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Listening to learn : the academic achievement of auditory learners

Rae Ann McLean-Dickinson
University of Northern Iowa

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Listening to learn : the academic achievement of auditory learners

Abstract

Teachers present lessons in a variety of modalities to engage students with different strengths in processing within the classroom. Using literature from a variety of educational specialists focused on how the brain processes oral and auditory information, this paper reviews how students translate learning while engaging in reading and writing tasks. It explores the different learning problems some children face, and gives suggestions about how teachers may recognize them and offer an environment where all learners become successful.

LISTENING TO LEARN:
THE ACADEMIC ACHIEVEMENT OF AUDITORY LEARNERS

A Graduate Review

Submitted to the

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Rae Ann McLean Dickinson

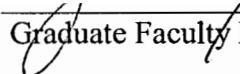
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Lynn E. Nielsen



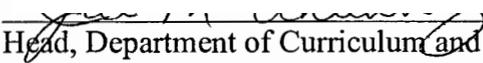
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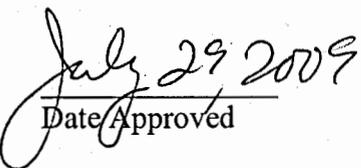


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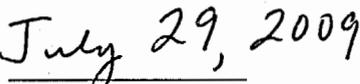
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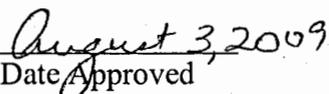
Head, Department of Curriculum and Instruction



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Abstract

Teachers present lessons in a variety of modalities to engage students with different strengths in processing within the classroom. Using literature from a variety of educational specialists focused on how the brain processes oral and auditory information, this paper reviews how students translate learning while engaging in reading and writing tasks. It explores the different learning problems some children face and gives suggestions about how teachers may recognize them and offer an environment where all learners become successful.

Introduction

Dr. Linda Silverman created the terms, Visual-Spatial and Auditory-Sequential, when describing learning styles. The visual-spatial learner thinks in visual images and tends to excel in spatial tasks as well. The auditory-sequential learner uses movement and learns better with hands-on activities, sometimes needing additional wait time (Golon, 2008). Armed with this knowledge, teachers realize students in their classroom learn in a variety of ways so they attempt to provide a variety of activities to meet the needs of all learners.

Silverman worked with hundreds of children using her theory, based upon Nobel prize winner, Robert Ornstein's discovery that we each have two hemispheres of the brain. We use our 'right brain' to understand wholeness of an idea or the 'big idea', whereas the left brain operates at a linear, analytical level to complete tasks. However, the two sides of the brain work together to accomplish most cognitive tasks (Golon, 2008). Teachers bring a variety of activities into the classroom with the goal of providing learning that engages both sides of the brain.

Children who possess strength in using both hemispheres are often gifted. The concern presents itself when a student is able to learn by using only visual-spatial or auditory-sequential strategies or is weak in one particular hemisphere. So much learning in the classroom is accomplished with lively dialogue to bring the student into an activity. If a child is unable to connect with any verbal discussion and/or examples written on the board, completion of a project becomes nearly impossible without a one-on-one mini-lesson. At that point, a teacher must start investigating why that student is not motivated to complete activities. How can a teacher turn a visual-spatial learner into a student that can use both hemispheres to learn? Could there be other problems involved such as an actual hearing loss or might the student have an auditory processing disorder (APD)? Is the student on task or does he or she have problems fidgeting and

concentrating because of an attention deficit disorder (ADD)? What is the difference between a processing disorder and language disorder? Is the student under-resourced, lacking the necessary phonemic awareness to process classroom information (Payne, 2008)? How does a teacher recognize and deal with these complex issues to maximize learning within the classroom?

Methodology

During the past year, I observed that many of my students were lacking in listening skills. This is not unusual for second graders at the beginning of the school year, but these students also had a difficult time attending to any task that was initiated. I began to wonder if they potentially had problems hearing, and discussed these students with the professional in charge of doing the hearing tests. Hearing tests were performed on the students and all of their hearing was within normal limits. Next, I contacted the Area Education Agency (AEA) psychologist and parents of the students about doing observations for attention problems, and began gathering data and documenting classroom interventions I was using, for our team at school.

Two of these students already had Individual Education Plans (IEP) for auditory processing concerns, but I wanted to be certain there wasn't something else we should have been doing for those students. By the end of the school year, one of them had an IEP that will extend his services for next year in third grade. Even though he was fairly high functioning and was receiving a lot of parental help, he struggled each day. I knew he would need extra support in third grade, where there is no Title 1 Reading.

