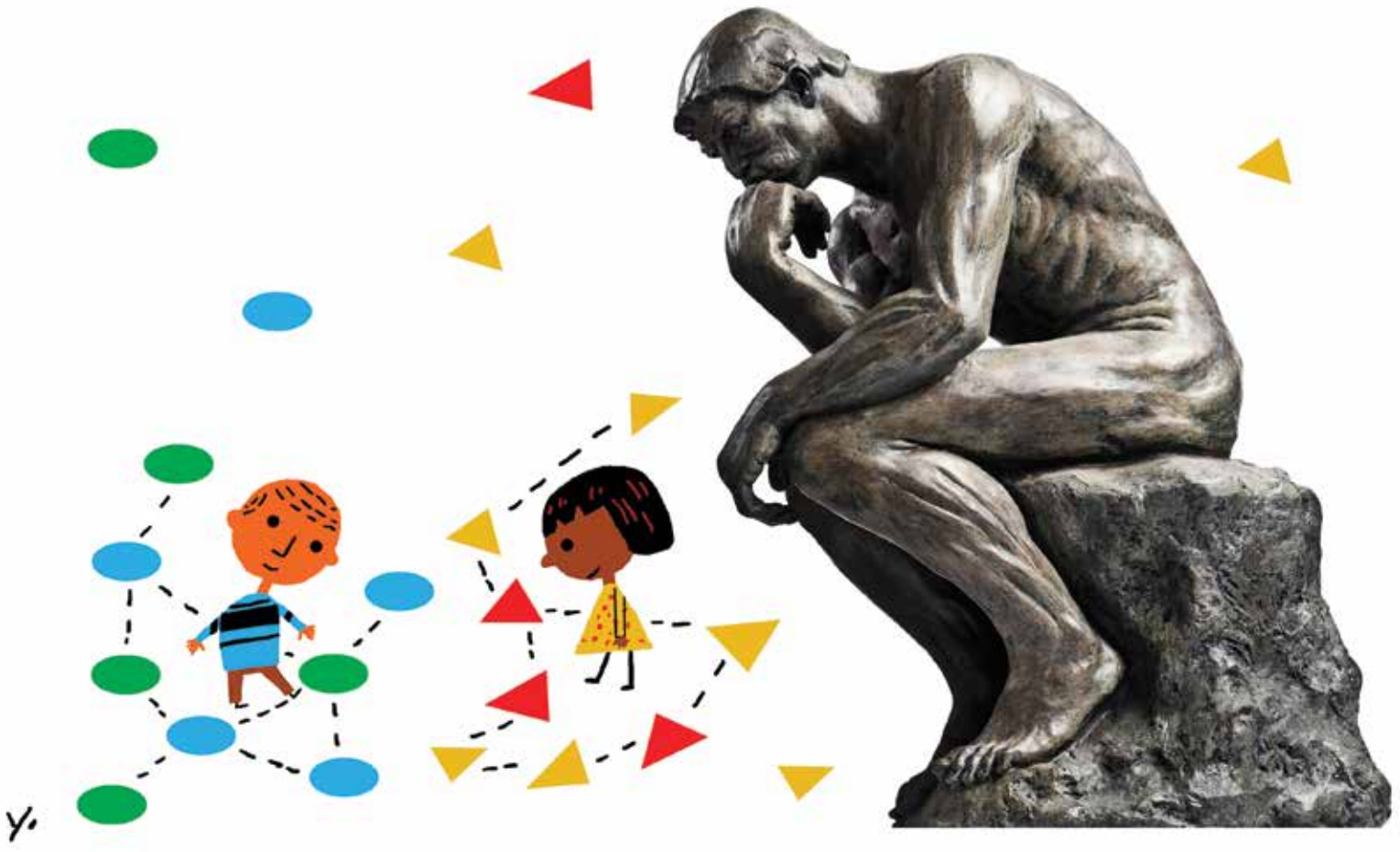
Does Tailoring Instruction to "Learning Styles" Help Students Learn?



How does the mind work—and especially how does it learn? Teachers' instructional decisions are based on a mix of theories learned in teacher education, trial and error, craft knowledge, and gut instinct. Such knowledge often serves us well, but is there anything sturdier to rely on?

