# Teaching to What Students Have in Common

*Daniel Willingham and David Daniel*

**Research shows that instruction geared to common learning characteristics can be more effective than instruction focused on individual differences.**

Scientists and poets see the world differently. Scientists focus on predictability and order; they are therefore interested in how seemingly different entities are actually the same. Poets are more often interested in the individual, the unique. Carl Linnaeus looked at a butterfly and thought about ways that it was similar to other insects, even more similar to other butterflies, and interchangeable with butterflies of the same species. Robert Frost looked at a butterfly and saw something worthy of its own elegy.

Both perspectives have value, but they highlight a challenge for educators: How are we to think about individuality among students?

## How to Think About Differences

On the one hand, if we think like a scientist and focus exclusively on ways in which students are the same, we're likely to name "best practices" that we think are applicable to all students and mulishly apply those practices to students who are clearly not benefiting from them. On the other hand, if we think like a poet and focus exclusively on students' individuality, we won't benefit from prior experience. If every child really is unique, then when I contemplate how to teach Tiffany I can't be sure that she'll benefit from the methods I've used successfully with other students.

When presented with two extremes, one often assumes that the wise course lies toward the center. But we suggest that's not the case here. We should not envision a sliding scale of uniqueness and similarity and then pick a point on which we think the whole child can be located. Rather, we suggest three classes of differences that might apply to different characteristics of the child.

*Class 1: Characteristics that all students share.* All students *do* have certain things in common. Indeed, it would be astonishing if they didn't. After all, we don't expect that individual human beings will differ radically in the way that the stomach participates in the digestion of food or the heart contributes to circulation. Why, then, shouldn't there be commonalities in the fundamental features of cognition, development, emotion, and motivation?

*Class 2: Characteristics that vary across students, but that are classifiable.* Some characteristics that often differ across students may provide useful categories into which we can group individuals. This idea lies at the heart of learning styles theories, which may posit that there are, say, four learning-style categories into which individual students fall. Students within a category are fairly similar, and

students in different categories are less so. Other examples of this approach are categorizing students by their ability level or by their interests.

The idea of categorizing students sounds pretty distasteful. Why wouldn't we treat each child as an individual? We might want to categorize kids for the same reason we categorize anything: It allows us to apply our experience. Consider that any apple I see is unique; I've never seen that particular apple before. But even acknowledging its uniqueness, I can identify a few features that allow me confidently to put it in the category "apple," and doing so means that I know much more about it: I know that it has seeds inside, I know that it makes a nice pie, and so forth.

Similarly, if I categorize a student as having an autism spectrum disorder on the basis of a few observable features of the student, that might tell me some things about the student that enable me to teach him or her more effectively.

So categorizing may have some advantages, but I should do so only under specific conditions. Students will reap benefits only if (1) the categories are meaningful; that is, kids within categories are more similar than kids in different categories; (2) I know which features to pay attention to so that I can categorize kids successfully; and (3) the distinction drawn by the categories is educationally meaningful; that is, my plan to treat students differently on the basis of the categories means that everyone in each category learns better.

*Class 3: Characteristics that vary across students and are not classifiable*. Some characteristics of students are deeply individual, and a teacher is unlikely to find useful ways to group kids on the basis of these characteristics. Examples might be students' background experiences and their personalities. What educators ought to do about this third class seems relatively uncontroversial. Successful teachers get to know their students as individuals—to understand and appreciate their tastes and quirks.

All three classes of differences are potentially important to successful teaching. But we argue that educators should pay greater attention to the first class—ways in which all students are the same. The available evidence strongly supports using our knowledge about common properties of students' minds (Pashler et al., 2007; Willingham, 2009), whereas the evidence for categorizing students is much less certain.

## Common Characteristics in Students

So what kinds of characteristics do we think all kids share? Common cognitive characteristics come in two varieties: (1) things that the cognitive system needs to operate effectively, and (2) methods that seem to work well to help most kids meet those needs. Identifying the former is a bit like specifying the vitamins, minerals, and other elements of a healthy diet; we'll call these *must haves*. Identifying

the latter is like suggesting foods that are high in t he necessary elements and ways to incorporate these foods into the diet; we'll call these *could dos*.

Pointing out cognitive needs (*must haves*) does not dictate pedagogical methods or lesson plans (*could dos*)—just as listing protein as essential to maintain health, for example, does not prescribe which protein-rich foods to prepare, much less specific recipes.
Let's look at a few examples of cognitive characteristics that affect learning.

## Must Haves

*Factual knowledge*. To think critically about science, or history, or literature, we need a lot of domain-specific knowledge (Penner & Klahr, 1996). For example, one thinking skill in science is recognizing the importance of anomalous results. A surprising result tells you there is something to be learned in the data. But you can't be surprised by a result if you haven't made a prediction, and you need domain knowledge to make a prediction.

Here's a simple example. Suppose a teacher develops a demonstration to create interest in the concept of whether liquids are *miscible*. She has her students mix distilled water and olive oil. Then she has them mix distilled water (with blue food coloring in it) and a water-and-salt solution (with red food coloring). The students note that the first mixture rapidly separates into two visible layers, whereas the water and salt mix does not. But if the students don't know that liquids of different densities should separate, they will not be especially surprised or intrigued by the demonstration. Students can't develop thinking skills in isolation; they need to develop those skills as they acquire domain knowledge (Willingham, 2007).

*Practice*. It's important for students to practice some knowledge and skills until they become automatic—available immediately from memory, without calling on valuable (and limited) attention resources. The great mathematician and philosopher Alfred North Whitehead (1911) made this point vividly by noting that although we are often urged to make a habit of thinking about what we're doing, "The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them" (p. 61). For example, students must know math facts automatically so that they don't have to calculate simple sums or products each time they are needed in a larger problem (Hecht, 2002). The best way to get such knowledge is to practice.