Understanding these students needed a lot of visual support, all lessons were modeled on the board, followed by a brief visit to their individual desks, ensuring they understood the task at hand, by using manipulatives or rereading directions, pointing out key words and, perhaps, completing another example. During the course of the year, many opportunities were provided

for the students to practice speaking, listening and reading in class. Oral reading was included each day, sharing appealing novels, employing read alouds, using Guided Reading groups, discussing what good listening skills are and reminding students to use them. These students use casual register, which is sometimes difficult to understand, and often sounds disrespectful. Students also seemed unwilling or unable to follow through with verbal instructions (Payne, 2008).

One student, who barely spoke, would not begin tasks without being asked several times and did not stay on task most of the time. He was extremely under-resourced and there had been very little accomplished, as his parents wouldn't allow him to be retained and there had been no other school interventions pursued. Receiving occupation therapy (OT) the year before, the OT Specialist refused to serve him last year until his parents addressed his identified attention problem. I was informed he was more engaged in my class than he had been in past years, but otherwise, he was a mystery.

Because we are left to our own resources for most student concerns, I continued to explore different activities that would help these students become successful learners. I began my literature review by searching for information on auditory learning, revisiting information on visual/spatial and auditory/sequential brain functions. It started to become apparent that, although these students appeared to have auditory processing concerns, there could be other comorbid concerns. In addition, I explored language processing disorders and attention deficit disorders, which often accompany concerns with auditory processing.

Through my readings, I learned specific characteristics of these disorders and the differences between them. Keeping in mind the specific students in my classroom, it became

clear which students exhibited characteristics of the different disorders and how to provide instruction for these students.

Continuing to attempt to strengthen the auditory skills of these students so they would be more responsive in class, I encouraged their parents to increase their talk time with their children and be certain they followed through with verbal instructions when requesting that their child complete chores. I had begun to suspect that many of these children came from under-resourced backgrounds. Dr. Ruby Payne's models for interacting with students from under-resourced environments point out that knowledge of a student's background can provide insight into what resources are or are not available for that student to utilize. If a child is never given an instruction and asked to follow through to completion, how would that child understand to act upon verbal requests? On the other hand, if parents are responsive and supportive of classroom activities, support reading and writing at home and assist with homework, children tend to be more successful at school (Payne, 2008).

Finding some success using effective research-based interventions in spelling and vocabulary memory, which these students struggled with, I continued sorting out the variations of different disorders and continued to explore researched-based methods for improving actual listening skills. I found several concept maps for classroom word study, which exercise practice in imagery and connections the students could use to relate to later. These proved to be successful in assisting students to remember words long-term (Golon, 2008).

Literature Review

Defining Processing Disorders

In 1954, Mykelbust identified children that were unable to structure and manage their auditory world, demonstrating deficits in dealing with auditory information that led to behavioral

and communication problems (Geffner & Ross-Swain, 2007). Later, in 1969, Chalfant and Scheffelin referred to the problem as a Central Auditory Processing Disorder (CAPD) where children have hearing acuity within the normal range but are unable to acquire meaning from auditory stimuli (Geffner, 2007).

According to the National Institutes of Health (NIH), children with what is now called Auditory Processing Disorder (APD) might experience difficulties that include sound localization, auditory discrimination, problems with prosody and the musical aspects of spoken language (pitch, rhythm, and melody), difficulties in pulling out the relevant from irrelevant information in auditory messages, sound blending/phonemic synthesis, and having difficulties obtaining meaning from sound in general” (Lucker, 2007, p. 10). By 1977, although no agreement was reached as to what an APD was or was not, at the Central Auditory Dysfunction (CAD) symposium in Cincinnati, Ohio, Robert Keith (Lucker, 2007) used the term CAD. Auditory-Perceptually-Handicapped Children (Sweitzer, 1977) was also used. “However, all professionals essentially stated that the problems in children with APD (or CAPD as it was called at that time) were due to primary deficits in the children’s abilities to obtain meaning from auditory messages not due to hearing loss, cognitive/intellectual deficits, or other *non-auditory* problems” (Lucker, 2007, p. 11).

Another presenter at the Ohio symposium offered her description of APD. Referring to research by Paula Tallal (1977), Charlotte Dempsey introduced the explanation that is recognized today, that children with APD or developmental dysphasia “were unable to discriminate rapid changes in the pitch of tones or experienced a language-based learning disability where a disorder exists in taking in and using auditory information” (Lucker, 2007).

