**Teacher Education: Failed Reform and a Missed Opportunity**

I plan to cheat in this chapter. We're meant to write about a failed reform, and I will do so, with a brief review of alternative pathways to teacher certification. But that topic will serve as a Trojan horse to introduce a more urgent issue: the need for reform in mainstream teacher education. The fact that teachers without training from graduate schools of education hold their own with novice teachers who have had such training ought not to be viewed as a failure of an education reform, but as a failure of the traditional method of educating teachers.

Here I will focus on one aspect of teacher education, namely, what teacher candidates learn about the science describing children's cognition, motivation, and emotion. I will suggest that teachers do learn some of this content, but fail to learn it in a way that improves classroom outcomes. I will also suggest a better way to teach future teachers.

Alternative Pathways to Teaching

The traditional educative pathway to a teaching career calls for university classwork in education, some supervised student teaching experience, and the passing of some set of standard examinations for certification. Advocates of alternatives to this pathway have articulated two potential advantages.[1] First, if alternative training were less arduous and less expensive, it would open the profession to more people and relieve teacher shortages in some subject areas or geographic regions. Given the evidence that certification matters little to student learning it's hard to see why the certification requirement should remain in place given that teachers are scarce in some subfields, for example, high school science.[2] Second, removing meaningless obstacles might make the profession more attractive to competent people who want to teach, but aren't eager to incur the trouble and expense of further education. Imagine, for example, an

engineer who retires early and thinks it would be nice to give back to her community by teaching a high school course in physics; one could easily imagine she'd be dissuaded once she had read the state certification requirements.

So, have these advantages panned out? Drawing a conclusion is complicated by the diversity of what researchers generically call "alternative pathways to teaching." These include emergency certification, certification offered based on life experiences, certification contingent on completion of university classwork at a school of education, and others. Still, collapsing across the differences, we can say that alternative pathways have increased access to the profession. In 2011, 14% of those completing a teacher preparation program had taken the non-traditional route.[3]

But other data show that teachers entering the profession via these alternative methods are less likely to stay the course. In one study, 31% of traditionally trained teachers in New York City had left the field after five years, whereas for New York City Teaching Fellows, the figure was 48%.[4] Other studies concur that the attrition rate for alternate-pathway teachers is higher, even when controlling for the fact that they are more likely to teach in hard-to-staff schools.[5]

And what of teacher quality? Unfortunately studies comparing student learning outcomes of traditionally prepared teachers and those of their non-traditional counterparts show little difference[6] or perhaps some advantage for those receiving traditional training,[7] or an initial advantage that dissipates over time.[8] The conclusion of Donald Boyd and his colleagues in 2006 is still a fair summary today: there is much more variation in student outcomes within teacher preparation methods than between them (Boyd et al. 2006).[9]

In one sense it's fair to call alternative certification a failed education reform because it doesn't result in improved student learning. But in another sense, these data highlight a much

larger failing. Putting a teacher without training in front of students ought to result in disaster; those with training ought to be much much better. Imagine choosing a dentist, or an architect, or an air traffic controller based on their good will and smarts, giving them a six-week crash course, and then asking them to fill cavities, design hotels, or manage air traffic.

## Why *Should* They Be Better?

There are at least two possible reasons that traditional teacher preparation doesn't add value to teacher practice. First, it may be that no one really knows how to teach someone how to be a good teacher. Perhaps teaching is not comparable to dentistry, wherein there are a limited number of situations to diagnose, each with an accepted strategy known to be successful. Instead, teaching may be more like writing a novel; we can recognize better and worse ones, but we can't prescribe what to do to create a good product. The second possibility is that this knowledge *does* exist, but schools of education are not imparting it.