Cognitive science is an interdisciplinary field of researchers from psychology, neuroscience, linguistics, philosophy, computer science, and anthropology who seek to understand the mind. In this regular American Educator *column, we consider findings from this field that are strong and clear enough to merit classroom application.*

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By Daniel T. Willingham

Question: In 2005, you wrote that there was no evidence supporting theories that distinguish between visual, auditory, and kinesthetic learners.* I still attend professional development sessions that feature learning-styles theories, and newer teachers tell me these theories are part of teacher education. Is there any update on this issue?
Answer: Research has confirmed the basic summary I offered in 2005; using learning-styles theories in the classroom does not bring an advantage to students. But there is one new twist. Researchers have long known that people claim to have learning preferences—they'll say, "I'm a visual learner" or "I like to think in words." There's increasing evidence that people act on those beliefs; if given the chance, the visualizer will think in pictures rather than words. But doing so confers no cognitive advantage.

*To read my Summer 2005 column, "Do Visual, Auditory, and Kinesthetic Learners Need Visual, Auditory, and Kinesthetic Instruction?," in *American Educator*, see www.aft.org/ae/summer2005/willingham.

ILLUSTRATIONS BY JAMES YANG

People believe they have learning styles, and they try to think in their preferred style, but doing so doesn't help them think.

Different children learn differently. This observation seems self-evident and, just as obviously, poses a problem for teachers: How are they supposed to plan lessons that reach all of these different learners? The job might be easier if the differences were predictable or consistent. If a teacher knew that, of the 25 students in her class, 12 learn *this* way and 13 learn *that* way, she could plan accordingly. She could teach *this* way and *that* way to separate groups of students, or she could be sure to include some of *this* and *that* into whole-class lesson plans. The question is: What is *this* and *that*?

It's fairly obvious that some children learn more slowly or put less effort into schoolwork, and researchers have amply confirmed this intuition.[1] Strategies to differentiate instruction to account for these disparities are equally obvious: teach at the learner's pace and take greater care to motivate the unmotivated student.[2] But do psychologists know of any *non*obvious student characteristics that teachers could use to differentiate instruction?

Learning-styles theorists think they've got one: they believe students vary in the mode of study or instruction from which they benefit most. For example, one theory has it that some students tend to analyze ideas into parts, whereas other students tend to think more holistically.[3] Another theory posits that some students are biased to think verbally, whereas others think visually.[4]

When we define learning styles, it's important to be clear that style is not synonymous with ability. Ability refers to how well you can do something. Style is the way you do it. I find an analogy to sports useful: two basketball players might be equally good at the game but have different styles of play; one takes a lot of risks, whereas the other is much more conservative in the shots she takes. To put it another way, you'd always be pleased to have more ability, but one style is not supposed to be valued over another; it's just the way you happen to do cognitive work. But just as a conservative basketball player wouldn't play as well if you forced her to take a lot of chancy shots, learning-styles theories hold that thinking will not be as effective outside of your preferred style.

In other words, when we say someone is a visual learner, we don't mean they have a great ability to remember visual detail (although that might be true). Some people *are* good at remembering visual detail,[5] and some people are good at remembering sound, and some people are gifted in moving their bodies.[6] That's kind of obvious because pretty much every human ability varies across individuals, so some people will have a lot of any given ability and some will have less. There's not much point in calling variation in visual memory a "style" when we already use the word "ability" to refer to the same thing.

The critical difference between styles and abilities lies in the idea of style as a *venue* for processing, a *way* of thinking that an individual favors. Theories that address abilities hold that abilities are not interchangeable; I can't use a mental strength (e.g., my excellent visual memory) to make up for a mental weakness (e.g., my poor verbal memory). The independence of abilities shows us why psychologist Howard Gardner's theory of multiple intelligences is not a theory of learning styles.[7] Far from suggesting that abilities are exchangeable, Gardner explicitly posits that different abilities use different "codes" in the brain and therefore are incompatible. You can't use the musical code to solve math problems, for example.

Learning-styles theories, in contrast, predict that catering to the preferred processing mode of a student will lead to improved learning. So what does the evidence say?

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Does Honoring a Student's Learning Style Help?