Jack Willeford created a test battery for identifying APD in children and, along with Joan Burleigh, published the *Handbook of Central Auditory Processing Disorders in Children*. In their book, they recognize CAPD as a learning disability that continues to be defined in present education laws: "Specific learning disability means a disorder in one of more of the basic psychological processes involved in understanding or in using language spoken or written which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations (PL 94-142, Section 121 [a] [5])" (Lucker, 2007, p.11). Some children identified with APD may exhibit poor listening skills, problems following auditory instructions, deficiencies in short-term memory span, difficulty understanding with background noise and frequently ask, "What?" or say "Huh?" They may misunderstand what is said to them, request information be repeated, be easily distracted, experience deficits with auditory integration for sound blending, phonologic awareness and phonic skills, possess weak auditory memory span for commands and sequences, have a delayed response to verbal stimuli, suffer problems with spelling, reading and academics and be hypersensitive to loud noises. These behaviors can also be associated with other comorbid conditions such as reading disorders, AD/HD, or other learning disabilities.

In a research study of 425 students aged seven through 14, each diagnosed with an auditory processing disorder, DiMaggio and Geffner (2003), found 31% of the students were medically diagnosed with AD/HD and 53% were identified the same by parental answers on a questionnaire. Forty-seven percent had a reading disorder, reading at least one level below grade level and 83% had a speech and language disorder. Only 27% had no problem with reading and of the 73% that did, twice as many boys as girls had difficulties. Nearly 50% of the children had suffered from otitis media with effusion, according to parental interviews. Many children go

undiagnosed because of being asymptomatic, so the instance was probably higher (Geffner, 2007).

Researchers also found a high number of complications during pregnancy or at birth, such as the umbilical cord tied around the neck, loss of oxygen at birth, trauma to the mother, or premature birth.

Under-Resourced Learners: Eight Strategies to Boost Student Achievement

The term 'under-resourced' is a term used by the United Nations when referring to a person who doesn't have access to a number of resources in order to become successful within the school setting. Many families of students who exhibit learning problems at school struggle to provide support for their child because they are under-resourced. Dr. Ruby Payne introduced eight strategies to assist students needing this extra support. She created strategies educators and community leaders can use to assist these families in need (Payne, 2008).

First, there are nine resources Payne identifies that a person needs to address life's situations and live in various environments that are personal and situational.

1. Financial resources provide one with the ability to purchase goods and services.
2. Language resources allow one to speak and write formally.
3. Emotional resources give one the ability to choose controlled responses without engaging in self-destructive behaviors.
4. Mental abilities and skills assist one with daily life.
5. Spiritual beliefs bring a feeling of purpose and guidance.
6. Physical abilities offer good physical health and mobility.
7. External resources, such as friends, family and other backup resources ensure help in times of need.

8. Relationships and role models give students access to adults who are appropriate, nurturing and do not participate in negative behaviors.
9. Students who understand the hidden rules of a group they are involved with, are able to behave in a way that allows success within that group (Payne, 2008).

Assessing the resources of a student “at risk” allows an educator to identify interventions that will work with his/her individual strengths to enhance underdeveloped resources. Payne suggests assessing the resources of the household, using this information to determine family strengths and ascertain where to make interventions.

Second, teachers who build relationships of mutual respect with students promote a nurturing and safe classroom environment. They create an upbeat classroom climate, pleasant with conversation and laughter, and use classroom management strategies with which students comply. Students learn best when teachers respond to their needs, moods, interests and capabilities. Mutual respect also involves high expectations, insistence and support. Increased student connection to school allows them to become more motivated and increases school attendance.

Teacher Expectations and Student Achievement (TESA) has identified 15 behaviors of mutual respect that significantly increase learning. Five of these behaviors of mutual respect include teachers: calling on everyone in the room equitably, providing individual help, giving wait time, asking questions to give students clues and asking questions to entail more thought.

Research has shown that the number of words children are exposed to prior to school varies by social class and economic level of the home. Three-year-old children of professionals are exposed to up to 30 million words compared to 10 million words for children of parents on welfare. Positive messages are heard at a rate of five positive for every one negative for

professionals, whereas that ratio is only one positive for every two negative messages for children in under-resourced homes (Payne, 2008).

