4-22-2025

The Reading Brain: Brain Research behind the Science of Reading

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SENIOR THESIS APPROVAL

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and submitted in partial fulfillment of
the requirements for completion of
the Carl Goodson Honors Program
meets the criteria for acceptance
and has been approved by the undersigned readers.

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Date

The Reading Brain: Brain Research Behind the Science of Reading

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The Carl Goodson Honors Program, Ouachita Baptist University

Senior Honors Thesis

Dr. Carrie Sharp, Dr. Rachel Pool, and Dr. Mary Chung

22 April 2025

The Reading Brain: Brain Research Behind the Science of Reading

"Our species alone rises above its biological condition, creates an artificial cultural environment for itself, and teaches itself new skills like reading" (Dehaene, 2010, p. 3). This is a quintessential statement concerning the vast abilities of the brain. The human brain is a fascinating network of neurons and lobes that work together to produce everything from speech to critical thinking. Humans use their brains daily while experiencing involuntary actions such as breathing and blinking. The brain can also learn and understand multiple languages and complex ideas and concepts. While it can be used at its bare minimum, the brain can do many things researchers and scholars yearn to know more about. The brain is necessary for human development and function and plays an essential role in learning.

One task the brain is responsible for is learning how to read. While the human brain is hardwired for speech at birth, it is not hardwired for reading. The brain has to form connections between different parts of the brain to read and comprehend. The Science of Reading explains the skills that children must know to build the pathways in their brains. It also includes the regions of the brain that are active while a child reads. In the accompanying presentation board, pictures will be provided of the areas of the brain that light up on imaging while literate children read. These images show that different brain regions light up while reading occurs. While it may not be seen on imaging, pathways between the areas help them work together for reading and comprehension.

The Science of Reading has gained popularity as the term encompasses everything a student requires to read. Teachers across the United States receive training that better prepares them to assist their students as they rewire their brains. In Arkansas, the Reading Initiative for Student Excellence, or R.I.S.E., "encourages a culture of reading by coordinating a statewide

reading campaign with community partners, parents, and teachers to establish the importance of reading in homes, schools, and communities" (Learning Services, 2024). In Texas, the Texas Association for Literacy Education, or TALE, helps promote literacy in education. It cannot be ignored when such big steps are being taken to ensure students read proficiently.

The R.I.S.E. initiative in Arkansas began in 2017 when legislators decided to pass The Right to Read Act (A new chapter, 2018). The literacy of the students in Arkansas was lacking, but the legislators knew that they had the growth potential. The R.I.S.E. Academy began in the summer of 2017. It is a six-day intensive training that teaches the new reading instruction that is taking place in Arkansas. Teachers still participate in R.I.S.E. training today. R.I.S.E. is changing the reading proficiency of the students in Arkansas and bringing awareness to the importance of reading.

The T.A.L.E. initiative in Texas began in 2011. This initiative resulted from a small group of educators desiring to have a literacy association to connect educators across the state in a shared effort to improve Texas students' literacy (Grote-Garcia, 2022). T.A.L.E. has grown from a small group of educators to hundreds across the state of Texas. They hold conferences each year and promote the importance of literacy to all educators, no matter their grade level.

The steps these and other states are taking show the importance of literacy in students' lives. Reading is the foundational skill upon which all other learning is built. These important skills are the reason for this paper, brochure, and presentation board.

Thesis Purpose

As a future elementary teacher, I feel a great responsibility to be the best reading instructor for my students. This thesis has come from a heart for students and their learning minds and a desire to further my research on the brain and the Science of Reading. The idea for a

poster and accompanying paper grew from a love for what I learned in my reading classes regarding the reading brain. Over a semester, I looked in-depth at the Science of Reading and abundant brain research explaining how the brain learns to read. From this research, my thesis was born.

I desired more knowledge that would make me proficient in the Science of Reading so I could share what I have learned with other teachers. I have been encouraged to have a professional learning community mindset while studying elementary education. I have learned alongside friends and colleagues who have encouraged me to pursue education wholeheartedly. It is with them that I have learned, and I hope to take my knowledge and pass it along to the many teachers I will come into contact with.

The courses I completed in my elementary education degree with my peers have given me a wealth of information. I had a series of four reading classes that encouraged me to write this thesis. The first course was Reading Children's Literature. In this class, I learned the many genres of literature that are available for students. I wrote my own children's book and had three field experience opportunities in which I got to practice reading aloud to a small group of first-graders. The next course was Reading Foundations. This was the class where my love for the Science of Reading first began. Here, I learned all about the Science of Reading and began to delve into how the brain learns to read. In this course, I taught phonics lessons to a small group of first-graders throughout the semester. The next course, Reading and Writing, focused more on the strategies to achieve whole-group listening. I learned many strategies for the total participation of students. In the final reading course, Reading Diagnostics, I worked with a struggling student on the many reading diagnostic tests. I gave the student reading assessments

and wrote a case study on my findings. These courses formed me into the teacher I am today and helped me write this thesis.

