Current Practice ALERTS

A focus on: Brain-Based Learning

Sponsored by Division for Learning Disabilities (DLD) and Division for Research (DR) of the Council for Exceptional Children

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What is It?

Brain-based learning and brain-based education have become increasingly popular as evidenced by the steadily growing number of brain-based learning websites, conferences, professional development opportunities, and articles in both the popular and academic press. Brain-based learning includes educational theories, instructional practices, and commercial products that claim to be based on the structure and function of the brain. Put simply, brain-based learning attempts to integrate neuroscience research and educational theory to best address how students learn.

Research support for the wide range of brain-based learning theories and programs run the gamut from research findings based on high-quality empirical studies to pseudoscientific claims. There are no formal guidelines to regulate assertions that a theory, practice, or product is brain-based. As such, just because a theory or program is called brain based does not mean that it is based on sound neuroscientific principles or that research has shown it to be effective. Indeed, many brain-based theories and practices are based on imprecise and superficial understandings of the brain (Pasquinelli, 2013) and are promoted by individuals who do not have training in cognitive neuroscience or a related field (Jorgenson, 2003). Misconceptions about the brain, frequently called neuromyths, have been circulating among the general public and education for quite some time, and are sometimes used as the basis of brain-based learning approaches (Geake, 2008; Howard-Jones, 2014).

This *Current Practice Alert* focuses on three popular brain-based programs and concepts: Brain Gym®, hemispheric dominance (right-brain vs. left-brain theory), and learning styles. *Brain Gym®* is a movement-based learning program that promotes the interdependence of movement, cognition, and applied learning to improve academic and behavioral outcomes (Brain Gym International, 2015). The theory of *hemispheric dominance* encourages teachers to tailor their instruction to the different learning needs of "right-brain" learners and "left-brain" learners (Jensen, 2008). Lastly, the concept of *learning styles* is founded upon the belief that individuals learn best when they are taught according to their preferred mode of instruction (e.g., auditory, visual, kinesthetic; Murawski & Spencer, 2011; Villa, Thousand, & Nevin, 2008).

For Whom is it Intended?

Although brain-based theories are intended to be used for all students, their specific claims are especially relevant for students with exceptionalities—particularly students with learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), and emotional and behavioral disorders. Many brain-based curricula target common academic and behavioral challenges faced by students with these high-incidence disabilities. For example, several of the more popular brain-based approaches (Brain Gym®, hemispheric dominance, and learning styles) profess to support students in the areas of reading, executive function, engagement, and motivation, which frequently pose difficulties for students with high-incidence exceptionalities.

How Does it Work?

The *Brain Gym®* program consists of 26 different physical movements designed to create a mind/body balance for optimal learning (Brain Gym International, 2015). Teachers select specific movements, or combinations of movements, to activate skills necessary for learning. Brain Gym® claims to promote skills in multiple areas, including attention, communication, organization, and self-awareness (Brain Gym International, 2015). The program does not provide students with explicit instruction in these areas. Rather, the movements are believed to prime students for learning by simultaneously engaging various anatomical regions of the brain. For example, the "Earth Buttons" and the "Thinking Cap" are movements intended to increase self-awareness and improve receptive and expressive communication skills (Dennison & Dennison, 2010). The "Earth Button" movement involves placing two fingers under the lower lip and placing the opposite hand on the stomach while breathing deeply and looking up

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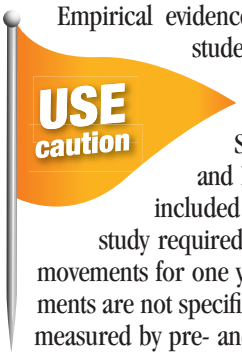
and down several times. The "Thinking Cap" movement involves unrolling the ear cartilage from top to bottom several times; ostensibly, this action will improve a student's focus and concentration. These choreographed movements can be performed before instruction, or interspersed as activity breaks during lessons. The movements can be performed as a whole-group activity, in small groups, or as individual interventions.

