Train the Brain to Hear

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Understanding and Treating Auditory Processing Disorder, Dyslexia, Dysgraphia, Dyspraxia, Short Term Memory, Executive Function, Comprehension, and ADD/ADHD

Second Edition

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Chapter 1

An Introduction to my Passion

In 1996, I became a mother for the first time. My husband and I had co-created the most wonderful, beautiful, creative, genius who was born to any parents ever. At least, like all first time parents, that is what we thought at the time. He grew and amazed his father and me at every milestone by proving to us just how right we were.

By the time Seth was two, I had a few questions. Like, why did I have to get down on his level every time I spoke to him? Why didn't he seem to hear me? And if he was supposed to be 50 words, if I counted moo and bbrrrrrmmmm for a truck, he was at 48. Was that ok? We went for a hearing test and were told that his hearing was perfect. We went home somewhat mollified, but still with concerns looming. My husbands' sister assured me that he hadn't spoken until late either and neither had her son, who at that time was a very successful college student.

Before we knew it, we had baby number two. Benjamin was a little more demanding, but said his first word at 4 months, literally. His older brother would pop up over the edge of the tub and say 'boo' over and over again to make his little brother laugh. Benjamin started repeating the word himself at four months. His grandparents didn't believe me. So, when we were at the grocery store, Grandma popped up over the edge of the grocery cart and Benjamin promptly said, "BOO!", and laughed. Our second little amazing, bright, beautiful child had been born into the world.

It was around this time that Seth was severely ill. He developed a pneumonia that moved outside his lungs. He was hospitalized twice and had to have surgery to drain a pocket of infection that developed outside his lungs. He had a chest tube for 3 days and major antibiotics for about 2 months for what was termed atypical pneumococcal pneumonia with pleural empyema that required surgical drainage. Seth was rushed to the ER more than a dozen times in a year with temperatures over 106. The highest recorded was 107.3 and I swear he was over 108 once and I was afraid to measure it. Ten months after chest surgery, Seth had his second surgery to remove his tonsils and adenoids. He was 4 years and 4 months old. We ended up discovering a black mold in our house and the entire house had to be remediated.

Once the mold was removed, all of Seth's health problems including frequent nosebleeds, fluid in his ears, runny noses and high fevers stopped immediately. We needed to play catch up with his speech, so he attended speech therapy for 4 months. He was sent for another hearing evaluation, because I still had

some concerns about his hearing. We were once again told his hearing was fine.

With a background in education, I just knew something was not right. We were referred to a Children's Hospital in Kansas City for a complete hearing evaluation. We scheduled and went in for that evaluation. Seth was supposed to be in kindergarten, but I was home schooling him, following my instinct that told me something was going on. The audiologist came out and said the same words I had heard twice before, "Good news, Mrs. Holland, his hearing is perfect." This time I started crying and said, "Then why can't he hear me?" This audiologist then said, "I'm not done yet." She sent me on to another facility where Seth was tested for other hearing problems. That was my first introduction to the term auditory processing disorder. Seth heard at about 68% (Figure 1.1) when there was background noise present, which is actually at the low end of the grey area where a diagnosis can be made. However, because of the struggle Seth was exhibiting, and the other test results, he was diagnosed as having auditory processing disorder.

Figure 1.1: Excerpts from Seth's Test Results

SCAN-C

Filtered words subtest (monaural low redundancy stimuli) – 84th percentile. Seth's ability to understand distorted speech is good when listening in quiet.

Auditory-figure ground subtest (speech understanding in noise) – 16th percentile, 1 standard deviation below the mean. Seth has significant difficulty understanding speech in noise.

Competing words subtest (binaural integration task) – 25th percentile. The competing words subtest is a dichotic listening task that assesses binaural integration. Seth's overall score was 1 standard deviation below the mean, but of note is the difference between the right and left ears. There should be no more than a 15 % difference between ears; Seth's ear difference was 24%. Seth shows a left ear weakness.

Speech-in-Noise Test

Single-syllable word recognition lists were used to evaluate understanding in noise. Each ear is tested separately. W-22 words were presented at 45 dB SL and the speech spectrum noise presentation level was at 40 dB SL. Seth's responses were 68% correct on the right and 68% correct on the left, 1 standard deviation below the mean for 9 year olds. Seth has significant difficulty understand speech in noise.