It's quite clear that the first of these possibilities is not true; there is a relevant body of knowledge that teachers can learn and that improves student outcomes. Foremost among these are content knowledge—e.g., understanding place value[10]—and also pedagogical content knowledge.[11] This term refers to knowledge about the best way to convey domain-specific knowledge and skills to students, e.g., knowing how to communicate place value to students who are new to the concept.[12]

There is another, less studied domain of knowledge that may improve practice. Pedagogical content knowledge is situation specific—knowing how to teach place value does not transfer to knowing how to teach inequalities. Future teachers may also learn situation-specific techniques that apply to motivation (how to address a sixth-grader's belief that he can't do math)

or emotion (how to calm a preschooler who is upset after drop-off). But once in the classroom, it's inevitable that teachers will encounter situations for which they never learned a strategy. The teacher has to wing it. When confronted with a student problem related to cognition, motivation, or emotion, it's reasonable to suppose that the teacher consults a *mental model of the learner* as they compose a strategy to help the student. A mental model of the learner refers to teacher beliefs about what students are like: how they learn, what interests them, what motivates them, and so on.

There is some evidence suggesting that teachers do have such a mental model and indeed have one before they begin teacher training.[13] This is unsurprising; teachers have assumptions and beliefs about what children are like. Fortunately, there is also evidence that this mental model is open to modification both from experience, and from classwork.[14] Much of developmental and cognitive psychology is devoted to describing the sort of general principles that could contribute to a mental model of the learner.

## Recent Attempts to Improve Teacher's Mental Models

Does a teacher attending a traditional teacher preparation program learn the findings from cognitive and developmental psychology that will lead to mental models of the learner in accord with the latest scientific understanding of children? It is difficult to generalize, given that there are thousands of teacher education programs in the United States, covering dozens of content areas. Still, that's probably the intent. Most programs require a course in educational psychology or foundations of education, the latter of which includes at least some introduction to this content.[15] More telling, the teacher licensure tests of many states include this content. For example, the New York State Assessment of Teaching Skills (Elementary) requires that teacher

candidates demonstrate "knowledge of the major concepts, principles, and theories of human development"[16] and the framework for the Florida certification exam specifies that teacher candidates will "apply learning theories to instructional design and planning."[17] Most important, the Praxis II test (Principle of Teaching and Learning), used by dozens of state certification programs, requires that test-takers know "the theoretical foundations of how students learn," including the contributions of foundational theorists such as Piaget, Bruner, and Vygotsky.[18] Thus, there is reason to be confident that many, if not most, teachers learn this content during their preparation.

In the early 1990s, educational psychologists grew concerned that this preparation was not having much impact on teaching practice.[19] Critics pointed to transfer of learning as a key problem. The content that future teachers were asked to master was abstract, theoretical. Much research during the 1980s had shown that knowledge acquired in one context transferred poorly to other contexts.[20] Why, then, should teacher educators expect that decontextualized, abstract knowledge about Piagetian stages (for example) would be recallable in the classroom, much less be applied in a way that improves teacher practice?

These concerns culminated in the creation of a committee by the Educational Psychology Division of the American Psychological Association (APA) to study the issue and make recommendations. The committee report offered concrete suggestions for change in teacher preparation, including better coordination across the curriculum and changes to educational psychology textbooks and other materials, to help future teachers see how educational psychology applied in the classroom.[21] This latter step was meant to address directly the transfer problem.

The recommendations of the committee were revisited in 2011. Patrick, Anderman, Bruening & Duffin concluded that significant progress had been made.[22] A journal focused on the effective teaching of educational psychology had been launched, and textbook writers had made greater efforts to tie psychological principles to classroom realities. Patrick et al remarked "It seems to us that educational psychologists have in general heeded the call to make their content more relevant and meaningful to preservice teachers and to emphasize connections between theory and classroom application."[23]

That sounds encouraging, but teachers begged to differ. A survey of new teachers published in 2012 reported that fewer than half felt their training was "very good" or better. The most frequent complaint was that their training had not prepared for teaching in the "real world," the very problem that teacher educators had tried to address.[24] It may be that the reforms suggested by the 1995 committee have improved teacher training, but teachers don't think these measures were enough. This effort might be called a second failed reform, or more generously (and probably more fairly) an incomplete reform.