Payne's third strategy involves teaching formal register and story structure to students who lack appropriate language skills. "Language resources allow a person to share understandings, experiences, and information with others" (Payne, 2008, p. 40). Every language has five 'registers' or structures of language: frozen or language that does not change (wedding vows, prayers, etc.); formal or complete sentences that use specific words for the occasion (work, school); consultative or formal language used in conversation; casual or language between friends; and intimate or language between lovers or twins. Sometimes one can 'drop down' a register around friends, but any more than that can be socially offensive (Payne, 2008).

Conflict resolution is difficult in casual register because most vocabulary used for this purpose is in formal register. For example, in formal register one says that a situation was 'physically violent' whereas in casual register, one would say that 'he hit him'. Many students are unable to use the formal register that is expected at school.

For elementary school children, students are told that formal register is the way newscasters might speak, whereas a friend would use casual register. Without knowledge of the difference, or the ability to make the switch, entering into the job market is all but impossible.

Writing is one of the best ways to teach discourse patterns. Vocabulary development, word webs, note-taking and step-by-step processes for reading non-fiction texts are strategies for students needing knowledge and practice in the use of formal register.

Payne's (2008) fourth strategy involves teaching students tools for negotiating the abstract representational world. Students must learn to survive in school, which means they must learn information they can utilize in a practical way. If a child grows up in an environment that

has few books, calendars and clocks, or does not acknowledge the information these items contain, it will be difficult for those children to navigate in a world that depends on this information. 'Situated learning' research shows that routines, behaviors and information the child may recognize as common to their everyday life, may not be what they experience at school. Some hidden rules at school may include written information, rather than orally shared, learning is relational at home, rather than formal at school, and laughter is used to lessen conflict at home, whereas it may be considered disrespectful at school.

We are who we are half because of our genetic code and half by environmental nurturing (Payne, 2008). Any learning that occurs early on is through the adults in a child's life. They give a child the what, the why and the how, about the child's environment. They point out the stimulus, give it meaning and help the child figure out what to do. Learning is physiological, meaning there are actual chemical or electrical interactions in our brains. So the learning that occurs, even if it may be incorrect, is difficult to change later.

Learning becomes a set of abstract models in the brain, much like icons in a computer. Each icon represents a program on the computer, just as an idea is in the brain. Students need these mental models to connect new concepts to something they already have learned. Teachers, then, need to base new information on concepts that students already are familiar with. Under-resourced learners may not have the familiarity needed, so teachers must teach the what, the why and the how in a relational learning environment, revisiting the content multiple times. Providing mental models through drawings, stories and analogies helps students connect new learning with something they already have knowledge about. Teachers also must practice connecting time to a task so students learn to complete a task in a certain time frame.

In every learning environment, teachers must communicate appropriate behaviors

and procedures to their students to create a safe environment in school. Payne's (2008) fifth strategy advises teachers to continue to build ongoing mutual respect between students and teachers. This involves classroom and school procedures that ensure a minimum of discipline problems occur. Relationships of mutual esteem should also exist between parents and teachers. Administrative support promotes understanding and mutual respect with parents and teachers.

Benjamin Bloom conducted well-known research to study the factors that affect learning and identified four points of interest. First, he stressed an awareness of the amount of time it takes to learn. He recognized how the intervention of the teacher can influence a student and acknowledged the importance of clarity in the focus of the instruction. Bloom also pointed out the significance of connecting prior knowledge a student possesses to learning new concepts.

Payne's sixth strategy lists steps for teachers to follow to maximize student learning (Payne, 2008). Identify students who can move up in achievement and determine what interventions you can make. Structure lessons which provide reasonable expectations and logical amounts of time devoted to learning. Use high-quality effective classroom management and instruction for content understanding and knowledge. Employ formative assessments that identify and assess growth a student makes on a regular basis and intervene to provide alternate strategies if achievement is not apparent. To embed the processes for student achievement into the system, planning time to monitor student learning should be provided within the school calendar (Payne, 2008).

The earlier parental involvement occurs in a child's school career, the more positive the relationship becomes. Research shows that parental involvement in school promotes higher grades, test scores and graduation rates. Students have better school attendance, increased motivation, lower rates of suspension, decreased use of drugs and alcohol and less violent

behavior. Support systems offer assistance to a student so he or she can dedicate his or her energies to learning and personal growth (Payne, 2008).

Students who are successful in school most likely have a strong external support system. Parents are that primary support system, their beliefs and attitudes having a major bearing on the attitude of their children. Schools must keep in contact with parents, promoting mutual respect, involving them in school activities, and overcoming reluctant or difficult parental relationships.

