Learning Styles: Addressing the Neuromythology

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April 2022

> "I'm not very good at math—I'm too right-brained."
>
> "It's no wonder you struggle with giving speeches—you're not really an auditory learner, are you?"
>
> "I think the reason why I excel in art is that I am a visual learner."
>
> "I wish Mrs. Blue would explain the problems in more detail. Just reading about it is not enough for me—I'm an auditory learner."

Comments such as these are often shared among students and are offered as a rationale for success and struggles in learning new information. Sometimes they are presented by struggling students as a critique of a teacher's delivery of information. Unfortunately for those who use learning styles to frame success in teaching and learning, no empirical evidence supports those beliefs about learning styles.

Background

The idea of learning styles represents a point of view that there are specific modes of learning that help learners to acquire and learn information more effectively. Coffield (2004) and his colleagues identified more than seventy different learning styles, with models that identified three, four, seven, and even eight different "styles" of learning. Among the best-known is the VARK model, which posits that there four general modes of learning: visual, auditory, reading/writing, and kinesthetic (Fleming & Mills, 1992; see figure 1). Advocates for learning styles argue that aligning teaching strategies with student learning styles will produce more effective learning. An "auditory" learner will learn better and more effectively if they are presented new information in an auditory manner, such as listening to a podcast or a lecture. Visual learners will learn more effectively if information is presented through diagrams or figures such as graphs. Those who learn best through reading and writing will benefit from written text materials to support their learning.

A variety of learning style assessments are available for use in education and professional training settings, with workshops available to help integrate learning style practices into instruction. Pashler, McDaniel, Rohrer, and Bjork (2009), in their review of learning styles in education, documented that use of learning styles has

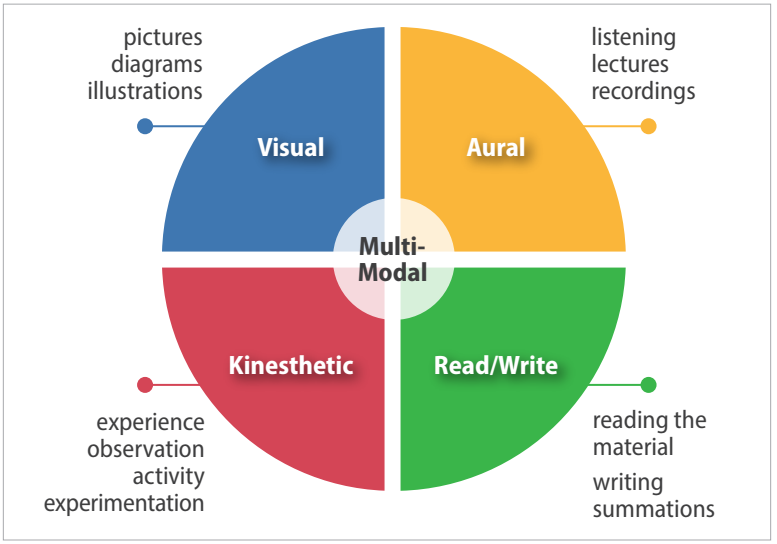

Figure 1. VARK Learning Styles. © EBSCO.

acquired wide acceptance in the education field, ranging from elementary classrooms through graduate school.

Among the ongoing influence of the work of Pashler et al. (2009) is the establishment of methodological criteria that should be employed by studies testing the relationship between learning styles and learning—that it must consider whether or not learning is enhanced when learning style and instructional style are matched. These four criteria were established to objectively evaluate the role (or lack thereof) in teaching and learning activities:

- Study participants must be separately assigned into two or more groups (e.g., visual learners and auditory learners)
- Subjects must be randomly assigned to at least one of two different learning/instructional methods (e.g., visual learners and auditory learners)
- All participants must be complete the same assessment of learning at the conclusion of the investigation.
- The results of the study must show that participants show a difference in learning that is different related to an alignment between a preferred learning style and the instruction provided.

The studies that are profiled below apply these standards in developing their conclusions regarding the influence of learning styles on teaching and learning.

Research

Despite the appeal of the learning style concept, there is scant research evidence that supports this point of view. Authors (Nancekivell, Shah, & Gelman, 2019; Will, 2019) characterize this pervasive belief in learning styles as a "neuromythology"—a belief held to be true, but without evidence to support this belief. Numerous stud-

ies have explored the connection between learning styles and learning over several decades. These studies have challenged the role of learning styles as a means of positively aligning teaching and learning (Huang, 2019; Nancekivell, Shah, & Gelman, 2019). Despite this, belief in the effectiveness of learning styles persists within the community of professional educators and the general public as well (Altun, 2019; Dalaman, Can, & Durukan, 2019).

A concise overview of relevant literature testing the effectiveness of learning styles follows. Two areas of inquiry are addressed below: (1) the mechanics of how information is used in learning and (2) evidence gained from studies on teaching and learning that examined the relationship between learning styles and learning.

Photo courtesy Pixabay.

Memories and Learning

Most memories are stored in terms of meaning. While some memories may have an auditory, visual, or kinesthetic element to them, cognitive psychologists have confirmed that memories are stored based on the meaning of the memory, which is unrelated to the style or modality of learning.

Aslaksen and Lorås (2019) recently explored this topic and affirmed what has been understood for decades (see Bransford & Franks, 1971), that memory is stored by the learner not through auditory means or visual means, but by retrieving from memory their understanding of the story. This provides evidence that the memory does not simply store information the learner received through auditory means. But rather, it incorporates information coming from outside into what is already in the memory. That is, memory is not a mere copy of learners' experience.