In the remainder of this chapter, I focus on a better way forward. I suggest that efforts to improve the connection between psychological theory and classroom practice are useful, but are insufficient. If we are dissatisfied with the way that future teachers are taught, we might turn, as a guide, to recommended teaching practices for children. Three principles stand out as preconditions for effective learning. First, ensure that you are actually teaching what you want students to know, and not something else.[25] Second, make sure that students understand this content in the first place, because if they don't understand it, they are unlikely to remember it or to successfully apply it[26] Third, learners need practice if the learning is to become durable and

useful in different contexts.[27] The teaching of educational psychology principles to future teachers is suspect on all three of these points.

## Teach Them What You Want Them to Know

Memory researchers appreciate that human learning is fine-grained, specific. By this I mean that when one learns a concept, that learning is closely tied to specific way that the concept was experienced. Hence if, among a list of words I see "jam" and think of a traffic jam, my memory for the experience can only be accessed through that route. Suppose you later said "those words you saw earlier…was one of them a food? Maybe something sweet you eat at breakfast?" Although you've provided a terrific cue for "jam" it will be useless to me because I thought of another sense of "jam."[28]

More surprising, this specificity of memory applies to shades of meaning even if the same sense of the word is probed. For example, different properties of "envelope" are called to mind if I read the sentence "The secretary licked the envelope and then closed it," versus the sentence "The secretary put all of the paper clips in the envelope." If you later try to prompt my memory for "envelope" the cue "something with glue" will be a good hint for the former sentence, but not the latter. And the reverse is true for the hint "something that can hold small objects." In each case what ought to be a pretty good hint doesn't work because it hints at as aspect of the word that I didn't think about when I encountered it.[29]

The members of that 1995 APA committee had this principle in mind when they suggested that textbooks and ancillary materials should provide more classroom illustrations of educational psychology principles. They correctly reasoned that if teachers are to recognize

classroom situations to which psychological principles can be fruitfully applied, they must think about those principles in the context of classroom situations when they first learn them.

This reasoning is correct, but incomplete. The problem, I suggest, is that this useful content gets lost in the shuffle of a great deal of additional psychology content that future teachers are also asked to learn—content of low utility.

## Three Types of Statements in Educational Psychology

What content from educational psychology are future teachers expected to learn? It's difficult to draw a general conclusion with confidence because there are thousands of teacher preparation programs in the US. Still, as noted, most programs require a course that includes educational psychology, and many –perhaps most—state certification examinations test this content. Looking at textbooks that support these courses, and looking at documents meant to help future teachers prepare for certification examinations, it's clear that knowledge of three sorts is expected.

Teachers are expected to learn what I will call *empirical generalizations*. Empirical generalizations are observable, predictable ways that children behave: for example, "practice improves memory retention,"[30] or "background knowledge strongly influences reading comprehension;"[31] or "switching attention always carries a cost to task performance,"[32] or "children's understanding of their own memory changes around 4th grade,"[33] or "children's ability to regulate their emotions is a strong predictor of success in school."[34] Empirical generalizations have been observed repeatedly in research contexts—to the extent that behavioral scientists are ready to call finding "facts about the world," empirical generalizations are facts.

Teachers are also expected to learn *theories*, a term whose meaning can be debated,[35] but that I will use in a relatively typical, accepted scientific sense. A theory is a small set of interrelated statements meant to clarify and explain a much larger set of empirical generalizations. For example, many empirical generalizations concern the focus of attention: "people can only keep about four objects in mind simultaneously,"[36] and "the focus of attention can be divided among objects, but not among tasks that require different responses,"[37] and "attending to an object does not guarantee it will later be remembered,"[38] Many competing theories account for these empirical generalizations, and propose radically different architectures of the human mind in their accounts.[39]

Teachers are also expected to learn *epistemic assumptions*. Although scientists aspire to let their beliefs follow wherever the data lead, they know that science cannot be free of assumptions.[40] In educational psychology, these beliefs concern the very nature of learning and what it means to know something. For example, behaviorism views knowledge as relationships between observable events in the world, behaviors the child might engage in, and the consequences of those behaviors for the child.[41] Cognitivism assumes that knowledge is most fruitfully described as mental representations of objects and events, and mental processes that manipulate those representations.[42] Constructivism (in particular, the situated view) conceives of knowledge now as residing solely in the individual, but as embedded in a social and physical context.[43]



Do You Want Them to Know Empirical Generalizations?