Payne's seventh strategy identifies approaches to utilize in communicating with parents. Some of these ideas are: including parents in School Design Teams, scheduling regular home visits, hosting student-led parent/teacher conferences, implementing staff development to explore strategies for dealing with parents, providing informational/support groups for parents and promoting student groups that allow students to form relationships with other students that provide mutual problem-solving help.

Payne (2008) lists the most important issues to address in dealing with under-resourced parents, in order: mutual respect, use of casual register, the way discipline is used in the home, the way time is viewed and the role of school and education in their lives.

The U. S. Department of Health & Human Services say that every day in the U. S. three children die from abuse, nine from murder, 13 from guns and 27 from poverty. Seventy-five percent of those that suffer are under the age of 12. Daily, there are 2,385 babies born into poverty, 4,262 children are arrested (many for violent crimes), 17,000 students are suspended and 2,756 students drop out of school (Payne, 2008).

If an adult has no support system, parental support will be slight or nonexistent. Strategy eight models how communities can collaborate on how to address concerns of these under-resourced families. A scaffolding of interventions to support under-resourced parents might

exist. Not all communities have actual support systems for families, but schools should be aware of the programs that do exist in their areas. Providing families with help that can make their lives easier and richer, schools may act as advocates for the families of students who are unable to focus on learning because their needs are not being met. Teachers, along with schools and communities, have unique opportunities to support students by bringing new ideas, hope, skills and understandings to families.

A study published in the American Educational Research Journal (AERJ), reported that children in a high-minority urban school district, could out-perform state standards, when implementing Lindamood-Bell reading programs like Lindamood Phoneme Sequencing (LiPS); Seeing Stars: Symbol Imagery for Phonemic Awareness, Sight Words and Spelling, and Visualizing and Verbalizing for Language Comprehension and Thinking (V/V), with regular and special education students. These programs develop phonological and orthographic awareness for reading and spelling words, and concept imagery. High-poverty and high minority students in Pueblo, Colorado, went from scoring only 67% in reading proficiency in 1997, to 83% in 2006, using these programs. Pueblo's schools have over 60% minority population, compared to the entire state of Colorado's districts at an average of 30% minority population. Not only did Pueblo's schools score above the state average, their mean score increased, demonstrating even the lower scoring students were reading substantially better (Bell, 2007).

For all of us who wish to make a difference in the lives of all children and adults who live in poverty, we must remember that, with proper assistance and instruction, all students can learn to their potential.

Using Imagery and Verbal Processing

Educators from Aristotle to Piaget (Bell, 2007) have taught that mental imagery plays an important role in language processing. Allan Paivo (1969), a cognitive psychologist and researcher, created the Dual Coding Theory (DCT) in which he presents that all functioning is reconciled by dual activity between verbal and nonverbal systems. Extending that further, he suggests that, in addition to imagery and verbal experiences, our linguistic memory also contains action sequences and interaction between objects and events. It is because of Albert Einstein's abilities to make his thinking concrete by retrieving the sensory role of mental imagery, that he was able to revise and develop the understanding of the universe. "He [Einstein] stated that if he couldn't picture it, he couldn't understand it" (Bell, 2007, p. 327).

The ability one has to retrieve mental images for and from language is important for processing language. There are two language processes that work, in tandem, within that imagery when reading: decoding and comprehension. Symbol imagery is important in decoding or creating mental representations for sounds and letters, including phoneme awareness, word attack, word recognition, context reading and spelling. Concept imagery is the ability to create a mental representation for the whole used in critical thinking, like understanding main idea, drawing conclusions, using inferences, predicting and extending.

Individual students may possess differing abilities in symbol and concept imagery. A student weak in symbol imagery may have difficulty in reading and spelling words, but may have good comprehension. Another student may be strong in symbol imagery, like spelling and reading individual words, but may be unable to comprehend the big idea.

Attention Deficit Disorder or Auditory Processing Disorder: What's the Difference?

According to the American Psychiatric Association (APA), diagnosis of Attention Deficit Disorder (ADD) or Attention Deficit with Hyperactivity Disorder (ADHD) is made when behaviors are seen across three realms (inattention, hyperactivity, impulsivity) with symptom onset before age of seven lasting longer than six months and taking place across two settings: home, school, or playground. Not always diagnosed in early grades, ADD or ADHD becomes more visible as the class work becomes more difficult and grades plummet (Geffner, 2007).