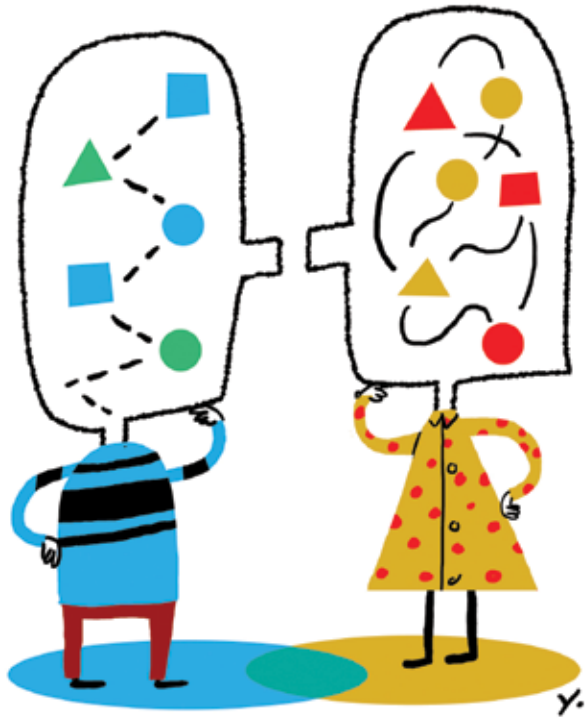
There are scores of learning-styles theories, some going back to the 1940s. Enough research had been conducted by the late 1970s that researchers began to write review articles summing up the field, and they concluded that little evidence supported these theories.[8] Research continued into the 1980s, and again, when researchers compiled the experiments, they reported that the evidence supporting learning-styles theories was thin.[9]

In 2008, professor Hal Pashler and his associates reviewed the literature and drew the same conclusion, but they also noted that many of the existing studies didn't really test for evidence of learning styles in the ideal way.[10] For example, if you want to test the verbalizer/visualizer distinction, it's not enough to show that visualizers remember pictures better than verbalizers do. Maybe those people you categorize as visual learners simply have better memories overall. You need to examine both types of learners and both types of content, and show that words are better than pictures for the verbalizers, and that the opposite is true for the visualizers.

The article by Pashler and colleagues prompted a microburst of articles on learning styles, but their warning that many prior studies were poorly designed went unheeded, and much of the recent research is uninformative.[11] Nevertheless, some studies are interpretable, and three published since 2008 claim support for a learning-styles theory. For example, one group of researchers reported that active learners benefit more from brainstorming, whereas reflective learners benefit more from instruction and recall.[12] In another study, one researcher compared three modes of web-based instruction and reported differences in input-oriented and perception-oriented learners.[13] But both articles had the same drawback; they used such a small number of experimental subjects (9–11 per group) that there's a real chance the results were flukes.

The third experiment claimed positive results when testing psychologist Robert Sternberg's theory of self-government.[14] Sternberg describes some learners as "legislative," meaning they like to be able to create their own learning experiences without restraints, so they would learn best when allowed to skip learning materials. "Executive" learners like to follow directions, so they would learn best with clear guidance about what to do and when to do it. And "judicial" learners like to judge things and compare them, so they would learn best with lots of materials that they can compare. The researchers had subjects learn in an online environment with instruction matched (three groups) or mismatched (six groups) to their learning style.[15] The outcome measure was a little unusual—participants were asked to reflect on the material they had learned, and two raters evaluated the quality of these reflections. The researchers reported better reflections from students when the instructional method matched their preferred style than when it did not, but a breakdown showing exact group performance was not provided.

So three studies show results with some promise for two different learning-styles theories, which indicates the theories merit further investigation. But 13 other published papers, testing five different learning-styles theories, in both natural settings and laboratories, show no support for learning-styles theories. Although all of them tested students beyond the K–12 years, likely because that group was easiest for the experimenters to access, each theory predicts that differences would be observed in higher education settings.



As with the few studies showing positive results, the studies showing negative results are often imperfect (for example, some needed more participants).[16] But some experiments were carefully designed. For example, one study provides a straightforward, powerful test of the verbalizer/visualizer distinction.[17] In the study, 204 university students took a questionnaire meant to measure their proclivity to learn in one of four ways: visually, auditorily, via reading or writing, or kinesthetically.[18] In the next phase of the experiment, participants heard 20 statements, read one at a time. Half of the participants were to rate each statement for how well they could form a vivid mental image based on the statement. The other participants were asked to focus on the auditory aspect of the statement by judging how well they could pronounce it. Participants were not forewarned that they would be tested on information from the sentences, but the third phase posed 20 questions about them. Everyone got more questions right if they performed the imagery task (about 16 questions right), compared with the auditory task (about eight questions right). That result didn't change at all if the questionnaire classified participants as more of a visual learner or more of an auditory learner.