It sounds like teachers are expected to know a great deal of psychology. Let's return for a moment to what this knowledge was supposed to facilitate. The hope is that teachers will

develop an accurate mental model of the learner, which will inform classroom practice. For example, suppose a cross-country coach encounters the following problem: he wants to send members of the team on a different route for each practice, so that they will get used to the varied terrains they might encounter at meets in other cities. But his athletes keep forgetting that day's route and getting lost, even though he gives explicit directions before each run. If the coach had a good mental model of the learner, he might recognize the applicability of the empirical generalization "learning is impossible without attention." Runners are not forgetting the route, they aren't paying attention when he describes it because they are so eager to get going. He can ensure they pay attention by requiring them to repeat the route back to him before starting the run.

It seems self-evident that empirical generalizations can be useful to classroom practice; by definition, they describe predictable patterns in the cognitive, motivational, and emotional lives of children. They can therefore help teachers predict the consequences of classroom actions they might take. Indeed this function should serve as a guide as to which empirical generalizations future teachers might learn. Even if we restrict the list to empirical phenomena that have been replicated multiple times with different demographic groups and in different contexts, the list of empirical generalizations would be overly long. One obvious criterion to winnow the list would be classroom utility. Weber's law relating stimulus intensity and perception of perceptual change is conspicuously reliable, but not useful in classrooms and is therefore a poor candidate for teachers to learn.[44] Other empirical generalizations might be both reliable and have potential classroom utility, but the size of the effect is so small that it may not be worth bothering with. For example, there is a reliable effect of emotional concordance on

memory—if you were happy when you learned something, you're more likely to remember it if you're in a happy state again—but the impact on memory is tiny.[45]

These criteria governing which empirical generalizations to teach are subjective, but there's no reason to think that's a problem. It's expected that different teacher education programs will emphasize different empirical generalizations as the faculty will evaluate the relative importance of empirical generalizations differently. Indeed, that's no different than the current situation.

## Do You Want Them to Know Theories?

Theories, like empirical generalizations, would seem to be useful. In fact, theories sound *more* useful, because they summarize empirical generalizations. Do we envision teacher candidates being handed a long long list of factoids— for example, "practice improves memory"—with the expectation that they will memorize them? Why not ask them to learn a theory that encompasses all these facts?

This strategy (as it's usually enacted in teacher education) brings problems to the teacher candidate. First, I alluded to the fact that multiple theories might account for a single set of empirical generalizations. That's not just typical in science, it's considered desirable. For example, most educational psychology textbooks offer five or six theories of motivation, including self-efficacy, self-esteem, self-determination attribution, expectancy, and achievement goal theory e.g.[46] The first problem is that learning all these theories constitutes a significant memory burden for students, and makes it likely that none will be remembered well.[47]

A second problem is that some of these theories likely will contradict one another. The study of intelligence provides a straightforward example. Howard Gardner's multiple

intelligences theory suggests that there are eight types of intelligence.[48] Robert Sternberg's theory of practical intelligence puts the number at three.[49] And John Carroll offers a hierarchical model of intelligence in which the number of intelligences is not so obvious because different aspects of intelligence are nested in one another.[50] What is a teacher supposed to conclude about intelligence? It's easy to see the motivation to teach multiple theories to future teachers: we are both presenting a realistic view of the field as it stands, and perhaps offering the opportunity for teachers to select the way of thinking about intelligence that best fits with their emerging teaching style. But we are also offering the opportunity for future teachers to conclude that researchers are not really certain about anything when it comes to intelligence.

