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Learning styles: where's the evidence?

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Whereas modern medicine owes much of its success to its reliance upon evidence-based treatments, most popular techniques of instruction have not been subjected to thorough empirical scrutiny. A particularly glaring and costly result of this, we argue, is the wide acceptance of the idea that instruction should be tailored to a student's so-called *learning style*. For example, students might be divided into visual learners and verbal learners (on the basis of a learning style test given to each student) and then provided with instruction that emphasises pictures or words, respectively. The visual–verbal distinction is only one simple example of the many proposed taxonomies; a recent review described 71 different schemes.¹ Given this advocacy by academics and the ensuing heartfelt praise of educators, tailoring instruction to students' style is now a prevalent and profitable enterprise. However, as we and others have pointed out,^{2–5} a thoughtful review of the data provides no support for style-based instruction.

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At first blush, style-based instruction seems to be supported by a large empirical literature. However, closer examination reveals that only a small portion of these studies use the only research design capable of supporting the idea that customised instruction produces better learning than using the same kind of instruction for everyone.^{4–6} To illustrate the appropriate design and the kind of result needed to show support for style-based instruction, we describe a hypothetical study of the visual–verbal taxonomy. Firstly, subjects are divided into visual learners and verbal learners on the basis of some sort of learning styles test (usually a questionnaire). Secondly, all subjects, regardless of their assessed style, must be randomly assigned to receive either instruction tailored to visual learners or instruction tailored to verbal learners. Notably, this means that half of the visual learners and half of the verbal learners will receive the 'right' kind of instruction, and the other half of each group will receive the 'wrong' kind of instruction. Finally, all subjects must be given the same test of learning. The results of such a study would support style-based instruction if and only if the test scores revealed two findings:

visual learners do better if instruction is visual rather than verbal, and verbal learners do better if instruction is verbal rather than visual. If these two findings are not observed, it means that both kinds of learners did better with the *same* kind of instruction, which is a negative finding.

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Our search of the extensive literature on learning styles, which included written inquiries to prolific advocates of style-based instruction, revealed that the appropriate design was used in only about 20 studies, and the results of most of them are compellingly negative. These negative findings were obtained with a variety of learning materials, including some in science⁶ and medicine.⁷ By contrast, we are aware of only three appropriately designed studies that yielded a positive finding like that described in our hypothetical example, and these findings are not very convincing. In one case, no measures of the data were provided, and the authors reported that only one of three studies of the same intervention produced a statistically significant finding.⁸ In another study reporting a positive finding, only one of the two final tests revealed a benefit of

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customised instruction, the size of which is unknown because the research report did not include measures of variability or effect size.⁹ In short, there exist a smattering of positive findings with unknown effect sizes that are eclipsed by a much greater number of published failures to find evidence, and we suspect that additional null findings sit in researchers' file drawers.

Our search of the literature on learning styles revealed that the appropriate design was used in only a handful of studies

From a practical standpoint, even if the empirical evidence revealed a consistent benefit of style-based instruction, providing tailored instruction would not make sense unless its benefits were large. This is because style-based instruction is logistically demanding. Each student's style must be assessed by tests that are often quite expensive, and multiple versions of each course must be created and offered. The practical question, then, is not whether style-based instruction benefits learning, but whether it provides more bang for the buck than other interventions (such as smaller classes or tutors).

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If the empirical evidence is missing, why is style-based instruction so often assumed to have merit? It

seems to us that the concept probably enjoys an illusory legitimacy owing to its apparent similarity to several undoubtedly true observations, albeit observations that do not provide any logical support for style-based instruction. One of these observations is that abilities vary across individuals in fairly systematic ways. For this reason, it does indeed make sense to speak of students who, in comparison with their peers, have poor visual-spatial ability and strong verbal ability, but this does not imply that such students will learn anatomy better if their textbook has few diagrams. A second observation that is often imagined to support the idea of style-based instruction concerns the indisputable fact that some academic subjects are best taught visually, others verbally, and still others by a combination of the two. As a point of logic, however, this hardly shows that the optimal instruction of any one topic should differ among students.

There presently is no empirical justification for tailoring instruction to students' supposedly different learning styles

In summary, there presently is no empirical justification for tailoring instruction to students' supposedly different learning styles. Educators should instead focus on developing the most effective and coherent ways to present particular bodies of content,^{4,5} which often involve combining different forms of instruction, such as diagrams and words, in mutually reinforcing ways.

Given the costs of assessing students' supposed learning styles and offering differentiated instruction, this should come as good news to educators at all levels, from kindergarten through medical school.

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