In short, recent experiments do not change the conclusion that previous reviewers of this literature have drawn: there is not convincing evidence to support the idea that tailoring instruction according to a learning-styles theory improves student outcomes. Now, you may protest that I've disparaged some studies as poorly done. I should also note that the research covers only some of the existing theories of learning styles. So maybe tailoring lessons to students' learning styles *could* help, it's just that no one has done a good experiment to show that? That's possible, of course. In fact, even if 100 terrific experiments failed to support the visual/auditory learner distinction, we could still say, "Well, maybe all 100 experiments were set up in the wrong way to show that learning styles do matter. Let's try experiment number 101." When it comes to scientific theories, you can't prove a negative proposition beyond any doubt.

But "are we sure it's wrong?" is a bad criterion. We should ask whether there is good evidence *supporting* the theory. After all, if we're considering letting this theory influence classroom practice, we should be as sure as we can be that it's true. It's not enough to be able to say "we can't be certain it's false."

Evidence That People Act on Their Learning Style

Research from the last 10 years confirms that matching instruction to learning style brings no benefit. But other research points to a new conclusion: people do have biases about preferred modes of thinking, even though these biases don't help them think better.

Researchers used a clever task to show that verbalizers and visualizers do try to use their preferred mode of processing.[19] First, the experimenters created stimuli that could be verbal or visual: participants either saw an image with three features (for example, a blue triangle with stripes) or saw a verbal description of the features ("blue," "stripes," "triangle"). The task they performed was a similarity judgement: a target figure appeared briefly, and then subjects saw two more figures and had to judge which one was more similar to the target. (The more similar figure always shared two of the three features.) Both the target and the two choices could either be visual or verbal, so there were four types of trials: visual-visual, visual-verbal, verbal-visual, and verbal-verbal.

The experimenters measured brain activity while participants performed the task and found evidence that participants recode the target to match their learning style. The more someone

reported being a "verbalizer," the more likely they were to show increased activity in "verbal" parts of their brain (the left supramarginal gyrus) when they were presented with images. The more they reported being a "visualizer," the more likely they were to show increased activity in "visual" parts of their brain (the fusiform gyrus) when they were presented with words. It's worth noting that the survey identifying participants as verbalizers or visualizers was administered at least two weeks before the experiment. The experimenters wanted to ensure that people doing the task didn't act in accordance with a style simply because they had just finished the survey, which may have made them think about being a verbalizer or visualizer.

So this result shows that people actually act on their reported preference, changing a task so they can think in words or pictures as they like. But that doesn't mean that changing a task to fit your style makes you think better. An obvious prediction for a learning-styles theory would be that visualizers would be better at this task when the stimuli were pictures, and verbalizers would be better when they were words. But matching the task to individuals' preferred learning styles didn't predict task performance.

Other experiments exploring the verbalizer/visualizer distinction show the same pattern. Depending on their self-identified learning style, people seek out written instructions or diagrams,[20] or look at one or the other type of information longer.[21] Similar data have been observed in the visual, auditory, and kinesthetic framework.[22]

Another example of people acting on their learning styles concerns the difference between intuitive and reflective modes of thinking.[23] Here's a simple problem to illustrate the difference: "A small vase holds one white ball and nine red balls. A large vase holds 10 white balls and 91 red balls. From which vase should you randomly select a ball, if you hope to get a white one?" Intuitive thinking is fast and uses simple associations in memory to generate an answer, so it would lead you to select the large vase. That vase has more white balls, so you figure you're more likely to get a white one. The reflective mode of thinking is slower and relies on deeper, more analytic processing of available information. It would lead you to calculate the probability of drawing a white ball from each vase and ultimately to the correct answer, the smaller vase.