One of my main purposes in writing this thesis is for other future and current teachers to relish in the brain's science, which has intrigued me through this process. Through my research, I have become better equipped to teach reading. I want to share what I have learned so that every teacher can feel fully prepared to be the best teacher they can be.

Another purpose I realized when considering my thesis was the effect of the Science of Reading on parents. Parents play a vital role in their children's education. Students with active parents are more likely to succeed and excel in school because they feel supported. Along with this thesis and the accompanying poster, I will create a parent brochure highlighting the information parents need about how their student is learning to read and resources to guide them. Involving parents in any way I can is important because they are the mode through which students develop. I want parents to have the knowledge and resources to help their students in any way possible.

My overall purpose with this thesis is a result of my desire to never stop learning. I have enjoyed the research and the reading that has come from my efforts in this thesis. I have learned more than I could have ever hoped. This will ignite a fire in me to be a lifelong student and never think that I have learned everything I need to know. After all, there is always new research and ways to grow as an educator!

Thesis Process

This thesis came to be as the result of a growing interest in the brain and how it learns to read. I first learned about the Science of Reading and how the brain learns to read in one of my many reading classes. I was intrigued and decided to take a semester to learn more through a

directed study. I was inundated with knowledge as I read books and articles, listened to podcasts, and watched videos (See chart below). My thesis was born from the love of the knowledge I attained. I began my thesis research that semester and continued it into the next. I gathered my research in the form of an annotated bibliography that I used to write this thesis.

Science of Reading Resources		
Books	Journal Articles	Videos/Podcasts
Reading in the Brain: The New Science of How We Read - Stanislas Dehaene Wiring the Brain for Reading: Brain-Based Strategies for Teaching Literacy - Marilee Sprenger Teaching the Brain to Read: Strategies for Improving Fluency, Vocabulary, and Comprehension - Judy Willis Reader, Come Home: The Reading Brain in a Digital World - Maryanne Wolf	"Dyslexia and the Brain: What Does Current Research Tell Us?" "The 'Reading Brain' is Taught, Not Born: Evidence from Evolving Neuroscience of Reading for Teachers and Society" "The Science of Reading: Making Sense of Research" "Thinking Through Research and the Science of Reading"	How the Brain Learns to Read - Prof. Stanislas Dehaene Science of Reading: The Podcast The Science of Reading: How the Brain Learns to Read

The initial product was to be this paper, but I wanted to do more that would help other educators and even the parents of students learning to read. Alongside my thesis paper, I decided to create a board with all the information in a condensed format. This presentation board can serve as an overview of the contents of this paper. As well as the presentation board, I chose to create a brochure that could be handed out to parents, detailing the process of learning to read in an accessible format. Any parent or guardian wishing to help their child learn to read could read this brochure and have the right tools at their fingertips.

With my road ahead clear and my research gathered, I started work on the outline for this paper, detailing all the topics I wished to cover. I followed my outline and completed the paper before moving on to work on the brochure and presentation board. The information from the paper informed the creation of both the brochure and the presentation board. This was a labor of love. Many hours were spent writing, designing, and creating the paper, presentation board, and brochure. I have enjoyed this process tremendously. I am proud of the work I have created and cannot wait to share it with parents and colleagues I come into contact with as a new teacher.

How the Brain Learns to Read

The fascinating path of reading in the brain is marked by research and discoveries spanning the past several decades. As mentioned earlier, the Science of Reading is the catalyst that educators learn about the reading brain. The Reading League (2023) defines the Science of Reading as a "vast, interdisciplinary body of scientifically-based research about reading and issues related to reading and writing" (p. 6). Contained in this definition are many key elements that will be discussed in this paper, most importantly, the "scientifically-based research" aspect. Researchers such as Stanislas Dehaene have dedicated countless hours to the pursuit of studying the reading brain in action. More than just intense research, professionals from countless fields, such as Cognitive Psychology, Communication Sciences, Developmental Psychology, Implementation Science, Linguistics, Neuroscience, and School Psychology, have developed the Science of Reading (Reading League, 2023).

Research is born out of a desire to understand and communicate topics that need to be clarified or that little is known about. While the Science of Reading has been used as a term since as early as the 1800s, it gained popularity in the 1990s when the debate of whole-language versus phonics reading instruction emerged (Keso, 2022). Research about best teaching methods

and brain activity has abounded since, creating an immeasurable amount of books, journal articles, and websites discussing how the brain learns to read. When a topic gains such a large amount of support and following in such a short amount of time, it is hard to ignore. The scientific research-based methods of the Science of Reading have given it credibility and instituted it as an educational buzzword.