Hemispheric dominance is another brain-based learning concept. In pop vernacular, hemispheric dominance is commonly referred to as the "left-brain" versus "right-brain" phenomenon. According to the theory of hemispheric dominance, left-brain individuals are logical and systematic, and right-brain individuals are artistic and creative. Jensen (2008) suggested that teachers can improve student outcomes if they teach to the characteristics and needs of their right-brain and left-brain learners. Many specific teaching techniques have been developed that draw on the analytic or logical nature of left-brain learners and the creative and artistic strengths of right-brain learners. For example, when instructing left-brain learners, teachers could use outlines, flowcharts, and lectures; and when teaching right-brain learners, teachers might incorporate visual representations, and infuse art and music into daily lessons. (Connell, 2005; Sousa, 2001).

According to the concept of *learning styles*, teachers can boost student outcomes by teaching to their preferred learning styles (e.g., visual, auditory, kinesthetic). First, teachers assess students' preferences using one of several published learning style inventories such as Elementary Learning Style Assessment (Burke & Dunn, 2007), Building Excellence (Rundle & Dunn, 2007), and the Kolb Learning Style Inventory (Kolb, 2005). Then teachers match their instructional approach to the assessed learning style of each student. For example, teachers might provide visual learners with anchor charts or videos, auditory learners with recorded lectures and frequent opportunities for discussion, and kinesthetic learners with opportunities for movement during learning and the use of manipulatives. The Dunn and Dunn model (1993, 1999) of learning styles is most closely associated with students with exceptionalities. According to this model, student learning styles are comprised of elements across five broad domains (environmental, emotional, sociological, physical/physiological, and psychological). Teachers can manipulate elements within these domains to individualize instruction and maximize learning outcomes. See Landrum and Landrum (2014) for a previous Current Practice Alert devoted specifically to learning styles that urged special educators to use caution when considering the approach.

How Adequate is the Research Knowledge Base?



Empirical evidence supporting the use of *Brain Gym*® for students with LD is very limited. Four peer-reviewed research studies on Brain Gym® have been reviewed by Hyatt (2007), Stephenson (2009), and Spaulding, Mostert, and Beam (2010), and only one of these studies included students with LD (Cammisa, 1994). This study required participants to complete daily Brain Gym® movements for one year (the time, frequency, and type of movements are not specified in the article). Intervention response was measured by pre- and post-perceptual and academic tests. Study participants did not score significantly higher on academic tasks. They did show statistically significant improvement on perceptual motor tests; however, the study did not take into account confounding factors, including maturation of study participants. More recently, Watson and Kelso (2014) conducted an intervention study to explore the effect of Brain Gym® on academic engagement for three children with developmental disabilities. Using a single-subject design, the authors compared the effect of Brain Gym® on academic engagement to an alternate intervention, simple physical activity. Results did not demonstrate consistently positive effects for either of the interventions. Additionally, the existing research on Brain Gym® suffers from methodological flaws. In their review, Spaulding et al. (2010) determined none of the supporting studies of the Brain Gym® program could be considered high quality. Most of the reports supporting the use of Brain Gym® are anecdotal in nature and are published by the Brain Gym® organization. Additionally, the Council for Learning Disabilities has issued a position paper opposing the use of perceptual motor programs, including Brain Gym® (Board of Trustees of the Council for Learning Disabilities, 1986).

Hemispheric dominance is not supported as an effective instructional approach by extant research either. At the time of writing, I did not identify any studies demonstrating that teaching techniques designed for right-brain learners and left-brain learners caused improved student outcomes. Moreover, the concept of right-brain and left-brain learners is founded upon a misunderstanding of neural anatomy. It is true the brain is separated into two hemispheres that are connected by the corpus callosum. However, the idea that people use different sides of their brains, independent of the other, is simply not true. Both hemispheres of the brain work together regardless of task, and the importance of inter-hemispheric interaction for cognition and attention is well documented (Banich,1998; Christman, Propper, & Dion, 2004).

Teaching to specific *learning styles* is a popular concept among educators. In a recent study of U.S. educators (n=598), 76% were found to endorse the use of learning styles (Macdonald, Germine, Anderson, Christodoulou, & McGrath 2017). This trend has been demonstrated in other countries as well. For example, a survey of educators in Latin America (n=3,451) revealed that 90% support the learning styles concept (Gleichgerrcht, Lira Luttges, Salvarezza, & Campos, 2015). Despite its widespread popularity, the use of learning styles is not based upon empirical evidence. Reviews of research on this concept do not demonstrate sufficient evidence to support the claim that student outcomes improve when teachers attempt to match instruction to the learning styles of individual students (Kavale & Forness, 1987; Scott, 2010). Pashler, McDaniel, Rohrer, and Bjork (2008) argued that research evidence supporting the use of learning styles must demonstrate a relationship between a student's learning style preference and a matching instructional approach. This type of evidence is missing from the research literature on learning styles. Additionally, Landrum and Landrum (2014) noted that very few studies are school-based or hold relevance for actual classroom instruction.