Everyone uses both modes of thinking at different times, but individuals are biased to start with one or another type of processing, especially if nothing in the environment (like instructions or a time limit) nudges them toward one or the other.[24] But most problems are not open to equally good solutions through either type of processing. Probability problems (like the vase example) are better solved through reflection, even if your bias is toward intuition. Creativity problems that benefit from free association are better solved by intuition, not reflection. The data show that people do have some propensity to use one or another mode of thinking, but people would be better off if they didn't; rather, they should use the mode of thinking that's a better fit for the task at hand.[25]

This suggestion—tune your thinking to the task—assumes that people have the flexibility to process as they choose. To use an example from a different learning-styles theory, we're assuming your status as a verbalizer can be overridden if you want to think about something visually. There's evidence that's true. In a recent study, researchers asked participants to navigate virtual cities.[26] They found that verbalizers showed better memory for landmarks, but visualizers made more accurate judgments about the relative directions of city features. In a second experiment, the researchers *instructed* people to act like a verbalizer or a visualizer. People were able to follow these instructions, and the results matched what happened when they let people process as they pleased: thinking verbally helped with landmarks, and thinking visually helped with direction. Important to our purposes, the effect of instruction overwhelmed learning style; when told to process in a manner inconsistent with their preferred style, everyone showed the same memory effect.

People do have biases about preferred modes of thinking, even though these biases don't help them think better.

We saw the same pattern in the experiment discussed earlier that used sentence memory to test the verbalizer/visualizer distinction. You can remember sentences by thinking visually or verbally, but there's a *huge* advantage to the former strategy, and it works just as well no matter what your preferred style.[27] In sum, people do appear to have biases to process information one way or another (at least for the verbalizer/visualizer and the intuitive/reflective styles), but these biases do not confer any advantage. Nevertheless, working in your preferred style may make it *feel* as though you're learning more.[28]

But if people are biased to think in certain ways, maybe catering to that bias would confer an advantage to motivation, even if it doesn't help thinking? Maybe honoring learning styles would make students more likely to engage in class activities? I don't believe either has been tested, but there are a few reasons I doubt we'd see these hypothetical benefits. First, these biases are not that strong, and they are easily overwhelmed by task features; for example, you may be biased to reflect rather than to intuit, but if you feel hurried, you'll abandon reflection because it's time-consuming. Second, and more important, there are the task effects. Even if you're a verbalizer, if you're trying to remember sentences, it doesn't make sense for me to tell you to verbalize (for example, by repeating the sentences to yourself) because visualizing (for example, by creating a visual mental image) will make the task much easier. Making the task more difficult is not a good strategy for motivation.

Let's review the conclusions we can draw from this research before we consider the implications for education.

First, since the last major literature review in 2008, more experiments have been conducted to measure whether participants learn better when new content fits their purported learning style. The bulk of the evidence shows no support for style distinctions. This conclusion is in keeping with a great many prior findings. The following four conclusions are more tentative.

Second, there is emerging evidence that people have a propensity to engage in one style of processing over others. Only a few learning-styles theories have been tested this way, but there seems to be pretty good evidence for the idea that visualizers and verbalizers are biased to process information in their preferred style, and that people may be biased toward either reflective or intuitive thinking. These biases are not very strong, however.

Third, the type of mental processing people use often has a substantial effect on task success. Reflective thinking is much better than intuitive thinking for probability problems. Imagery is much better than verbalizing for sentence memory.

Fourth, people can control the type of processing they use. Someone may prefer to think intuitively when solving a problem, but they can think reflectively if something in the environment prompts them to do so, or if they recognize it's the type of problem best addressed that way.

Fifth, there's no evidence that overruling your bias in this way incurs a cost to thinking. In other words, visualizers may be biased to use visual imagery, but when verbalizers use it, they are just as successful in solving problems.

One educational implication of this research is obvious: educators need not worry about their students' learning styles. There's no evidence that adopting instruction to learning styles provides any benefit. Nor does it seem worthwhile to identify students' learning styles for the purpose of warning them that they may have a pointless bias to process information one way or another. The bias is only one factor among many that determine the strategy an individual will select—the phrasing of the question, the task instructions, and the time allotted all can impact thinking strategies.

A second implication is that students should be taught fruitful thinking strategies for specific types of problems. Although there's scant evidence that matching the manner of processing to a student's preferred style brings any benefit, there's ample evidence that matching the manner of processing to the task helps a lot. Students can be taught useful strategies for committing things to memory,[29] reading with comprehension,[30] overcoming math anxiety,[31] or avoiding distraction,[32] for example. Learning styles do not influence the effectiveness of these strategies. ☐

Endnotes

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