A third problem is that theories make inaccurate predictions. Theories cannot merely account for existing, known empirical generalizations. They must make new predictions, anticipate as-yet unobserved phenomena. A theory that merely accounts for what's known is not doing its scientific job.[51] A theory's novel predictions will be tested and some will inevitably be proven wrong, which will lead to emendations of the theory. That's how science advances. That's good for science, but not so good for a teacher who learned the theory during her education and still applies it years later.

## Do You Want Them to Know Epistemic Assumptions?

It appears that asking teacher candidates to learn theories from educational psychology will not be helpful. What about epistemic assumptions? Educational psychologists are not uniform in the assumptions they make about the nature of knowledge and about what it means to learn something. As noted above, three broad views can be distinguished—behaviorist,

cognitivist, and constructivist—and a typical introductory textbook will delineate these views and devote a chapter to each.

As with theories, the motivation for presenting different views of epistemology is understandable. These differing views are foundations of the field. How can one say that a student is learning the fundamental concepts of educational psychology without knowing the views of learning taken by different educational psychologists? Then too, consider the classroom strategies students ought to learn. How can a student understand the token economy as a classroom management technique without understanding behaviorism?

But as noted earlier, these epistemologies are incompatible. It's not obvious how teacher educators hope future teachers will square that circle. Perhaps they expect that future teachers will isolate these views, one from the other. When you're using a token economy you think like a behaviorist, and when you assign a group project, you think like a constructivist. Such isolation seems difficult to assimilate; how can one believe "X" in one moment and "not X" another? Or perhaps the hope is that teacher candidates will knit these views together into their own, internally consistent view. Given that learning theorists themselves have not put forward such a rapprochement, that hope seems far-fetched.

A much more likely outcome is that teacher candidates will conclude that learning theorists don't have any firm conclusions to offer teachers. Even at the most general level, they can't agree on how to describe what learning is or how it happens. That interpretation of teacher candidates' reaction to their training is especially plausible given what they say about it: kind of interesting, but too theoretical to be of any practical import.[52]

A more insidious possibility is that teacher candidates will take some epistemic assumptions to heart, but will come to confuse them with empirical generalizations. Consider a

statement like "learning is social." This is an epistemic assumption. On its own, it means very little, as most epistemic assumptions do. It doesn't describe how children learn, and it's consistent with many possible theories. It merely represents an assumption that learning has a social component, and that a theory of learning that excludes all social factors is likely to be incomplete. One theory might conceive of "social" as reflecting the learning opportunities afforded by peers.[53] Another theory might conceive of "social" as meaning that knowledge is shared in a peer network—it makes no sense to think of knowledge as residing solely within one individual's mind.[54] So the statement "learning is social" actually means very little on its own—it just provides a weak constraint on theory development.

The problem is that epistemic assumptions can *sound* like empirical generalizations. "Learning is social" sounds like a short step to the conclusion that students learn better in social situations like small-group discussion than in non-social situations like a class lecture. If learning is social, the reasoning goes, then learning situations ought to be compatible with the way learning naturally occurs. Another example would be the epistemic assumption that "learning is constructed." Again, this is a very general statement meaning that new learning happens in the context of old learning—we put together new understandings by combining knowledge in the environment with knowledge already in memory. But this statement is easily confused with the statement "students learn better when they construct their own knowledge" which is interpreted to mean that lesson plans should have obvious conceptual gaps for students to fill, so that they will be "constructing" knowledge. Again, this statement about teaching methods is actually an empirical generalization, and it is at the least, controversial.[55]

In sum, I suggest that empirical generalizations represent exactly the information from educational psychology that teachers need to know—they tell a teacher how children usually

think and behave. Theories, in contrast, contradict one another and make incorrect predictions. Epistemic assumptions also contradict one another, and are easily mistaken for empirical generalizations. So it sounds as though I'm suggesting teacher educators should compile an enormous list of empirical generalizations, which teacher candidates will then memorize. That practice sounds inefficient, to say the least, and is probably more fairly characterized as "dreadful" because it conflicts with the second desideratum mentioned earlier: to-be-learned content should be made easy to understand. Let's consider that principle more closely.

