that their counterfactual judgments need to be suitably circumscribed as well. If the climate had been a bit colder or a bit warmer then the species would have or might have displayed *p*. If it had been drastically hotter or colder, perhaps there is no saying whether the species would have survived, or what adaptations might have occurred. The more students understand about a range of phenomena, the more acute, refined, and sensitive their inferences are expected to be.

The commitments that constitute an understanding form a network in reflective equilibrium. They are reasonable in light of one another and as reasonable as any available alternative in light of the relevant antecedent commitments. This latter constraint must be keyed to an appropriate epistemic community. The community of fourth-grade biology students has antecedent commitments that they draw on in developing an understanding of evolution. It is looser and less reliable than the commitments of professional biologists. Nevertheless, by drawing on what the students know or can observe about biological inheritance—for example, that members of a family are apt to share certain visible characteristics—they can begin to get a handle on heritability. Not all of the original commitments will be retained in the system that emerges. Like other epistemic agents, students correct and refine their untutored beliefs. But they typically start with such beliefs. The system provides both resources and constraints. Coherence conditions both limit the inferences that can be drawn and provide opportunities for elaboration and expansion of a network of commitments. If this is so for humans, the students think, something similar should hold for other animals. Maybe not all animals, they then might think, but anyway for mammals; maybe not for all mammals, but anyway for all terrestrial mammals. We can see how such reasoning can extend and deepen their understanding. One pedagogical goal is to orient students to

significant features, and direct their attention to potentially useful lines of inquiry. Although entertaining counterfactuals can be fruitful, outside of philosophy it is usually ill-advised to worry about very distant possible worlds.

I said that the network of commitments that constitutes an understanding should be reflectively endorsed. That requires that the students not just accept the commitments, but that they recognize that the commitments stand up to scrutiny. To do that the students must both be capable of, and inclined to engage in, critical reasoning (see Siegel 1988). They need to be responsive to reasons—that is, to be both able and motivated to recognize reasons for and against a claim; to assess those reasons; to assign them due weight. They also need to be motivated and equipped to provide reasons for contentions that they think are worthy of reflective endorsement. That is, they need not only to be able to ask, “Why should we believe *this*?” they should also be equipped and motivated to recognize and accept good answers, and recognize and reject bad answers. To reflectively endorse a consideration is to recognize that it satisfies the standards that ought to be satisfied for considerations of its kind. What the standards are, and how demanding they are, changes as one matures and becomes more sophisticated in a discipline. Here too, the light dawns gradually. But even very young children ask “why?” And quite early, they can be brought to be recognize both that the question is legitimate, and that there are good and bad ways of answering it. Merely asking “why?” of course is not enough. One major goal of education is to equip students to learn how to ask “why?” effectively—that is, how to frame a question, approach a problem, draw on available resources, and marshal evidence, so that an acceptable answer emerges. Stella and Lilith were successful because they did not tell their students what to think; they showed them how to think, and they did so in a way that made manifest something of the power of thinking about the phenomena that way.

CONCLUSION

Lackey’s creationist teacher and Malfatti’s climate science professor do not testify; they teach. Since teaching is not testimony, their seemingly surprising success does not bear on the dispute between reliabilists and evidentialists about testimonial knowledge. Evidentialists and reliabilists agree that although the testifier assures her audience that the information conveyed is suitably justified, she does not articulate the justification. Hence, it is entirely acceptable for her audience to be clueless about the evidence for the content of claim they come to know. They believe it and are justified in believing it because they have it from a source whose word they justifiably take. This, as I said, is valuable. It underwrites the efficient transfer of information to epistemic agents who lack the resources or incentive to acquire or vet the evidence for themselves. Teaching, however, equips learners to go beyond the information given. Students acquire the ability to use what they are

taught as a resource to extend, deepen, and critique their understanding of the subject matter.

The divergence of teaching from testimony suggests that the justificatory terrain of epistemology is more variegated than we might suppose. Perhaps some knowledge and understanding answers to evidentialist constraints; some to reliabilist constraints. But even if testimony answers to evidentialist constraints, those constraints are different from the ones that teaching answers to. This raises the question whether there are other modes of information transfer with distinct epistemic profiles, powers, and limitations.

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