The hyperactive child is more recognizable and may be diagnosed earlier in the school setting because he or she will fidget with hands or feet, and/or squirm or run around, leaving his or her seat completely. These children often have problems playing with others, are loud, blurt out answers, are always on the go, interrupt and talk excessively.

The inattentive ADD child might exhibit the following: difficulty staying focused, unable to give attention to detail, make careless mistakes, appear not to listen, unable to follow through with instructions or finish schoolwork or chores, seem disorganized and forgetful.

Children with ADD may need to be told several times to complete a chore, so confusion may exist as to whether the child has an auditory processing deficit or attention deficit (Geffner, 2007).

Students hypersensitive to or distracted by loud sounds are additional indicators for referral. Children with auditory processing disorders have a lower tolerance for loud sounds due to abnormal central suppression effects. Geffner, Luckner, and Koch (1997) found that children with an attention deficit disorder had significant differences (from norm) in their preferences for comfortable listening levels and the ability to tolerate loud sounds.

Although APD should be diagnosed by an audiologist and speech-language pathologist, it is important for the classroom teacher to understand the basic principles of central auditory processing. "Mastery of reading and spelling skills requires prior mastery of specific auditory processing/phonemic awareness skills" (Ross-Swain, 2007, p. 155).

Teachers may recognize a student has trouble with: initial and final sounds, adjacent sounds in consonant blends, discriminating short vowel sounds, rhyming, breaking a word into syllables or individual sounds, blending sounds together, remembering the sound of a letter, relating an auditory symbol to a visual one, or pronouncing multi-syllabic words. "It is helpful to remember that when children learn to listen then they can listen to learn" (Ross-Swain, 2007, p. 154). Within the school environment, reading, language development, and comprehension are all dependent upon the auditory modality. A child who experiences an auditory processing deficit may miss the most important point of a lesson because of a delay in understanding, or may lose track of where the class is in the sequence of steps just explained by the teacher. This child eventually becomes fatigued because he or she is always one step behind in following age-level appropriate concepts. This child, who appears to tune out or daydream, is probably having difficulty with overall learning in the classroom.

Three different processes are recognized as the major and interconnected components in attaching meaning to an auditory stimulus. Acoustic signals are received and processed into the phonological codes of spoken language. The message is then interpreted linguistically, where the person receiving the message works to understand the intention of the speaker (Richard, 2007).

Phonemic processing plays an equally important role in language processing and auditory processing. Development of phonic skills or grapheme representation of sounds heard are important to build the language and literacy skills needed to spell, read and write. The challenge

lies in trying to decode and interpret the message within the sound-symbol system of language. Most individuals with language processing problems need contextual cues, prompts, and linguistic assistance as the focal point of treatment. In other words, students with language processing deficits need to gain skills in explaining and interpreting the message, not repeating it.

Getting Students to 'Tune Into the Environment'

There is no national educational policy regarding assessment and intervention for auditory processing concerns in public schools. It is therefore the teacher's responsibility to contact parents and document interventions that have been used to improve student performance. These findings are then reported to the school's Teachers' Assistance Team to determine when and if testing for an APD or Learning Processing Disorder (LPD) may be indicated.

It is the audiologist's responsibility to evaluate and diagnose problems in the reception and/or transference of an acoustical signal. Speech-language pathologists are responsible for evaluating and diagnosing problems in analyzing an acoustic signal. "Collaboration between audiology and speech-language pathology is critical to ensure ethical and efficacious delivery of professional services" (Richard, 2007, p. 172). Effective treatment is then applied to the specific skill deficits that are found.

Auditory processing problems can lead to difficulty understanding the teacher's explanations in other subject areas, such as mathematics. Even if the material is on the appropriate level, a student with auditory deficits would have difficulty succeeding if the oral directions and instruction were not clear. Because auditory processing problems often make oral explanations and examples confusing, students may act as if their math assignments are much too difficult.

Parents and teachers can enhance auditory processing by being strong role models for effective communication, as well as implementing small changes in students' spoken or visual world.

Steele (2004) lists a summary of LD Modifications for the Elementary Mathematics Classroom that would assist regular education students, as well as those with APDs:

1. Provide graphic organizers to introduce the purpose of lessons.
2. Provide additional review of all skills as needed.
3. Prioritize, teach, and review major concepts frequently.
4. Teach generalization and application to real-life situations.
5. Model sequential procedures at a slow pace and with many clues.
6. Present new skills using concrete materials, pictures, and abstract explanations.
7. Provide additional practice in small steps with sufficient guidance.
8. Be sure directions are clear before starting independent practice.
9. Teach students to keep track of their progress with charts and graphs.
10. Check for error patterns and related mistakes when providing help (Steele, 2004).