## Make It Easy to Understand

A foundational principle of human memory is that organization helps us learn.[56] It's easier to master new content when the learner understands relationships among the to-be-learned facts and or relationships between to-be-learned facts and things the learner already knows. For example, it's easier to remember that Korea was divided in 1945 if you relate it to another fact, namely that Japan dominated the Korean peninsula until its defeat in World War II, whereupon the Allies split Korea at the Potsdam conference. Facts are easier to learn if they related to one another. And other facts already in long term memory might help make these connections. For example, if a student is familiar with other examples of a "proxy war," that will help organize facts about the US and Soviet involvement in the Korean War.

Empirical generalizations, like facts about the Korean War, ought to be easier to learn if they relate to one another, and it would seem the obvious way to relate them is via theoretical statements which coordinate and relate empirical generalizations. We've already noted one problem with teaching theories to teacher candidates: theories must make predictions that are unconfirmed at the time they are proposed. Some of these predictions will be inaccurate.

We can add a second problem to the use of theories in this context. We hope to make empirical generalizations more comprehensible and more memorable. Empirical generalizations themselves are usually not that difficult to understand given that they describe how children behave. In contrast, theoretical constructs used to account for thought and behavior can be abstract and unintuitive. Carey and her colleagues has provided evidence that thinking in terms of objects and object properties comes naturally to the human mind,[57] but theories make use of concepts that are neither objects in the usual sense, or properties not observed in everyday objects, for example, symbols that are distributed representations.[58] Put more simply, theories not only make use of specialized language, they make use of specialized concepts, and like any other unfamiliar concepts, it takes time and experience to really understand them.

There is, happily, a solution. These two disadvantages of teaching theory to teacher candidates apply to theories *as used by researchers.* Researchers want theories that make novel predictions, because this property pushes research in new directions. Teachers, in contrast, do not use scientific theory to advance science. They use theories to organize and remember what children are like (i.e., empirical generalizations). Because they put them to different uses, teachers need different theories than researchers need. In particular, teachers need theories that (1) do not make novel predictions and; (2) do not use specialized language.

There is precedent for this type of theory. Students of psychology are familiar with the "modal model" of memory. Proposed by Bennett Murdock in 1967, the model captured the features common to *all* models of memory current at the time, without their specialized features.[59] It thus captured properties of memory that all researchers agreed on, but the model had no specialized characteristics and hence made no novel predictions. It became well known not because it revolutionized the field of learning and memory, but because it was a useful cartoon model to

keep in mind. It was useful because it was simple and could account for most well-known phenomena of memory. A small number of these models would serve teacher's needs.

The second problem—technical language—is mostly resolved once we abandon the need to make novel predictions. A theory's more precise terms can be replaced by everyday language. For example, most of what teachers need to understand about working memory can be captured by the metaphor that it's the mental "work space" where thought occurs, and that this space is limited. The criterion of usefulness for these simplifications is whether the folk-language term is consistent with all of the empirical generalizations teachers ought to know. If not, some version of the more technical term must be used.

If teacher candidates are to learn a few modal models to help make empirical generalizations understandable and memorable, doesn't that imply that they must learn some epistemic assumptions? It surely does. A cognitive model is scarcely comprehensible if one does not understand the idea of symbolic representation. Ideally, the small set of modal models that teachers will learn should all be rooted in the same epistemology.

## Practice

We can expect that there will not be perfect agreement among different teacher training programs as to which empirical generalizations should be taught. Still, we would expect that virtually all would include this one: "learning improves with practice." The improvement of skilled performance in a negatively accelerating curve is ubiquitous—any theory or epistemology must be consistent with this observation.[60] That truism is especially important when the thing to be learned is abstract, and can take on different surface features. For example, every teacher knows that a student may learn how to work with proportions using examples from

recipes, but moments later be confounded by a similar problem describing the knitting of a scarf. Adults—for example, business school students learning contract negotiation techniques--face this same problem.[61] The surface structure of the problem—cookies or scarves—dominates our thinking, making it hard to see that the underlying structure is one we've encountered before.