Staggered Spondaic Word Test

The SSW is a dichotic listening test with different words going to each ear. Some of the words are non-competing (arriving at the two ears at different times) and others are competing (arriving at the two ears at the same time). The patient is to repeat all the words heard.

Seth's errors	*Limit of normal for age 9*
Total errors, 23	12
Right non-competing, 1error	2
Right competing, 6 errors	4
Left competing, 12 errors	6
Left non-competing, 4 errors	1

normal 9

I was given some papers with recommendations like preferential classroom seating and was told that unfortunately there was not much that could be done for him; he was going to have to learn to cope.

We started Seth in 1st grade that next year, giving his teacher the handouts from the audiology department and hoping for the best. By the time Seth was in second grade, he sat in the back corner of the classroom and cried if someone spoke to him. You see, my perfect, beautiful, smart little boy wanted very much to make the teacher happy. So if the teacher said something like, "There are two brown cows and two white cows in the field. How many cows are there all together?" Seth, being the smart little boy that he was and wanting very much too please and having heard the word cow out of all that, raised his little hand and said something like, "I saw cows yesterday that were black with a white stripe in the middle." Now if that happens one time, it is ignored. But when that happens over and over again to a little guy, the other kids start to laugh. And smart little kids start to feel like maybe they aren't as smart as they thought they were and their little egos are destroyed and they sit in the back corner of classrooms and try to blend into the woodwork rather than be noticed, spoken to, called on or laughed at. And mommies de-

cide they will not accept that this is as good as it can get for their little ones and start to research ways to help.

Benjamin was doing fine at this point. Benjamin has always had an easy smile and a laid back personality. Benjamin sailed through elementary school with us hearing, at every parent teacher conference, how he was loved by teachers and kids alike. I didn't catch on to little clues like "He's a little behind where I would like him to be in reading, so I have been working with him at recess and he is catching up," that I heard just about every year. His third grade teacher even said, "He does so well in class and then bombs the tests. He is smart and I know he knows the material, so I call him up to the desk and go over it and he knows it, so he is fine." His fifth grade teacher was hard on him in math and worked with him for weeks during recess to get him where she thought he should be. During all this, Benjamin was still getting good grades and was loved by all. When Benjamin hit middle school and went from one teacher who knew him extremely well to a different teacher every hour, he went from A's and B's to D's and F's. We began the process of testing him after one teacher noted that she was concerned that he was not performing up to his ability level and seemed easily distracted. He went to an eye doctor, had his hearing checked, had a full physical and even had the lead levels in his blood checked since our home is quite old. Nothing showed up.

Next he began the process of testing through the public schools. Since he was, at that time, attending a private school, he was being tested by people who did not know him. One came out and asked, "Why are we testing him? I am pulling out material I have not used before because his level is so high." When we were called in to review the results, we were told that Benjamin was not eligible for services because he tested on the 8th grade level overall when he was in 6th grade. It was during this session that my educator brain started kicking in and I noticed a few things. The first was that when he had tested in the fall in a classroom setting at the private school, the results showed him to be on grade equivalent of 3.5. (Figure 1.2)

Figure 1.2

DISTRICT WIDE ASSESSMENTS

Ben was given the Stanford Nine Achievement test in 10/09 with the following grade equivalence results:

Total Reading 3.3	Reading vocabulary 4.2	Reading comprehension 3.0
Total Mathematics 3.8	Problem solving 3.4	Math procedures 4.6
Language 3.9	Language mechanics 3.6	Language composing 7.2
Spelling 4.6		
Study Skills 4.7		
Science 2.7		
Social Science 5.8		
Listening 4.7		
Using Information 4.2		
Thinking Skills 3.8		
Basic Battery 4.2		
Complete Battery 4.2		

In the next chart, you can see the results of one test Ben was given in March of 2010. When he had tested at the public school in a room by himself, he tested on the 8th grade level. The silence and lack of distractions made a 5 grade level difference in his scores. Then I began looking at the results of another test in which his grade equivalent was at 8.1 (Figure 1.3) and noticed that some areas like story recall and story recall delayed that were at less than kindergarten level.

