



Science Behind the Story (SBS)
Why Can't I Remember? (🌈 A Cognitive Health Story)
(3rd Grade- 8-9yrs)

This story describes why we need to learn and remember and why it is better to use and apply information that you learn, rather than just memorize information.

- 🌈 Learning and remembering are behaviors that work together. Humans have the ability to learn more than other animals, because we have the ability to read and write. This means we do not have to remember everything.

Learning and memory, along with attention, are three cognitive behaviors that work together to help you to survive in the world you live in (Sarter, 2003). In order for learning to occur, we must focus or pay attention to certain events while we block out other events (Breedlove, 2020). Learning is the acquisition of knowledge about the world (Breedlove, 2020). Memory is the retention or storage of that knowledge (Breedlove, 2020).

All animals possess some form of these cognitive behaviors and most animals learn what they need to know during the course of their lifetime or they do not survive (Kline, 2015; Heyes, 1996; Zentall, 2014). Humans have the ability to learn themselves during their lifetime and also to learn from generations of other humans because we possess the ability to read and write (Frith, 2007). Learning how to read and write allows humans access to phenomenal amounts of information. A quote from a Dr. Seuss book reinforces this concept, "The more that you read, the more things you will know. The more that you learn, the more places you'll go." (Seuss, 2003). This quote has morphed into the saying, "learn to read, then read to learn".

- 🌈 As humans, we need to learn about some things that we will need to use all the time, other things we learn teach us how to think and communicate.

There are things that we learn that we use all the time, these things usually involve behaviors that keep us alive (Garipey, 2014). Some examples of these behaviors include, walking, talking, eating, sleeping, taking care of bodily functions, and protecting our body. Depending on the type of society you live in, you also need to learn how to interact with various kinds of technology. Just as animals learn from other animals around them, we learn lots of these basic skills from the people around us (Garipey, 2014).

There are also behaviors that we learn so that we can enhance our lives and these are the types of behaviors that we learn with formal education. Learning how to read and write is the first step in being able to learn how to think and to communicate what we thinking with others in the world around us (Corballis, 2009). The ability to think and communicate allows humans to come up with new and innovative ways to enhance our lives and, hopefully, enhance and protect the world we live in (Greene, 2003).

- When you think about something that you have learned, you move the information around in your brain and you strengthen the connections in your brain that help you to remember that information. Because we are all different, figuring out how you can do this will help your brain stay healthy.

Being able to learn involves our being able to use what we have learned and that means that information must be stored and accessible (Thompson, 1996; Kandel, 1999; Cowan, 2014). While storage of information is important, the ability to apply the information that you learn may be more important to the learning process (Hmelo-Silver, 2004). Each time that you think about or use information that you have learned, you strengthen the connections in your brain that stores that information (Feld, 2020; Owens, 2017; Rushton, 2010). Strengthening connections in your brain actually makes them more energy efficient, which is good for your brain health (Laughlin, 2003).

Different people learn in different ways and at different times, although it is best to think about this as learning preferences rather than learning styles (Pashler, 2008; Mahan, 2014). Each person may also have multiple ways of learning different kinds of information (Bjork, 2013). These are two very important concepts to teach children early in their education. Children can play a role in their own educational development if they understand these concepts (Bjork, 2013). The development of the brain also plays a major role in when and how children learn (Fandakova, 2020). If educators understand this concept as well, then they can guide their students on how to find the best way for them to learn. An example of this can be found in teaching and learning how to read. It is well known that children cannot learn how to read phonetically until certain parts of the brain develop (Waldie, 2013; Unger, 2021). The development of Broca's area and areas of the temporal lobe of the brain usually occurs between 4 and 8 (Roselli, 2014). While this means that some children will be able to read phonetically earlier than other children, this does not mean the other children cannot read. They simply need to use a different mechanism to read, namely using sight reading. When the brain of the child who has been sight reading develops, then the child will be able to phonetically read as well. The ability to perform behaviors using different techniques, allows all children to learn and this is not only good for cognitive health, but also for social health. Self-esteem is tied to how a child views their behavior in respect to the behavior of other children (Schlegel, 2011). Being able to read, albeit in a different way, makes a child feel good about themselves and makes learning more enjoyable. Making learning enjoyable is a way to foster a love of learning, which is something that we all have to do throughout our lives.