*Feedback from a knowledgeable source*. People cannot improve in skills—thinking, musical, athletic, whatever—without feedback. Sometimes that feedback is inherent in the performance. The comedian whose audience stares or walks out is getting clear feedback about his act, and the student who is trying to solve an algebra equation has at least some notion of whether she's got the right answer. But in either case, knowing that things are not going well is not the same as knowing how to do things better.

When students are learning a new skill, such as writing a good paragraph or analyzing an historical document, they need someone more knowledgeable to provide feedback. If the feedback can be immediate, so much the better. For one thing, if the feedback comes long after the work is performed, the student may have already lost motivation for the task. For another, the student may have forgotten the thinking processes that went into the work and thus will find it hard to remember why his or her choices seemed like a good idea at the time.

## Could Dos

Saying that students must have factual knowledge is all very well, but what can educators do to accomplish this goal? Again, on the basis of learning characteristics that are generally true of all students, here are a few *could dos*, most of which would help students gain the factual knowledge they must have.

*Distribute study time*. One strategy to make fact learning more effective is to distribute study time. That is, if a class of 9th graders is going to spend a total of 60 minutes in class studying Spanish vocabulary, it's better to distribute that 60 minutes into three 20-minute sessions on different days, rather than to crowd all 60 minutes into a single day. Even more important, students should revisit this material weeks or months later (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006).

*Practice recalling facts*. Another laboratory finding on learning that seems to apply well to the classroom is the benefit of querying oneself. The surprising truth is that probing one's memory in an effort to locate a bit of knowledge is an excellent way to ensure that the knowledge becomes permanently affixed in memory.

Suppose each of two science classes does a two-day project on magnetism. On the third day, students in one class listen to the teacher review the principles that the project illustrated, while students in the other class answer a series of questions that encourage them to recall those principles on their own. The second class will later remember the principles better. Once something is in memory, you're better off trying to remember the material than you are studying it again (Roediger & Butler, 2011).

*Cycle between the concrete and the abstract*. Here's a final example of a *could do*. Abstract concepts—such as *adaptation* in biology, or a *variable* in mathematics, or *irony* in literature—are some of the most difficult to teach. A number of studies point to the best path to help students understand such difficult concepts. The answer is neither emphasis on the abstract nor emphasis on the concrete, but rather a cycling back and forth between concrete examples and the abstract principles, preferably with a broad variety of examples (Kalyuga, Chandler, Tuovinen, & Sweller, 2001).

For example, one abstract definition of an *adaptation* is a change in an organism to make it better suited to live successfully in an environment. A teacher might offer varied examples. Body features might change to exploit a food source, as Darwin observed in the change in finches' beaks when different types of seed became more or less available. Adaptation can be symbiotic, as seen in the relationship between the clownfish and sea anemone; the clownfish eats invertebrates that could harm the sea anemone, and it gains protection from predators by the anemone's stinging cells. The continued integration of such examples with the abstract description of the principle helps students recognize the principle when they later encounter it in a different context.

## Choices for Practice

Clearly, there are many examples from the cognitive and education literature of near-universal principles around which a good teacher may build his or her practice. In fact, closely observing a high-caliber teacher's classroom will reveal several of these principles interacting at any given time. Because many of these principles are supported by significant consensus in the scientific literature and are also reflected in craft knowledge, we can be fairly confident in committing ourselves to creatively exploring and deploying them. In contrast, the observation that not every student can do everything the exact same way at the exact same time should not lead to the overreaction of hyper-individualizing the curriculum.

Instruction geared to common learning characteristics instead of individual differences can obviously increase efficiency and produce more bang for the buck because the teacher no longer needs to teach different lessons to students assigned to different categories. But another cost saving is even more important—the cost of failure. Although the characteristics that students share are fairly well documented, the manner in which students differ is not. Thus, focusing instruction primarily on differences may not be as effective as one may hope. Further, individual difference theories typically argue for a more fluid and contextual perspective, making static categories rather unwieldy, if not plain impossible. That is, a student may process lessons in science differently than he or she does in art or history. If this student is assigned to the same group in both domains, we may actually be subverting the learning process.

Of course, students will differ with regard to how they respond to and benefit from any single instructional strategy in a given lesson. There is no doubt that students have individual differences that are both situational and preferential. And there is no doubt that effective teachers address these differences using their own experience as a guide.

But when it comes to applying research to the classroom, it seems inadvisable to categorize students into more and more specialized groups on the basis of peripheral differences when education and cognitive sciences have made significant progress in describing the core competencies all students share. Teachers can make great strides in improving student achievement by leveraging this body of research and teaching to commonalities, not differences.

# References

Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin, 132*, 354–380.

Hecht. S. A. (2002). Counting on working memory in simple arithmetic when counting is used for problem solving. *Memory and Cognition, 30*, 447–455.

Kalyuga, S., Chandler, P., Tuovinen, J., & Sweller, J. (2001). When problem solving is superior to studying worked examples. *Journal of Educational Psychology, 93*, 579–588.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: Institute of Education Sciences, U.S. Department of Education.

Penner, D. E., & Klahr, D. (1996). The interaction of domain-specific knowledge and domain-general discovery strategies: A study with sinking objects. *Child Development, 67*, 2709–2727.

Roediger, H. L., & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences, 15*, 20–27.

Whitehead, A. N. (1911). *An introduction to mathematics*. New York: Henry Holt.

Willingham, D. T. (2007, Summer). Critical thinking: Why is it so hard to teach? *American Educator*, 8–19.

Willingham, D. T. (2009). *Why don't students like school?* San Francisco: Jossey-Bass.