How Practical is It?

Instruction based on the theories of learning styles and hemispheric dominance can be relatively practical. Many learning style inventories can be purchased for a reasonable cost online (e.g., the

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Dunn and Dunn Learning Style Inventory, and the Kolb Learning Style Inventory). Similarly, a google search yields dozens of free online surveys to determine whether an individual is a "right-brain" or "left-brain" learner. The inventories are not difficult to administer, and teachers can employ common instructional strategies to tailor their instruction to a specific learning style or hemispheric modality.

However, it is also possible for schools to spend significant amount of money on brain-based programs. For example, one popular brain-based training workshop about hemispheric dominance averages around $600 a workshop (www.jensenlearning.com). Similarly, Brain Gym® materials and training sessions cost a substantial amount of money. Compared to the brain-based concepts of learning styles and hemispheric dominance, the Brain Gym® program poses significant concerns in the area of social validity. Many of the movements required by the program may seem questionable to the students required to perform the movements, and might also appear unusual to peers observing the movements.

Although some of these brain-based concepts may be relatively easy to implement, it is important to emphasize that they are not supported as effective by sufficient, high-quality empirical evidence. Instead of trying to implement these questionable brain-based theories, teachers might instead integrate the principles of Universal Design for Learning (UDL) in their classrooms (see www.cast.org). UDL is a research-based set of guidelines that supports teachers in providing access to the diverse needs and characteristics of all students in their classrooms.

What Questions Remain?

Although educators should be critical consumers of products and concepts marketed as brain-based, it is important to stress the potential of educational neuroscience to inform and improve instructional practice for students with LD. Insights from neuroscience hold promise for the identification and treatment of academic and behavioral exceptionalities. For example, neuroimaging procedures can now be used to assist in the early identification of highly heritable conditions (e.g., ADHD, dyslexia), and can also be used to help establish effectiveness of interventions (Lizarazu et al., 2015; Temple et al., 2003). It is encouraging to note that several common instructional practices used by teachers to improve outcomes for students with LD (e.g., modeling, the use of visuals, intermittent schedules of reinforcements) are supported by research in cognitive neuroscience and cognitive psychology (Howard-Jones & Demetriou, 2009; Keysers & Gazzola, 2010). The challenge for educators is to discern and judiciously select appropriate brain-based claims that are founded upon sound research.

Many questions remain related to brain-based learning. At this point, the most important questions are: (a) How can educators discern recommendations based on sound neuroscientific research from pseudoscience, and (b)How can we translate sound neuroscientific research into better classroom instruction? A growing body of literature about the nature of neuromyths and the perils of pseudoscience (e.g., MacDonald et al., 2017; Travers, 2017) is beginning to address these questions. Neuroscience does hold promise for improving our understanding of how students with LD learn; however, educators must proceed with caution and avoid the misapplication of this research to classroom practice. The following tips are useful for analyzing brain-based programs or theories:

- Approach any program or intervention that claims to be "brain-based" or "based on neuroscience" with a healthy dose of skepticism.
- Avoid practices based on common neuromyths such as Learning Styles (Modality Dominance), Right Brain vs. Left Brain (Hemispheric Dominance), Brain Gym® (Perceptual Motor Training).
- Always select an instructional practice based on student need and teaching objectives. Do not give a "free-pass" or implement a program just because it includes the phrases "brain-based," or "based on neuroscience."
- Be wary of overreliance on testimonial and anecdotal evidence.
- Beware of the use of hypertechincal language. Pseudoscience is often shrouded in specialist terminology that provides unsupported programs or theories with unwarranted scientific respectability and allure.
- As with any education program or practice, check the evidence base. Is the research peer-reviewed? How many studies support the practice? Are these studies high-quality experiments?

How do I Learn More?

Books:

Howard-Jones, P. (2010). *Introducing neuroeducational research: Neuroscience, education and the brain from contexts to practice.* UK: Routledge.