Classroom teachers can enhance their daily activities to boost student learning. Simple games that develop related skills can complement formal therapy, as well as implementing small changes in students' spoken or visual world.

Auditory discrimination training helps improve the listener's ability to discriminate, identify and recognize changing acoustical cues. Rhyming games, ending sound word-chains (each player says a word that starts with the last sound of the word before: hiT-TaP-PeN-NeveR) the telephone game, and reading practice like Connecting Sounds to Words (write the word 'toy', change the 't' to a 'b' to make 'boy') give students fun practice with words.

“Binaural processing includes activities that enhance binaural integration and separation skills . . .” (Ferre, 2007, p.189), or communication across the corpus callosum from different stimuli in each ear). Sound localization games like Blind man’s Bluff or Marco Polo are examples.

Temporal processing refers to the listeners’ ability to use timing and patterning. Tongue twisters, clapping songs (B-I-N-G-O), dominoes, syllable counting and clapping are all examples of activities that use visual and motor cues.

Musical chairs, Simon Says and Twister are all examples of games that require paying attention and vigilance to auditory targets.

Tasks that encourage inter-hemispheric transfer would encourage communication between hemispheres in the brain. Intra- and inter-sensory exercises like ‘Pictionary,’ video games, sports, karate, dancing, ‘feely bags’ or ‘I Spy’ would be examples of games that integrate the senses, requiring single or double transfer of information.

Auditory closure uses missing words, messages or ideas so the student has to listen to the entire message.

Prosody training practices recognition of changes in meaning based on stress or intonation. Practice in reading different kinds of sentences: statements, questions, commands or exclamations, using sarcasm or other emotions all use prosodic cues (Ferre, 2007).

Being a positive role model for effective communication using visual, linguistic and cognitive skill strategies, can promote auditory processing success.

Using clear speech (encouraging students to speak slower and at a slightly increased volume), clear language (rephrasing, using appropriate vocabulary), modeling specific articulation (“Stop tapping your pencil!” rather than “Stop that!”), and practicing pre-teaching or

previewing of unfamiliar material all can help teachers model good communication strategies (Ferre, 2007).

Looking and listening should be modeled by teachers and parents to aid students in learning to use visual as well as auditory clues. There are students who are unable to combine these behaviors, and become confused, but it should be encouraged if possible. Teachers and parents should use multi-sensory cues, sequentially. When presenting to students, teachers should also wait to speak after writing notes on the board, not at the same time. The overall amount of information should be limited, breaking down long messages into shorter ones and tagging important ideas with familiar words.

Teaching involves much speaking and listening. Explaining allows one to move backward and forward in time, build excitement, and use thought-provoking language to captivate an audience. However, a teacher must be aware that, without the ability to see the 'big picture', the audience may fall away in a matter of minutes. Concept maps allow oral language to be visible and traceable so learners can see and follow ideas as the speaker progresses, kinesthetically, if they wish to follow with their finger (Caviglioli and Harris, 2003).

Mapping allows a student to quickly organize new information and link it to prior experiences. The learner can create extended personal links, organize and recall meaningful content longer. During mapping, the learner follows ideas as they develop, giving the process of learning significance, not just the end product.

Changing the Communication Environment

Improving room acoustics and lighting have been shown to enhance learning. Reducing background noise and standing in close proximity to the learner will also make the learning

environment more student-friendly. Use of assistive technology, such as an amplification system, can substantially improve a student's ability to listen in background noise (Ferre, 2007).

Larger and irregularly shaped rooms tend to exhibit more echo or reverberation, which can compromise the way children with hearing, language or processing concerns perceive speech. Classroom noise abatement techniques may range from avoiding open classroom spaces, relocation of classrooms away from gymnasiums, cafeterias, and playground noise. Placing carpeting in rooms, shades over windows, lowered ceilings, placing bookcases at perpendicular angles can create baffles and minimize noise. Cork bulletin boards increase sound absorption (Ferre, 2007). Preferential seating can maximize acoustical and visual aspects of the speaker.

Metacognition is a cognitive-based teaching strategy that increases awareness of our own internal thought and learning. Meta-skills are skills built upon a person's cognitive and language knowledge that allow the person to think or talk about cognition, memory and attention.