So what makes the Science of Reading so popular? Research-based teaching methods serve as one of the bases for instructional methods that teach students how to develop phonemic awareness, phonics, fluency, vocabulary, and ultimately comprehension. The five pillars of literacy, as they are called, serve as the perfect elements in an equation that results in skillful and proficient reading. The Simple View of Reading (See image below), a model for reading comprehension, "has been empirically validated by over 150 scientific studies" and "shows us that reading comprehension is not the sum but the product of two components - word recognition and language comprehension" (Reading League, 2023, p. 17). This model of reading explicitly states that students cannot have word recognition without language comprehension and vice versa. It is a multiplication problem for the reason that one multiplied by zero is still zero. Students will not reach comprehension if they are missing even one of the critical pillars of literacy.

Simple View of Reading

While the literary components of the Science of Reading are intriguing and will be discussed further in the application portion of this paper, the main point to be discussed is the brain's role in learning to read. Cognitive neuroscientist Stanislas Dehaene (2010) describes in great detail the many wonders of the reading brain in his book, *Reading in the Brain.* Dehaene refers to the creation of imaging, such as PET and MRI technology, that has allowed scientists to observe the brain at work. In 1988, Steve Petersen, Michael Posner, and Marcus Raichle were able to identify the major areas of the brain that are involved in reading (Dehaene, 2010). Imaging that allowed researchers to see brain activity was unheard of, and the majority of brain research before this time had to be done post-mortem. It is incredible to imagine the excitement brain researchers had when they discovered modern imaging techniques. With the invention of PET imaging, Petersen, Posner, and Raichle discovered that the occipital, temporal, and frontal lobes all play a part in reading.

As research has continued and technology has advanced, fMRI has taken over as the primary imaging technique used by brain scientists to study how the brain reads. With these new and improved imaging techniques, Dehaene and his team were able to identify an area in the brain that they have labeled the "letterbox" (Dehaene, 2010). This area in the brain is mainly responsible for the visual analysis of letters when reading. While this area is mainly specialized in visual analysis, studies also show that the letterbox is activated when verbally spelling words with p, q, and j, distinguishing between speech sounds, and in Japanese speakers when they think about spelling a word (Dehaene, 2010, p. 72). Even with these few exceptions, it can be ultimately concluded that the purpose of the letterbox is a visual analysis of letters for reading. To support this conclusion, research has been conducted that proves damage to the letterbox causes the loss of the ability to read. In 1887, Joseph-Jules Déjerine examined a patient whose

traumatic brain event caused the total loss of the ability to recognize letters and words. Déjerine was limited in his research because no further exploration could be done until the patient died. However, postmortem, he was able to conclude that the area now known as the letterbox played a significant role in reading. Without the help of modern imaging techniques, Déjerine placed the letterbox in the incorrect area of the brain, which has now been corrected with the technological advances discussed earlier.

Now, to answer the question of what happens to the visual analysis that comes through from the letterbox. Where does it go? What happens to the letters that are read? Luckily, diffusion MRI technology "has begun to reveal that large bundles of connections link the brain's cortical areas" (Dehaene, 2010, p. 100). Anatomists in Switzerland were able to discover this, as well as increased density in connections near the regions of Broca and Wernicke's area. The experiment also gave the researchers a clearer view of the pathway that occurs through the brain when reading occurs. After reading a word, the occipital lobe lights up on imaging, showing that the eyes are processing the word. After a short time in the occipital lobe, the pathway jumps to the letterbox, where it finishes visual analysis. Once a word has passed through the visual stops on its brain journey, the temporal lobes in both brain hemispheres are abuzz with activity. The word also makes a stop in Wernicke's where meaning is determined. The journey then ends, after only milliseconds, in the left hemisphere in Broca's area. Dehaene (2010) expresses his intrigue with the pathway, noting that "after about 250 milliseconds, the activated areas ceased to be exclusively restricted to vision" (Dehaene, 2010, p. 104). After visual processing is complete, the areas of the brain that process vision work together with the areas of the brain that are connected to spoken language. This is fascinating, considering that reading primarily has to do with vision.

It goes to show that without the research that has been done on reading in the brain, reading instruction would not be where it is today.

With a path in the brain defined, it is easy to wonder how children develop the skills to complete skillful reading that results in comprehension. Sprenger (2013) suggests that there are two distinct paths of reading in the brain: the beginning reader path and the advanced reader path. Beginning readers need to build the connections that allow them to immediately recognize a word and its meaning as advanced readers do. Their reading in the brain is mainly focused on the parietal-temporal region as they attempt to "pull the word apart into its various sounds and put it back together to make the word" (Sprenger, 2013, p. 42). While reading is developed in the brain, beginning readers will grow into advanced readers as they form connections and neural networks that hold the meanings, spellings, pronunciations, and visual representations of words in their occipital-temporal area (Sprenger, 2013). These reading pathways create a visual in the brain that lights up on imaging. These images give a deeper look into not only how the brain reads but also into the research that drives how teachers instruct students in reading.