Tokuhama-Espinosa, T. (2010). *Mind, brain, and education science: A comprehensive guide to the new brain-based teaching.* New York, NY: WW Norton & Company.

Journal Articles:

Sylvan, L. J., & Christodoulou, J. A. (2010). Understanding the role of neuroscience in brain based products: A guide for educators and consumers. *Mind, Brain, and Education, 4,* 1-7. doi:10.1111/j.1751-228X.2009.01077.x

Travers, J. C. (2017). Evaluating claims to avoid pseudoscientific and unproven practices in special education. *Intervention in School and Clinic, 52,* 195-203. doi:10.1177/1053451216659466

Videos (Brain-based Learning & Learning Styles):

http://www.danielwillingham.com/videos.html

Neuromyths Website:

http://www.oecd.org/edu/ceri/neuromyths.htm

Journals:

Educational Neuroscience

Mind, Brain, and Education

Trends in Neuroscience and Education

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Professional Organization:

International Mind, Brain, and Education Society (www.imbes.org)

References

Banich, M. T. (1998). The missing link: The role of interhemispheric interaction in attentional processing. *Brain and Cognition, 36,* 128-157. doi.org/10.1006/brcg.1997.0950

Board of Trustees of the Council for Learning Disabilities. (1986). Measurement and training decrease challenging behavior in boys with developmental disabilities and an emotional of perceptual and perceptual-motor functions: A position statement by the Board of Trustees of the Council for Learning Disabilities. *Learning Disability Quarterly, 9,* 247. doi:10.2307/1510473

Brain Gym International. (2015). Brain Gym about. Retrieved from http://www.braingym.org/about

Burke, K., & Dunn, R. (2007). *Elementary Learning Style Assessment (ELSA).* Retrieved from http://www.learningstyles.net/

Cammisa, K. M. (1994). Educational kinesiology with learning disabled children: An efficacy study. *Perceptual and Motor Skills, 78,* 105-106. doi:10.2466/pms.1994.78.1.105

Christman, S. D., Propper, R. E., & Dion, A. (2004). Increased interhemispheric interaction is associated with decreased false memories in a verbal converging semantic associates paradigm. *Brain and Cognition, 56,* 313-319. doi:10.1016/j.bandc.2004.08.005

Connell, D. (2005). *Brain based strategies to reach every learner.* New York, NY: Scholastic.

Dennison, P. E., & Dennison, G. E. (2010). *Brain Gym®: Teacher's edition* (Rev.). Ventura, CA: Edu-Kinesthetics.

Dunn, R. S., & Dunn, K. J. (1993). *Teaching secondary students through their individual learning styles: Practical approaches for grades 7-12.* Boston, MA: Allyn & Bacon.

Dunn, R. S., & Dunn, K. J. (1999). *The complete guide to the learning styles in-service system.* Boston, MA: Allyn & Bacon.

Geake, J. (2008). Neuromythologies in education. *Educational Research, 50,* 123-133. doi:10.1080/00131880802082518

Gleichgerrcht, E., Lira Luttges, B., Salvarezza, F., & Campos, A. L. (2015). Educational neuromyths among teachers in Latin America. *Mind, Brain, and Education, 9,* 170-178. doi:10.1111/mbe.12086

Howard-Jones, P. A., & Demetriou, S. (2009). Uncertainty and engagement with learning games. *Instructional Science, 37,* 519-536. doi:10.1007/s11251-008-9073-6

Howard-Jones, P. A. (2014). Neuroscience and education: myths and messages. *Nature Reviews Neuroscience, 15,* 817-824. doi:10.1038/nrn3817

Hyatt, K. J, (2007). Brain Gym®: Building stronger brains or wishful thinking? *Remedial and Special Education, 28,* 117-124. doi:10.1177/07419325070280020201

Kavale, K. A., & Forness, S. R. (1987). Substance over style: Assessing the efficacy of modality testing and teaching. *Exceptional Children, 54,* 228-239. doi:10.1177/001440298705400305

Keysers, C., & Gazzola, V. (2010). Social neuroscience: Mirror neurons recorded in humans. *Current Biology, 20,* 353-354. doi:10.1016/j.cub.2010.03.013

Kolb, A. Y. (2005). *The Kolb learning style inventory-version 3.1 2005 technical specifications.* Boston, MA: HayGroup.