Figure 1.3

Cheryl Herton Special Education Teacher with the following results:

Woodcock Johnson-III					
(norms based on grade equivalence)					
Subtests	***SS***	***GE***	***Clusters***	***SS***	***GE***
Letter Word Identification	111	8.4	Broad Reading	100	6.3
Reading Fluency	101	6.6	Basic Reading Skills	104	7.3
Story Recall	54	<K.0	Reading Comprehension	90	4.5
Understanding Directions	90	3.9	Broad Math	104	7.0
Calculation	104	6.9	Math Calculation Skills	102	6.6
Math Fluency	99	6.1	Math Reasoning	106	7.5
Spelling	107	7.9	Broad Written Language	96	5.6
Writing Fluency	88	4.5	Basic Writing Skills	104	7.1
Passage Comprehension	86	3.5	Written Expression	88	4.5
Applied Problems	105	7.8			
Writing Samples	91	4.4	Oral Language	91	4.6
Story Recall-Delayed	45	<K.0	Oral Expression	86	3.4
Word Attack	98	5.4	Listening Comprehension	98	5.7
Picture Vocabulary	97	5.6			
Oral Comprehension	103	7.5	Academic Skills	110	7.8
Editing	100	6.4	Academic Fluency	94	5.6
Reading Vocabulary	96	5.6	Academic APPS	94	5.2
Quantitative Concepts	105	7.2	Academic Knowledge	86	4.1
Academic Knowledge	86	4.1	Phoneme/Grapheme Know	89	3.5
Spelling of Sounds	69	1.7			
Sound Awareness	105	7.7			
Punctuation & Capitals	87	4.2	Brief Achievement	110	8.1

As you can see, the areas of understanding directions, comprehension, spelling sounds, and phoneme knowledge showed a significant delay as well, especially when compared to the levels he was performing other tasks. At some point, during that meeting, I reached over and smacked my husband and said, "Oh my God! I know what is wrong with Ben. He has it too."

We went on to explain what was going on with Seth and, once we got past that he was not eligible for services, were directed to the Missouri School for the Deaf to be tested. The results showed that Ben hears in the first percentile when compared to other kids his age when there is background noise present. Overall, he hears only 64% in the right ear and 40% in the left ear of what is said in a typical classroom situation. (Figure 1.4)

Figure 1.4: Excerpts from Ben's Auditory Processing Disorder Testing

Competing Sentences Subtest: Short sentences are presented simultaneously to both ears. The student is asked to repeat only the sentence in the right for the first half of the test and then only the sentence in the left for the second half of the subtest—9th **percentile**.

The total of all the subtests shows that Benjamin's performance is in the 1st **percentile** and is considered to be below the normal range.

Speech-in-Noise Test: Single-syllable word recognition lists were used to evaluate understanding in noise. Each ear is tested separately. W-22 words are presented in each ear at 45 dB SL and the speech spectrum noise is presented at 40 dB SL. The test words and the speech noise are presented to the same ear. Benjamin's responses were 64% in the right ear and 40% in the left ear. The results are significant for both ears. Benjamin's ability to understand speech in noise impaired. Speech-in-Noise is a direct measure of a problem commonly seen in

Auditory Figure Ground Subtest: The student repeats single syllable words that are presented amidst a background of multi-talker speech babble. Both the speech stimuli and the noise are presented to the same ear—2nd **percentile**.
These results are abnormal when compared to children of the same age who have no auditory processing disorder. Abnormal performance on this test suggests poor ability to understand speech when there are moderate levels of competing speech or noise in the background. In addition, highly reverberant rooms and a distance between the speaker and listener make speech understanding difficult.

Competing Words Subtest: The student repeats single syllable words that are presented simultaneously to both ears. A different word is presented to the left and right ears—1st **percentile.**
The results from this test are abnormal when compared to children of the same age with normal auditory processing abilities. Abnormal performance on this test suggests a neurologically based auditory processing disorder. In adolescent subjects there may be delay in the maturation of the neurological pathways, or damage to central auditory structures. For those persons cortical plasticity can result in improved listening abilities with appropriate intervention. Research

It was during that summer that we realized two things. 1. My husband did not have severe selective hearing or lack the ability to plan ahead. 2. Our youngest, then 4 years old, showed all the signs of having the same disability his brothers and father have. In that summer, it went from being a symptom left over from health issues early in life, to a wiring difference the boys in my house have inherited from their father and something that I had to find a way to help my family with.

We have a daughter. She is a beautiful happy, blonde haired and blue eyed child. Since neither my husband nor I are blonde, we wonder how we were blessed with this fair haired beauty. She is happy and smart, making the A honor role most of the time. She has the same vertical challenges as her mother, but is a very aggressive basketball player. She is playing the flute and softball and loves life, animals, all things girly and hanging out with her friends. I mention her here, because she does not appear to have any difficulties with the way her brain processes information. I would be quite negligent in not mentioning her though since so much of this book is about the rest of the family.