With the discussion of how the average child's brain learns to read, there is also the question of exceptionalities that cause difficulty in reading. The main reading disability that comes to mind is that of dyslexia. "Dyslexia is a language-based learning disability" that mainly affects how a person reads (Dyslexia Basics, 2020). Sprenger (2013) discusses the imaging differences between a proficient reader and a dyslexic reader. In the imaging of a proficient reader's brain, the frontal cortex will be activated, however, the majority of the activity will be focused in the back of the brain (Sprenger, 2013). This is the opposite for dyslexic readers. They rely heavily on the frontal cortex, while little activity occurs in the back of the brain. It is estimated that between five and seventeen percent of children struggle with dyslexia in the

United States alone. To better pinpoint where dyslexia originates in the brain, Eraldo Paulesu performed a study on Italian, French, and English adults who suffered from dyslexia. The results of the study showed that dyslexia seems to affect the left temporal lobe (Dehaene, 2010). However, in Chinese dyslexics, the area of the brain affected was completely different. Paulesu concluded that dyslexia hailed from the same brain region in languages with alphabetic writing systems (Dehaene, 2010). In addition to the left temporal lobe, there is another area of the brain that malfunctions while dyslexics read. Broca's area is hyperactive in the brains of dyslexics, likely as an overcompensation for the areas that are lacking (Dehaene, 2010).

Research on dyslexics has shown that they struggle the most with reading texts at their grade level and decoding. Along with the struggles of reading and decoding, the dyslexic brain also struggles to comprehend what it reads because it cannot understand the words. In a study comparing the brains of 144 children with and without dyslexia, it was found that dyslexic children struggle the most with "identifying the names or sounds of letters, sounding out nonsense words, and sounding out and comparing meanings of real words" (Hudson et al., 2022). These are all critical skills that students must be proficient in to read skillfully. Dyslexia is a condition that affects its sufferers for life. There is no cure for dyslexia, but interventions and specialized instruction can help lessen the effects. Researchers can see into the brains of dyslexic children and pinpoint if interventions are effective. In another study, dyslexic children were put into a control group and an intervention group. The children in the control group showed no change in brain activity, but the intervention group children showed significantly more activity than before (Hudson et al., 2022). Dyslexia affects many students in classrooms across America. Knowing the science behind dyslexia and how the dyslexic brain is different from the proficient reading brain informs the way teachers instruct their dyslexic students.

Along with the discussion of dyslexia, a new issue has arisen, especially in the current day and age. With the introduction of technology in forms never imagined before, will children learning to read develop their brains the same way as before? Wolf (2018) discusses this growing concern in her book, *Reader, Come Home: The Reading Brain in a Digital World.* Reading, which takes an enormous amount of concentration, is being left behind for short-term gratification in the form of mobile games, social media, and video games. It begs the question of whether children living in today's technology-driven world even have the attention span to sit down and read a book anymore. Wolf (2018) offers three outcomes of the influence of technology on children learning to read:

> "The young reader can either develop all the multiple deep-reading processes that are currently embodied in the fully elaborated, expert reading brain, or the novice reading brain can become 'short-circuited' in its development; or it can acquire whole new networks in different circuits" (p. 7).

This is a real concern that should be taken into account when developing the minds of the next generation for reading. Technology has granted ease and efficiency in everyday life, but will this lead to a short-circuited reading brain that uses shortcuts instead of its full capacity? Time and further research will tell.

The reading brain is a complex system of lobes, chords, and connections. Reading is not a natural human process; "rather, for human-invented capacities like reading, the brain must create new circuits" (Gotlieb et al., 2022, p. 11). The path of reading through the brain is often interrupted by disabilities such as dyslexia. Research is being conducted to find the best interventions for these struggling students. Modern technology is also affecting the brains of today's children and limiting their attention spans. Research will continue in this area as

scientists further understand the effects of technology. As Willis (2008) concludes in her research has already and will continue to provide brain-based strategies and curriculum based on what the brain wants to do and can do best" (p. 157). Reading instruction is informed by the science that is available. The hope is that this ever-important topic continues to command attention that will shape future findings.