Many experts in the field of auditory processing disorders favor metamemory and metalinguistic strategies in a comprehensive intervention plan. Students who have learning disabilities, auditory processing concerns or ADD, can be taught how to apply metalinguistic strategies to support their own learning.

Segmentation skills, which form the basis of phonological awareness, help students recognize and manipulate the sounds of language by dividing sentences, words, phrases and syllables into smaller units. Auditory closure is the skill of processing a message even though some of it is missing or not processed. Listeners must fill in those gaps in the signal by using language, contextual or world knowledge. Acquiring skills such as grasp of multiple meanings (including figurative speech), homophones, context-derived vocabulary, inferencing (inferring or

predicting) and grammatical closure (appropriate use of linguistic rules and conventions) allow communication in meaningful ways (Hamaguchi, 2007).

Successful teaching of metacognitive processes requires a motivated, proactive participant. They use a simple model to follow when teaching students metacognitive skills, referred to as ARCA (Hamaguchi, 2007). Anticipate and adjust your listening set. Students need to develop a mind-set about how much attention needs to be paid, anticipate specific information being presented, and be a polite listener. Regulate your thought process and behavior accordingly. Listeners should pick out key words in directions to attend to, watch for body language and voice emphasis and attend to the 'who what, where, when, how and why of information being presented. Communicate to solve listening challenges. Encourage students to speak up when they are unable to hear what was said and ask for words to be explained, repeated, spoken louder or more slowly. Act to solve listening challenges. Students must move closer to the person talking, eliminate unwanted noise, look at a person's lips while speaking, ask the person to stand closer, or move the conversation to a better location (Hamaguchi, 2007).

Self-talk, or subvocalization (Boomgarden-Szypulski, 2007), allows a person to hear their own speech and correct output. Because children's brains are not fully developed, they attend to sound that is 10 times louder than background noise. Whisper phones, sometimes just made out of PVC pipe, allow students to hear themselves read or talk.

Conclusions and Recommendations

In the United States, 20 million school-age children suffer from reading failure, 75% of students dropping out of school have difficulty learning to read and 38%-70% of fourth graders cannot read at a basic level, depending upon the economic level of the school district in which the student lives (Bell, 2007).

Auditory processing deficits are often proposed as the cause of reading disorders.

However, there are inconsistencies in the research and evidence, causing doubts as to whether these deficits are the cause of reading problems (Catts & Kamhi, 2005). Language acquisition, speech perception, auditory processing and language comprehension are interrelated, but an accepted model of brain-behavior in this relationship has yet to be presented, and so questions continue to be raised (Wallach & Butler, 1994).

School-based speech-language pathology is attempting a shift from an "intuition-driven" practice to one in which consideration of the preponderance [the existence of new evidence from scientific investigations] is systematically integrated with clinical expertise and a knowledge base using many different methodological tools and research designs (Justice & Frey, 2004). Some researchers believe that only a small percentage of students have actual auditory processing problems but may have other language impairments (Catts, 2005). New research is indicated, but such studies have a limited research design, having no control group to study maturation or non-treatment.

Practitioners could perform quality studies of students identified as having auditory processing problems in their natural setting. This would permit the clinician/researcher to build hypotheses and watch general patterns emerge. However, there is a need for researchers in speech-language pathology, with professional research training at the doctoral or post-doctoral level, who can comfortably and competently engage in asking questions that both explicitly relate to school-based services, and peer-related research (Justice, 2004). Some early steps toward each of these objectives have been taken by the Evidence-Based Practice in Child Language Disorders Working Group (Justice, 2004).

Lastly, teachers and clinicians must consider how to best employ strategies for student success so students understand what is said and done within the classroom. New information should be explained in a clear, simple manner, with new vocabulary defined and spelled on the board. Repetition should be employed and alternate forms of expressing ideas encouraged. Students should be given various opportunities to collaborate in groups, work alone or with the teacher. Teachers should offer ways for students to express themselves in their own words, written or orally (Wallach, 1994). Most importantly, students should be taught metacognitive strategies to reflect on how they learn best, monitoring their own periods of inattention and focusing on completing classroom tasks.

Regardless of whether a student is falling behind and is experiencing an auditory processing, language processing or an attention deficit disorder, the classroom teacher must create a learning environment that maximizes the student's time in the classroom. Parents should be informed about ways they can impact their child's learning with a supportive home environment that encourages speaking, reading, listening and writing. Parents are their child's most powerful advocate.

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