The baby of our family is Teddy. Teddy is not only our sweetheart, but the sweetheart of everyone who meets him. I have been told it is the big brown puppy dog eyes coupled with his freckles and the fact that we call him Teddy that makes him so endearing to others. Many of the signs were there early, like they were with his oldest brother, but let's face it, he was the 4th. So if he wasn't talking early, we attributed it to the fact that no one let him have a need, every one of us catered to the little guy. If he said things wrong in a cute way, honestly, it was cute and we let it go. Too often, if he didn't answer when I called, I sent a sibling to check. If he didn't answer a question correctly as he ran by, I called him back and told him to listen to Mommy. He answered me, hugged me with those chubby little toddler arms and said, "You are the bestest mommy. I love you" and off he ran.

When he was in pre-k, Teddy had the type of teacher that all of us wish our kids would have for a pre-k teacher. She was kind, loving and supportive and talked very sweetly to the little ones in her care. She spent time getting to know all of them. When it came to parent teacher conferences, she noted that Teddy was one of the first to complete tasks expected of him like identifying all his letters and counting to 100… but that he didn't seem to grasp concepts the first time they were introduced. He always caught on, just not the first time around. (see Figure 1.5)

When Teddy was in kindergarten I observed a PE class. All the little kindergarteners were lined up on either side of the gym with their backs against the padded sides. The PE teacher said, "On your mark! Get set! Go" and all the little kindergarteners left the wall to run across the gym and then Teddy left the wall. I watched this happen several times and then realized that Teddy couldn't hear the teacher. He responded to the other kids running and then he followed suit. I had seen the same thing happen a few weeks earlier at the Valentine's Day party musical chairs game where he was the first one out. He only moved to sit after the other kids did. I don't think he could hear the music stop. Teddy is now 7, and, before this book is published, he will be tested to see what his level of hearing loss is when there is background noise present and what his other areas of difficulty are.

This school year, we are noticing some areas he is struggling. In math, he does not have his facts memorized. He is also complaining about a couple of the other students in class who, he says won't be quiet and keep bothering him. At home, Teddy is always asking for clarification when he hears a conversation and usually fills in the wrong words. His standard response is to say what he heard, listen again to what was said and then say, "ooohhhhh". We are working on the math facts at home on a daily basis and are telling Teddy to think about what he has heard for a minute before he responds to see if he can figure out something that might make sense.

Figure 1.5-Teddy's Pre-K Grade Card Comments

Area: Mathematical Thinking
Teddy is able to count to 20 and beyond independently. He recognizes his numbers to 20 and is now working on numbers to 30. He does very well with the concrete aspects in math, but has difficulty discussing and analyzing information. He often appears confused with what I am asking of him. I restate the question and sometimes need to restate in a different way and show and example in order for him to understand what is being asked of him.

Area: Scientific Thinking
Just like in his math skills, Teddy understands a lot, but is not always able to communicate his thoughts and does not always understand what is being asked of him. If re-stated or re-worded, he can come up with the answers.

Finally, we come to my husband. We now jokingly say that the wiring difference is all his fault. Charles is a very smart man. I call him the font of worthless knowledge. If he gets little factoids into his brain, they are there for good and can be pulled out randomly. Ask him about an article he read on some Civil War battle and he can pull out the information. He can trace the lineage of most major companies from where they started, who merged with whom and what the company is part of today. Charles has an undergraduate degree in Economics and an MBA with an emphasis in Finance.

He is a Business Development Specialist with the University Extension program. Charles helps people figure out their finances and helps them start companies, grow their businesses, rebrand themselves for success and figure out how to best utilize their cash flows to improve their decision making skills. He writes curriculum, holds business classes and works with international trade. Charles is a 4H Leader, a Boy Scout Leader, is involved at church and in our local government.