The Reading Brain Poster

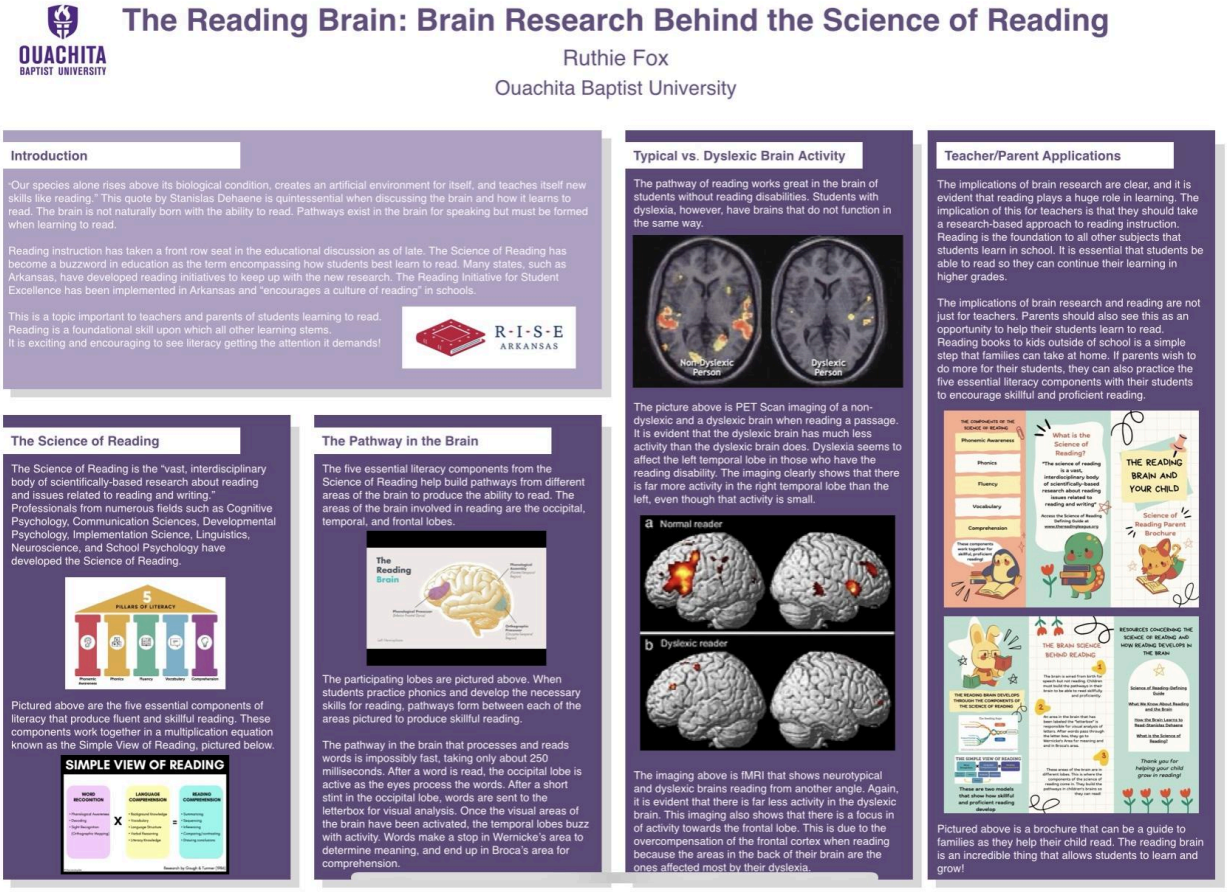
The creative element of this thesis is a poster that compiles the research from this paper into an organized visual. Pictures are accompanied by text that explains the images of activity in the brain. I hope this poster will be a reference point for many teachers and parents wanting to know more about the science behind reading in the brain. I chose a poster because it felt like I was combining the science element into my thesis. I relied heavily on science in the writing and research element of my thesis. A traditional science posterboard felt like an apt nod to the science that helped me complete my work.

I chose the content of my poster board by pulling the most important and notable research from my paper. Pictures were chosen based on the different parts of the brain I was explaining. MRI images and pictures showing the nature of reading activity in the brain were chosen based on their significance in explaining the reading brain.

Time and careful effort were put into the creation of this poster. I spent countless hours deciding between images, choosing appropriate text, and formatting the posterboard to create a poster that I felt best reflected my work on this thesis. I have wasted no amount of care or time in creating something I am incredibly proud of. This was out of my comfort zone, but as a lifelong learner, I knew it would benefit me for years to come if I took the time and cared. Education

crosses the lines of all disciplines to shape well-rounded individuals, and I know that I have been shaped during the process of creating this poster board.

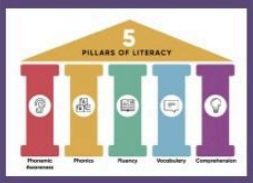
Below, I have included a picture of my finished poster board.



Introduction
"Our species alone rises above its biological condition, creates an artificial environment for itself, and teaches itself new skills like reading." This quote by Stanislas Dehaene is quintessential when discussing the brain and how it learns to read. The brain is not naturally born with the ability to read. Pathways exist in the brain for speaking but must be formed when learning to read.
Reading instruction has taken a front row seat in the educational discussion as of late. The Science of Reading has become a buzzword in education as the term encompassing how students best learn to read. Many states, such as Arkansas, have developed reading initiatives to keep up with the new research. The Reading Initiative for Student Excellence has been implemented in Arkansas and "encourages a culture of reading" in schools.
This is a topic important to teachers and parents of students learning to read.
Reading is a foundational skill upon which all other learning stems.
It is exciting and encouraging to see literacy getting the attention it demands!
R-I-S-E ARKANSAS

The Science of Reading

The Science of Reading is the "vast, interdisciplinary body of scientifically-based research about reading and issues related to reading and writing." Professionals from numerous fields such as Cognitive Psychology, Communication Sciences, Developmental Psychology, Implementation Science, Linguistics, Neuroscience, and School Psychology have developed the Science of Reading.