This problem has been examined in the higher education. Students who have taken a one-semester course that includes an introduction to standard deductive logical forms will be able to solve problems using these forms on homework assignments and exams. But if they encounter such a problem in a different context—a deductive logic problem introduced as a "brain teaser"—they fail to recognize the problem structure and are unable to solve it.[62] But practice helps. Students who have taken more than one course in deductive logic more successfully transfer the knowledge to new situations.[63]

There's every reason, then, to expect that teacher candidates who take a single course in educational psychology will not be able to apply the principles they learn in the classroom, whether in the current model, or with the changes that I suggest here. The principles are abstract, and can take on different appearances. Overloaded working memory can look like inattention when a teacher gives a student a rapid fire series of five directions to follow.[64] Or overloaded working memory can look like anxiety when a student experiences stereotype threat.[65] Seeing the similarity in the two situations (and recognizing that similar strategies will ameliorate each) requires practice.

Some data from in-service teachers support the supposition that practice matters. Teachers with more classroom experience are more likely to see the underlying structure of classroom situations like discipline problems.[66] Some alternative certification programs have emphasized the importance of practical knowledge in teacher education (and the lesser

importance of educational theory) but these programs are still short on practice because they are relatively brief.[67] And one study shows that, across teacher education programs, more practice teaching and more methods-related coursework predicts teacher retention.[68]

The point of this chapter is that students would benefit from teachers who have an accurate mental model of the learner. This mental model will be abstract. It will describe general principles of student cognition, emotion, and motivation, but the visible symptoms of the student's mental state and potential for change will vary by age, circumstances, relationship with the teacher, and so on. People are slow to learn abstractions that are associated with variable surface characteristics, so teacher education must include practice learning and using the mental model of the learner. That practice means that teacher education courses must be coordinated. Future teachers will (as they typically are now) be introduced to content from educational psychology early in their program, but that content must be revisited in future courses. The principles learned in that first course will take on a different cast for the adolescent literature specialist, the middle school math teacher, and so on. More advanced course work must make clear how the content future teachers learned in introductory courses plays out in the various specialties.

## Conclusion

Research from the last 20 years indicates that teacher training on average has little, if any, impact on student outcomes, although there is variation from program to program.[69] This state of affairs has prompted two reform attempts. In the first, the requirement that teachers undergo the standard training regimen was relaxed. In one sense, this reform was not a failure; nothing terrible happened. But students did not benefit.

Another lower profile reform in teacher training occurred at the same time. Textbooks for foundational courses in educational psychology were changed between 1995 and 2010, with the aim of making content more applicable to classrooms. Although the impact of this change on student outcomes is not known, this reform failed in that teachers still find this content too theoretical and of low utility.

Perhaps the third time is the charm. I've suggested a reform to teacher education that employs three principles foundational to effective learning: teach only what you want people to know, organize it to make it easier to understand and remember, and practice it.

Two caveats regarding this proposal should be borne in mind. First, this reform is likely more difficult to implement than it would appear. It requires change not just in a single course, but to the entire curriculum of teacher training. Professors are used to teaching content as they please, and their ability and willingness to coordinate the content of their courses with other faculty is unknown, but suspect. Second, the evidence base is thin concerning whether students benefit when their teachers have a better understanding of principles of learning. This lack of data is remarkable, as the issue seems central in the evaluation of teacher training—what are future teacher learning, and does it matter? Even if the reform proposed here failed, any increased effort to systematically track what teachers learn during their education and its relationship to student outcomes would be a boon.

Despite these gloomy caveats, aspiring reformers can take heart from the fact that one of the more obvious strategies to improve teacher education has not yet been tried: don't just teach principles of learning to future teachers—apply them to the teaching of future teachers.



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