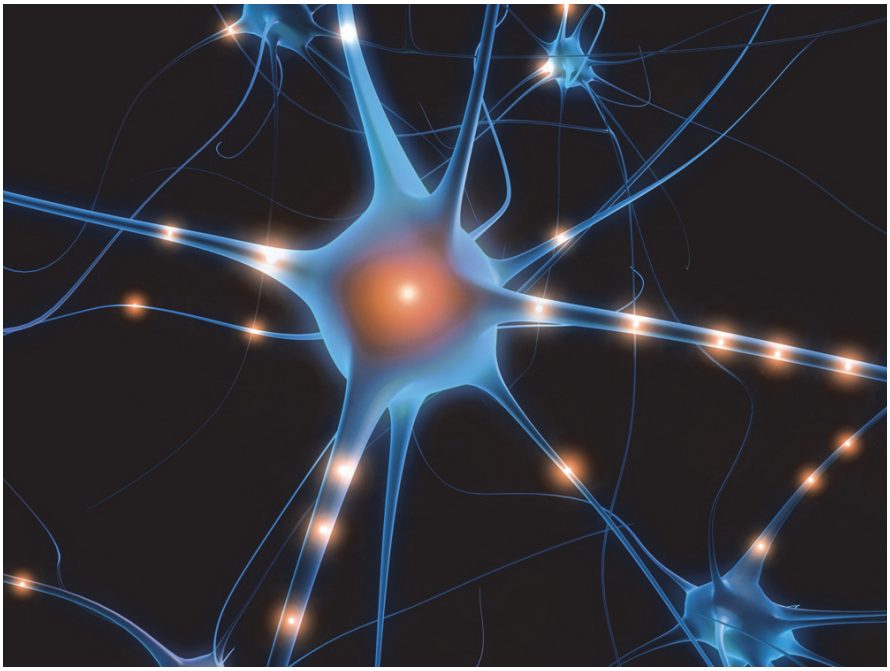
However, when working on a project, Charles requires two people running back up for him. He will get to the top of a set of scaffolding with only the tool in his hand to do the immediate job, requiring a runner to get each subsequent tool needed. His schedule must be written down or appointments will be forgotten. He hates talking on the phone, often mistakes tones of peoples' voices and is impossible to talk to with the television on. Charles misses turn offs on the highway if he is talking, has poor planning ahead abilities and often swears he has not been in-

formed about things that are happening. Charles is learning, as an adult who has just had a great deal of frustration explained to him through the auditory processing diagnosis of his children, how to cope with the difficulties it presents.

This is my family. Conversations in our home can get interesting, especially with teenagers. My husband will walk into the kitchen and ask Seth a simple question like, "what are you doing?" Seth, who does not often hear tones and innuendos, will respond back negatively with a comment like, "I'm making breakfast, is that a problem?" As the situation quickly escalates, as one quickly can where people are misunderstanding each other, Ben will walk into the kitchen, covering his ears and yell, "Stop yelling! I hate loud noises!" Teddy who has heard the commotion will then run in and start crying because of what is going on. All this happens before I come down the stairs and get into the kitchen to say something like. "You stop! You don't talk to your father that way! You take the volume down! And you quit crying!" Then I look at all of them and say, "We have got to get this figured out because I am not going to be 87 years old and still trying to fix all your conversations!"

Chapter 2:

Neurological Based Learning Disorders



"Everyone is a genius. But if you judge a fish by its ability to climb a tree, will it spend its whole life believing it is stupid?"

-Albert Einstein

Why do I start with this quote? Two reasons: 1. Albert Einstein is absolutely correct- imagine that. 2. Albert Einstein is believed to have some sort of neurological based learning disability. When Einstein was in second grade the teacher told his mother he was unteachable, especially in the area of math and would never amount to much.

**DISCLAIMER: Before I begin, I would like to state that I believe that using 'labels' like dyslexia, dyscalculia, auditory processing etc. do not provide an accurate picture of what is really happening. Using one word to define, not only the difficulty the person has with one senses input, but the specific set of difficulties that the individual is dealing with as a result of that input, undermines that person and often leads to more frustration. It is widely accepted that there is a lot of overlap between the symptoms of the various learning disabilities. I firmly believe that it is better to avoid putting each diagnosis in a convenient box and get to know the individual and treat the symptoms he or she has. Ideally, one should gather information to identify both strengths and weaknesses of each person. That being said, my children and those that I work with have been diagnosed with auditory processing disorder. If I were to label my kids specifically, I would actually say that they are learning disabled. One struggles with auditory and short term memory. One struggles with auditory ,short term memory and prosodic presentation. One of my students has a learning disability that begins with both the auditory and the visual process and includes struggles with comprehension and short term memory. Another of my students has a learning disability that begins with the auditory and the vestibular process and includes prosodic and executive function difficulties. **

What I have found as I work with kids and adults who have these learning disorders is that they are, for the most part, extremely intelligent people whose minds process information differently. If you want to see an impressive "Who's Who" list, do a quick internet search for people with dyslexia; a well known learning disorder. Here are some of the names on that list: George Washington, Walt Disney, Alexander Graham Bell, Henry Ford, George Patton, Leonardo DaVinci, John Lennon, Nolan Ryan, Whoopi Goldberg and Jay Leno. Although not documented, many think that the Wright Brothers also had one of these types of disorders since they were not known to be successful in school, but were able to think outside the box enough to build a plane. NASA often seeks those with these types of disorders

since they are known for thinking outside the box. These are bright people whose minds take information in differently. They were born and wired to think outside the box. Because of the way our schools function, they often begin life feeling unsuccessful.