Pictured above are the five essential components of literacy that produce fluent and skillful reading. These components work together in a multiplication equation known as the Simple View of Reading, pictured below.

The Pathway in the Brain

The five essential literacy components from the Science of Reading help build pathways from different areas of the brain to produce the ability to read. The areas of the brain involved in reading are the occipital, temporal, and frontal lobes.

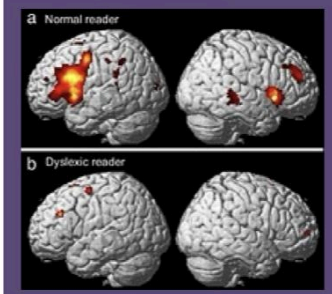
The participating lobes are pictured above. When students practice phonics and develop the necessary skills for reading, pathways form between each of the areas pictured to produce skillful reading.

The pathway in the brain that processes and reads words is impossibly fast, taking only about 250 milliseconds. After a word is read, the occipital lobe is active as the eyes process the words. After a short stint in the occipital lobe, words are sent to the letterbox for visual analysis. Once the visual areas of the brain have been activated, the temporal lobes buzz with activity. Words make a stop in Wernicke's area to determine meaning, and end up in Broca's area for comprehension.

Typical vs. Dyslexic Brain Activity

The pathway of reading works great in the brain of students without reading disabilities. Students with dyslexia, however, have brains that do not function in the same way.

The picture above is PET Scan imaging of a non-dyslexic and a dyslexic brain when reading a passage. It is evident that the dyslexic brain has much less activity than the dyslexic brain does. Dyslexia seems to affect the left temporal lobe in those who have the reading disability. The imaging clearly shows that there is far more activity in the right temporal lobe than the left, even though that activity is small.

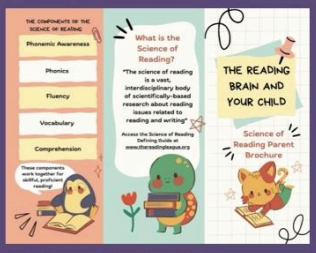


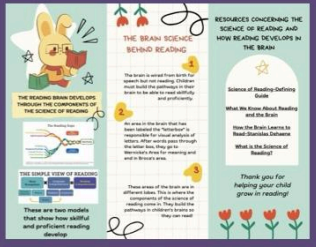
The imaging above is fMRI that shows neurotypical and dyslexic brains reading from another angle. Again, it is evident that there is far less activity in the dyslexic brain. This imaging also shows that there is a focus in of activity towards the frontal lobe. This is due to the overcompensation of the frontal cortex when reading because the areas in the back of their brain are the ones affected most by their dyslexia.

Teacher/Parent Applications

The implications of brain research are clear, and it is evident that reading plays a huge role in learning. The implication of this for teachers is that they should take a research-based approach to reading instruction. Reading is the foundation to all other subjects that students learn in school. It is essential that students be able to read so they can continue their learning in higher grades.

The implications of brain research and reading are not just for teachers. Parents should also see this as an opportunity to help their students learn to read. Reading books to kids outside of school is a simple step that families can take at home. If parents wish to do more for their students, they can also practice the five essential literacy components with their students to encourage skillful and proficient reading.





Pictured above is a brochure that can be a guide to families as they help their child read. The reading brain is an incredible thing that allows students to learn and grow!