National Standards:

Next Generation Science Standards

- Crosscutting Concepts:
 - **Patterns:** Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
 - Patterns of change can be used to make predictions.
 - Patterns can be used as evidence to support an explanation.
 - **Cause & Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.
 - Cause and effect relationships are routinely identified, tested, and use to explain change.
 - Events that occur together with regularity might or might not be a cause & effect relationship.
 - **Structure & Function:** The way an object is shaped or structured determines many of its properties and functions.
 - Different materials have different substructures; which can sometimes be observed.
 - Substructures have shapes and parts that serve functions.
- Related Grade Level Content
 - **Common Core Math: Numbers & Operation- Factors**
 - Develop understanding of fractions as numbers
 - 3.NF.A.1: Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

- 3.NF.A.3: Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

ASCA (American School Counselors Association):

Academic Development

- **Standard A:** Students will acquire the attitudes, knowledge and skills that contribute to effective learning in school and across the life span.
 - A:A1 Improve Academic Self-Concept
 - A:A1.1 Articulate feelings of competence and confidence as learners
 - A:A1.2 Display a positive interest in learning
 - A:A1.5 Identify attitudes and behaviors that lead to successful learning
 - A:A2 Acquire Skills for Improving Learning
 - A:A2.2 Demonstrate how effort and persistence positively affect learning
 - A:A2.3 Use communications skills to know when and how to ask for help when needed
 - A:A2.4 Apply knowledge and learning styles to positively influence school performance
- **Standard B:** Students will complete school with the academic preparation essential to choose from a wide range of substantial post-secondary options, including college
 - A:B1 Improve Learning
 - A:B1.1 Demonstrate the motivation to achieve individual potential
 - A:B1.2 Learn and apply critical-thinking skills
 - A:B1.3 Apply the study skills necessary for academic success at each level
 - A:B1.4 Seek information and support from faculty, staff, family and peers
 - A:B1.5 Organize and apply academic information from a variety of sources
 - A:B1.6 Use knowledge of learning styles to positively influence school performance
 - A:B1.7 Become a self-directed and independent learner
- **Standard C:** Students will understand the relationship of academics to the world of work and to life at home and in the community.
 - A:C1 Relate School to Life Experiences
 - A:C1.3 Understand the relationship between learning and work
 - A:C1.4 Demonstrate an understanding of the value of lifelong learning as essential to seeking, obtaining and maintaining life goals
 - A:C1.5 Understand that school success is the preparation to make the transition from student to community member
 - A:C1.6 Understand how school success and academic achievement enhance future career and vocational opportunities

National Health Education Standards (Shape America) & CDC (Centers for Disease Control and Prevention)

- **Standard 1:** Students will comprehend concepts related to health promotion and disease prevention to enhance health.
 - 1.5.2: Identify examples of emotional, intellectual, physical, and social health. **(CDC)**
- **Standard 4:** Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
 - 4.5.1-Demonstrate effective verbal and nonverbal communication skills to enhance health. **(CDC)**
 - 4.5.4- Demonstrate how to ask for assistance to enhance personal health. **(CDC)**
- **Standard 7:** Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
 - 7.5.1: Identify responsible personal health behaviors. **(CDC)**
 - 7.5.2: Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health. **(CDC)**
 - 7.5.3: Demonstrate a variety of behaviors to avoid or reduce health risks. **(CDC)**

References:

- Bjork, R. A., Dunlosky, J., & Kornell, N. (2013). Self-regulated learning: Beliefs, techniques, and illusions. *Annual review of psychology*, *64*, 417-444.
- Breedlove, S. M., & Watson, N. V. (2020). *Behavioral neuroscience*. Sinauer Associates, Incorporated Publishers.
- Corballis, M. C. (2009). The evolution of language. *Annals of the New York Academy of Sciences*, *1156*(1), 19-43.
- Cowan, N. (2014). Working memory underpins cognitive development, learning, and education. *Educational psychology review*, *26*(2), 197-223.
- Fandakova, Y., & Hartley, C. A. (2020). Mechanisms of learning and plasticity in childhood and adolescence. *Developmental Cognitive Neuroscience*, *42*.
- Feld, G. B., & Born, J. (2020). Neurochemical mechanisms for memory processing during sleep: basic findings in humans and neuropsychiatric implications. *Neuropsychopharmacology*, *45*(1), 31-44.
- Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current biology*, *17*(16), R724-R732.
- Gariépy, J. F., Watson, K. K., Du, E., Xie, D. L., Erb, J., Amasino, D., & Platt, M. L. (2014). Social learning in humans and other animals. *Frontiers in neuroscience*, *8*, 58.
- Greene, J. (2003). From neural'is' to moral'ought': what are the moral implications of neuroscientific moral psychology?. *Nature reviews neuroscience*, *4*(10), 846-850.
- Heyes, C. M., & Galef Jr, B. G. (Eds.). (1996). *Social learning in animals: the roots of culture*. Elsevier.
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn?. *Educational psychology review*, *16*(3), 235-266.
- Kandel, E. R., & Pittenger, C. (1999). The past, the future and the biology of memory storage. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *354*(1392), 2027-2052.
- Kline, M. A. (2015). How to learn about teaching: An evolutionary framework for the study of teaching behavior in humans and other animals. *Behavioral and Brain sciences*, *38*.
- Laughlin, S. B., & Sejnowski, T. J. (2003). Communication in neuronal networks. *Science*, *301*(5641), 1870-1874.
- Mahan, J. D., & Stein, D. S. (2014). Teaching adults—best practices that leverage the emerging understanding of the neurobiology of learning. *Current problems in pediatric and adolescent health care*, *44*(6), 141-149.
- Owens, M. T., & Tanner, K. D. (2017). Teaching as brain changing: Exploring connections between neuroscience and innovative teaching. *CBE—Life Sciences Education*, *16*(2), fe2.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles: Concepts and evidence. *Psychological science in the public interest*, 9(3), 105-119.

Rosselli, M., Ardila, A., Matute, E., & Vélez-Urbe, I. (2014). Language development across the life span: A neuropsychological/neuroimaging perspective. *Neuroscience journal*, 2014.

Rushton, S., Juola-Rushton, A., & Larkin, E. (2010). Neuroscience, play and early childhood education: Connections, implications and assessment. *Early Childhood Education Journal*, 37(5), 351-361.

Sarter, M., Bruno, J. P., & Givens, B. (2003). Attentional functions of cortical cholinergic inputs: what does it mean for learning and memory?. *Neurobiology of learning and memory*, 80(3), 245-256.

Schlegel, R. J., & Hicks, J. A. (2011). The true self and psychological health: Emerging evidence and future directions. *Social and Personality Psychology Compass*, 5(12), 989-1003.

Thompson, R. F., & Kim, J. J. (1996). Memory systems in the brain and localization of a memory. *Proceedings of the national academy of sciences*, 93(24), 13438-13444.

Unger, N., Heim, S., Hilger, D. I., Bludau, S., Pieperhoff, P., Cichon, S., ... & Mühleisen, T. W. (2021). Identification of phonology-related genes and functional characterization of Broca's and Wernicke's regions in language and learning disorders. *Frontiers in neuroscience*, 15.

Waldie, K. E., Haigh, C. E., Badzakova-Trajkov, G., Buckley, J., & Kirk, I. J. (2013). Reading the wrong way with the right hemisphere. *Brain Sciences*, 3(3), 1060-1075.

Zentall, T. R., Wasserman, E. A., & Urcuioli, P. J. (2014). Associative concept learning in animals. *Journal of the experimental analysis of behavior*, 101(1), 130-151.