When we discuss learning disorders, we are referring to those disorders that affect the way the brain takes information in, through a system that outwardly appears to work. For example, those who are dyslexic see perfectly, but information, on the way into the brain, gets mixed up. Those who have auditory processing disorders have ears that work perfectly, but on the way into the brain, the signal gets crossed and the information doesn't get there correctly. Dyscalculia is a math based issue. Individuals with dyscalculia often have trouble with math concepts and concepts involving order such as times and dates. Dysgraphia is a person who has difficulty with symbols such as written language, the words may line up correctly but the learner has difficulty making sense of them. These people often have extreme difficulty getting thoughts onto paper, organizing their thoughts and spelling. Dyspraxia is another neurological learning disorder. Those with dyspraxia have difficulty getting body parts to respond the way they want them too. These are people who cannot button their buttons, tie shoes or correctly grip a pencil to perform a task. Someone with dysphasia or aphasia can write down any answer but has a great deal of difficulty verbalizing answers. Often, when they do speak, they are very hard to understand or have trouble organizing their thoughts coherently.

These learning disorders affect learning in one of three ways. The first happens when the **input** is affected. If the input is affected as it is with auditory processing disorders, dyslexia and dyscalculia, the path the information takes into the brain is affected. This is not the same as a sight or vision loss. If the loss is physical, as it is with a hearing loss or loss of vision, the information has no way to get into the brain and the learner and those working with him must find ways to present that information in a way that makes sense for him. We can't give a person who is blind a test on the shades of blue. We can't give a person with a hearing loss a test on identifying the sounds made by the various brass instruments. The information has no way into the brain, no way to be processed and is irrelevant to the learner. Instead, with a learning disability, the path for input remains intact. He can hear and see perfectly, but the path the information travels is affected. To successfully work with the learner, one must find a way to reach, organize and extract that information that was input in a different manner.

Second, a learning disorder can affect the **organization** of the information once it is in the brain. Once we take information in, it must be sequenced, abstracted and organized. Those with learning disorders often have trouble with these areas. The information gets stored randomly so that sequencing is difficult. Many of these individuals find tasks such as telling time, multiplication tables, spelling and months of the year difficult. Once the information has been input into the brain, it must be abstracted so that it fits into a broader picture. A person must be able to understand that they're, their and there are all pronounced the same but have very different meanings and uses. They are taught their times tables and told to do something 3 times. A dog can be a pet and a person who is unattractive is a dog. Then, once the information is sequenced and abstracted, it must be organized. A person who is successful at organizing can put relevant information together, understands and can make good use of time, personal space, calendars and making and following through with plans.

Finally, learning disorders can affect **memory**, which is simply our ability to hold on to and then retrieve information when it is needed. Working memory refers to our ability to hold on to information long enough to make sense of it. To make sense of a sentence, we must hold on to the words until the sentence is complete. To make sense of a paragraph, we must hold on to the information until the sentences are all read. This information is stored in our working memory until we are able to use it.

Those with learning disabilities often have trouble with comprehension tasks, problem solving and math word problems. Our short term memory is often referred to as things we hold on to for 5 minutes or less. It is the list we put in our head as we leave the house. It is the directions a friend gives us to where they are stranded or a phone number. Those who have trouble with short term memory often forget placement of items or conversations, dates and times. Working memory is the mental scratch pad. It is the place you hold onto the running total at the grocery store or where you multiply two digit numbers together. It is the directions you hold onto as you make turns to get to a new place. Once information has passed from short term memory to working memory it is stored in our brain for later retrieval and becomes part of that persons' general knowledge or long term memory. The more we can do for those who have difficulty with working and short term memory at an early age, the more we can do for their overall well being as their long term memory or general knowledge will increase.

Chapter 3:

Auditory Processing Disorders