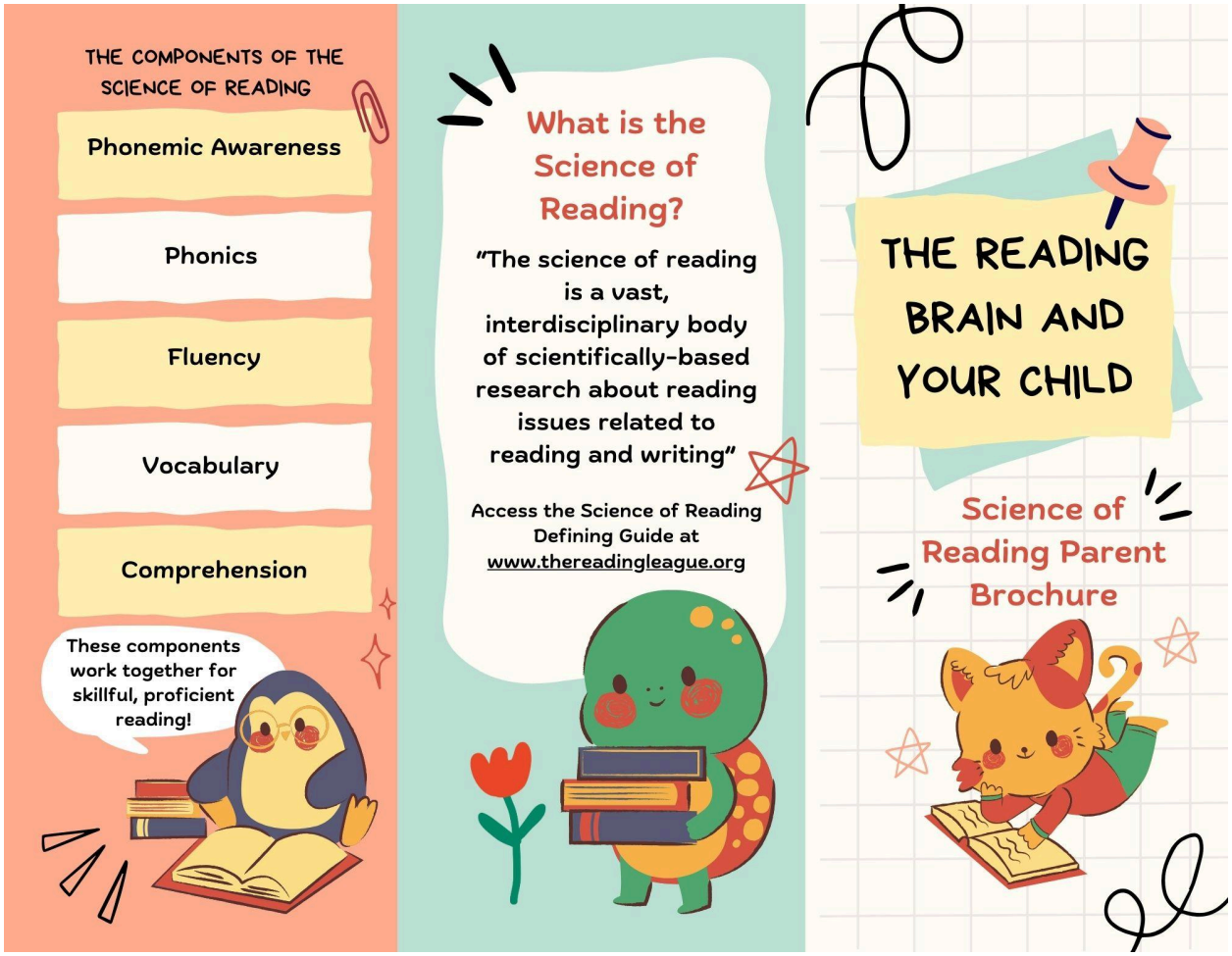
Parent Brochure

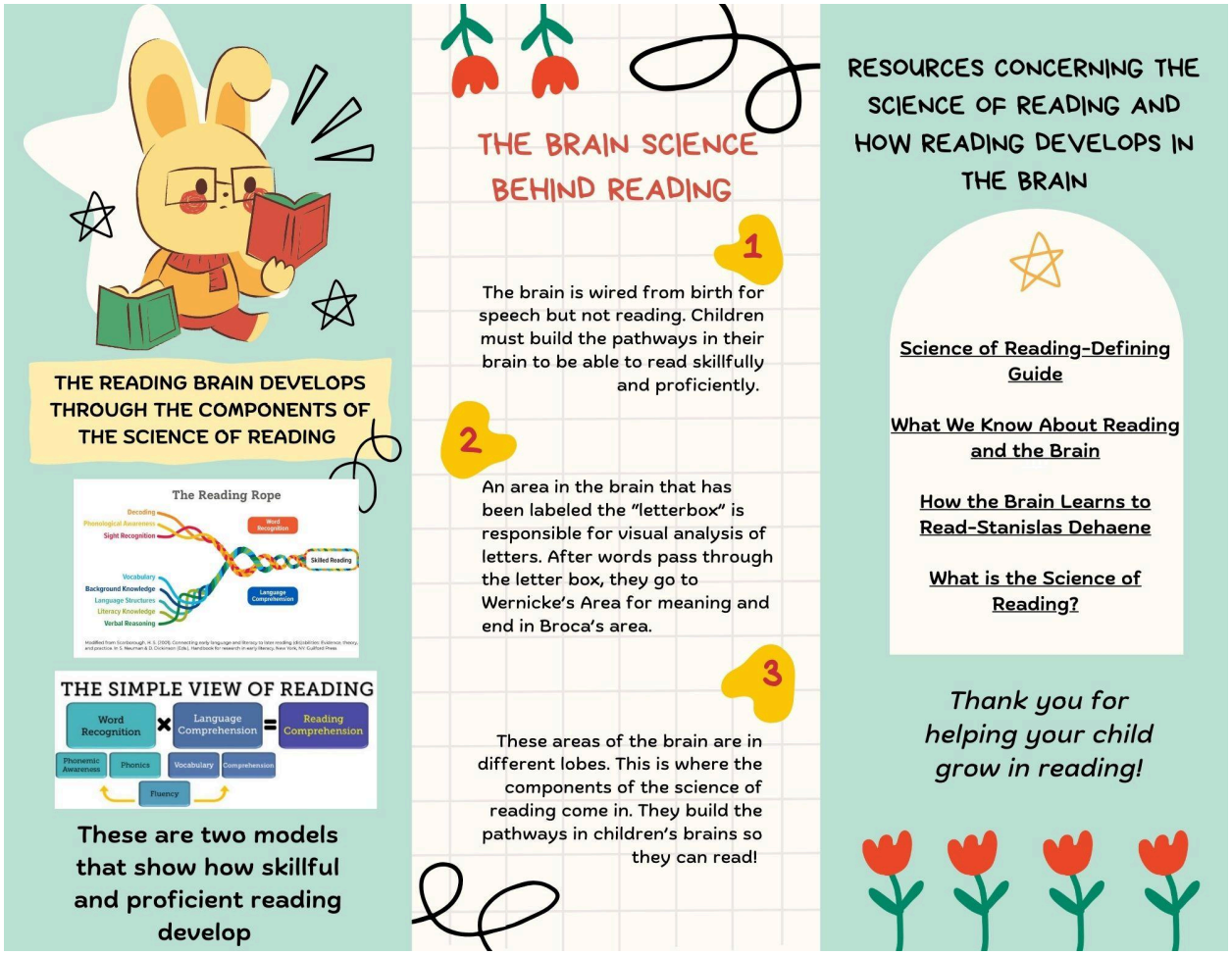
While presenting my thesis idea to a board of professors from every discipline at my university, I was approached with the idea of creating a brochure with a condensed version of the information in my paper and poster board. This condensed brochure would be a tool for parents wishing to learn about the reading brain so they can help their child at home. I was thrilled with the idea and agreed that it would be the perfect addition to my thesis. As a future teacher, I have dedicated my life to helping my students and, by extension, their parents and guardians. Providing a resource to parents was an automatic yes for me.