Their investigation focused on two issues:

- The association between two learning styles (auditory and visual) and how information was processed in working memory
- The degree to which aligning learning style preferences with the mode of instruction (visual presentation versus audio presentation) leads to better recall

Subjects were provided instruction in either a written or auditory format. After completing the learning exercise, participants completed a multiple choice assessment of the information presented in the learning activity. Questions asked for both explicit recall of specific information as well as interpretations of information in the learning activity that required the learners to develop an inference.

In both instances, the authors found no significant relationship between the learning style preference and the performance of learning task. The findings showed no differences in working memory performance between subjects who were matched with their learning style preference and those who were not matched with their preferred learning style. There was no advantage to learning style preferences in recall of information.

Learning Styles and Learning

Krätzig and Arbuthnott (2006) examined how learning styles might provide distinct cognitive advantages for learners. This was framed by presenting the information to learners using a learning style that the learner believed to be optimal—their preferred learning style. The investigation examined the hypothesized relationship between remembering material presented in different sensory modalities and receiving instruction in distinct learning modes. To assess this hypothesis, Krätzig and Arbuthnott used a set of memory tests that focused on one of three learning modalities: one featuring pictures, one for stories/verbal information, and one for tactile shapes. These memory tests were focused on visual, auditory, and kinesthetic learning tasks respectively.

Before completing the memory tests, subjects confirmed their beliefs regarding the learning style that they believed best reflected their preferred learning style. In addition, participants completed a learning style inventory, the Barsch Learning Style Inventory (BLSI). The BLSI (Barsch, 1991) is a widely available learning styles assessment that identifies visual, auditory, and kinesthetic learning styles.

The self-report of preferred learning styles and the BLSI learning style assessment documents that learner's beliefs about their preferred learning style and an objective assessment of learning styles do not always match (see table 1). That is, learners do not have an accurate understanding of their perceived learning style when compared with an objective assessment of their learning style. Further, there is no reliability or validity documented for this learning style inventory, which calls into question its fundamental value and the degree to which it measures what it claims to. The overall outcome found that there was no relationship between the learning style and the performance on the memory assessment (Krätzig & Arbuthnott, 2006).

Comparison of Self-Reported Learning Style with BLSI Assessed Learning Style – Percentage in Study Group (n = 65)

Learning Style	Self-Report Preference	BLSI
Visual	40%	60%
Auditory	34%	32%
Kinesthetic	16%	8%

Table 1.

These findings undermine the key point of learning style advocates: the researchers were unable to find any evidence of a relationship between the learning style and the performance on the learning assessment. When the participants completed the memory test, 52 percent of participants performed best using the tactile test and 23 percent performed best with the visual test. The remaining participants (25 percent) achieved their highest score with the audio memory test. The importance of this outcome is that regardless of what format yielded a high score, there was no connection between what the learner's belief about how they learned best and their actual performance.

Rogowsky, Calhoun, and Tallal (2015) also examined the influence of aligning demonstration of learning with a preferred learning style. Guided by the design considerations of Pashler et al., the authors examined learning style preferences among college-educated adults.

Participants in the study were assessed to determine their preferred learning style and were randomly assigned to an instructional group—one group was presented information in a written format; the other was provided the same information through narration. At the conclusion of the instruction, learners were assessed twice—once immediately after instruction and again after two weeks.

Their investigation determined that differences in preferred learning style (auditory, visual word) did not predict differences in aptitude. "[T]here were no statistically significant results that showed that individuals with stronger auditory learning style preferences had higher listening comprehension aptitude than reading aptitude or, conversely, that individuals with stronger visual word learning style preferences had higher reading than listening aptitude" (Rogowsky, Calhoun, & Tallal, 2015, p. 76). Rather, participants who demonstrated a preference for learning visually scored higher on the memory test than those who had a preference for an auditory learning style for both the listening and reading tests. The data does not support the hypothesis that aligning instruction based on learning style produced better results.

Knoll, Otani, Skeel, and Van Horn (2015) examined one of the factors that might explain why the belief in learning styles remains steadfast for both teachers and learners. Knoll et al. examined the impact of a subjective quality—a judgment of learning—to learning styles that may account for learner perceptions of perceived

value of these approaches. A judgment of learning (JOL) is an assessment made by learners regarding how well they have learned particular information (Son & Metcalf, 2005). The JOL allows them to predict how well they have learned information and how well they will remember information when asked later to recall what they learned.

Learner preference for visual and verbal presentation of information was assessed using the revised Verbalizer-Visualizer Questionnaire (VVQ). Following this, subjects reviewed a list of word pairs and picture pairs, making judgments of learning as they studied each list. Learning was tested by cued recall. The findings showed that higher VVQ verbalizer scores were aligned with higher judgments of learning scores for words and that higher visualizer scores were related to higher JOLs for pictures. The results showed that higher VVQ verbalizer scores were associated with higher JOLs for words, and higher VVQ visualizer scores were associated with higher JOLs for pictures. In terms of accuracy of recall, there was no association between the VVQ scores and the accuracy of the JOL.

The results suggest that learning styles may influence aspects of learning such as how much effort one would apply, but is not related to learning itself as measured by recall.

Conclusions

While the desire to help students learn well and for teachers to teach effectively is more than laudable, the focus on learning styles as a means to achieve this is not supported by the available evidence. Though widely held, beliefs in the efficacy of learning styles are not supported by the scholarship of teaching and learning—or performance in classrooms by students. Disconcertingly, schools of education and state certification examinations perpetuate the mythology of learning styles by embedding these concepts into their curriculum and in assessments required for earning licensure (Furey, 2020). Nancekivell, Shah, and Gelman's (2019) recent study confirms both the pervasiveness of beliefs in the neuromythology of learning styles as a tool for teaching and learning as well as the tenacity with which educators and the general public maintain those beliefs. The studies cited in this article represent the consensus of the scientific community: that aligning learning styles with a related type of instructional content has no impact on learning.

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