Jensen, E. (2008). *Brain-based learning: The new paradigm of teaching.* Thousand Oaks, CA: Corwin Press.

Jorgenson, O. (2003). Brain scam? Why educators should be careful about embracing 'brain research.' *The Educational Forum, 67,* 364-369. doi:10.1080/00131720308945585

Landrum, T., & Landrum, K. (2014). Learning styles. *Current Practice Alerts, 21,* 1-5. Retrieved from http://TeachingLd.org/alerts.

Lizarazu, M., Lallier, M., Molinaro, N., Bourguignon, M., Paz-Alonso, P. M., Lerma-Usabiaga, G., & Carreiras, M. (2015). Developmental evaluation of atypical auditory sampling in dyslexia: Functional and structural evidence. *Human Brain Mapping, 36,* 4986-5002. doi:10.1002/hbm.22986

Macdonald, K., Germine, L., Anderson, A., Christodoulou, J., & McGrath, L. M. (2017). Dispelling the myth: Training in education or neuroscience decreases but does not eliminate beliefs in neuromyths. *Frontiers in Psychology, 8,* 1-16. doi:10.3389/fpsyg.2017.01314

Murawski, W. W., & Spencer, S. A. (2011). *Collaborate, communicate, and differentiate! How to increase student learning in today's schools.* Thousand Oak, CA: Corwin Press.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest, 9,* 105-119. doi:10.1111/j.1539-6053.2009.01038.x

Pasquinelli, E. (2013). Slippery slopes. Some considerations for favoring a good marriage between education and the science of the mind–brain–behavior, and forestalling the risks. *Trends in Neuroscience and Education, 2,* 111-121. doi:10.1016/j.tine.2013.06.003

USE caution

Rundle, S., & R. Dunn. (2007). *Building excellence (BE).* Retrieved from http://www.learningstyles.net

Scott, C. (2010). The enduring appeal of 'learning styles.' *Australian Journal of Education, 54,* 5-17. doi:10.1177/000494411005400102

Sousa, D. A. (2001). *How the brain learns: A classroom teacher's guide (2nd ed.).* Thousand Oaks, CA: Corwin Press.

Spaulding, L. S., Mostert, M. P., & Beam, A. P. (2010). Is Brain Gym® an effective educational intervention? *Exceptionality, 18,* 18-30. doi:10.1080/09362830903462508

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Stephenson, J. (2009). Best practice? Advice provided to teachers about the use of Brain Gym® in Australian schools. *Australian Journal of Education, 53,* 109-124. doi:10.1177/000494410905300202

Temple, E., Deutsch, G. K., Poldrack, R. A., Miller, S. L., Tallal, P., Merzenich, M. M., & Gabrieli, J. D. (2003). Neural deficits in children with dyslexia ameliorated by behavioral remediation: Evidence from functional MRI. *Proceedings of the National Academy of Sciences, 100,* 2860-2865. doi:10.1073/pnas.0030098100

Travers, J. C. (2017). Evaluating claims to avoid pseudoscientific and unproven practices in special education. *Intervention in SchoolandClinic,52,*195-203.doi:10.1177/1053452166594 66

Villa, R. A., Thousand, J. S., & Nevin, A. I. (2008). *A guide to co-teaching: Practical tips for facilitating student learning (2nd ed.)*. Thousand Oaks, CA: Corwin Press.

Watson, A., & Kelso, G. L. (2014). The effect of Brain Gym® on academic engagement for children with developmental disabilities. *International Journal of Special Education, 29,* 75-83.

About the Alert Series

Current Practice Alerts is a joint publication of the **Division for Learning Disabilities** and the **Division for Research of the Council for Exceptional Children**. The series is intended to provide an authoritative resource concerning the effectiveness of current practices intended for individuals with specific learning disabilities.

Each *Alerts* issue focuses on a single practice or family of practices that is widely used or discussed in the LD field. The *Alert* describes the target practice and provides a critical overview of the existing data regarding its effectiveness for individuals with learning disabilities. Practices judged by the Alerts Editorial Committee to be well validated and reliably used are featured under the rubric of **Go For It**. Those practices judged to have insufficient evidence of effectiveness are featured as **Use Caution**.

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