Creating a brochure for parents that included the right amount of information without being overwhelming was challenging. I created a brochure on the Science of Reading for a class and used some of the resources from that brochure in the creation of this one. I decided to include information on the Science of Reading, the development of reading in the brain, and resources they could access if they wished to access materials or help for their child. The main purpose of this brochure is to ensure that parents feel they are taking an active role in the education of their children.

When creating the brochure, I wanted something that caught the eye and captured the attention. Fun pictures and graphics accompany the information so that parents and guardians feel excited to read the information given. More than anything, I wanted this brochure to be a reference point. More often than not, parents and guardians desire to help their children learn at home. This brochure references websites that promote reading and the science behind it. Whether or not parents actually use this resource, I wanted to have it as an option so parents feel included in their child's education.

Below, I have included images of my finished brochure. The included information is what the science of reading is, the components of the science of reading, two models of proficient reading, an explanation of what occurs in the brain when children read, and a few helpful resources that parents can access. This is just a slice of the information there is on the brain and reading, but it is enough to give parents an idea of what their child is doing in reading instruction.





Thesis Application

The application of this thesis is for the educators and parents of students learning to read. Any teacher in lower elementary will be required to teach reading instruction to their students. Parents of these lower elementary students can be beneficial in the reading process because they can help their students at home. The saying "it takes a village" is often overused, but in the case of reading, it could not be more accurate. Teachers, parents, and peers all contribute to a student's ability to learn to read.

This thesis is for anyone wanting to learn more about the reading brain and the pathways that are created in the brain. Teachers and parents are not the only ones who want to know how the brain learns to read. Leaders in education, scientists, and instructional facilitators are also

individuals who need to know about how the brain learns to read for curriculum purposes and scientific publications. Anyone who wants to know more about how their brain learned how to read can refer to this thesis.

This thesis is applicable and can be used as a tool for any teacher or parent wishing to learn more about the reading brain. The posterboard that accompanies this paper is a visual tool. It shows images with accompanying text that walk through the brain and its reading process. The parent brochure provides helpful information to those wishing to help their child read. I wanted to create a resource that contained a wealth of information, all available in one spot for those who wish to access it.

More than anything, I wanted this thesis to be a representation of my learning throughout my time at college. The one thing that stuck with me more than any other thing I learned was about how the brain learns to read. I wanted to create a tool for others based on the information that helped me so greatly during my education. As I have mentioned before, this thesis was a labor of love. I spent many hours researching, writing, and planning to get to where I am today. I want this thesis to be for anyone who wishes to learn more about this topic that I hold so dearly to my heart!

Thesis Conclusion

"Reading instruction changes our brains' structure and how they work" (What we know, 2025). The brain is an incredible organ that reaches new heights every day. While the brain is wired for many amazing tasks, it is known through research that it is not born with the ability to read. This paper highlights the pathway of reading in the brain and the learning activities that help students become proficient readers. There are endless resources available to those wishing

to learn more about how students learn to read. This paper and the accompanying posterboard and brochure aim to provide as much information in one place as possible.

Whether you are a parent helping your child learn to read, a teacher wanting to know more about the science behind your instruction, or a college student just learning about the Science of Reading and the reading brain, I hope you find this resource helpful! Be a lifelong learner, and never stop using the amazing reading brain that works so hard for you every day!

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