

# Hearing Impairment and ADHD: How they Affect Students' Ability to Learn Math

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## Introduction

Being able to do mathematics is a necessary and valuable life skill. Whether you are shopping for groceries, paying a bill, or cooking from a recipe, mathematics skills are important. However, it is the process of learning which can be affected by different abilities and disabilities. Hearing impairment and Attention Deficit Hyperactivity Disorder (ADHD) are two disabilities that can affect students' abilities to learn mathematics, and understanding these issues is essential to helping students overcome them.

## Hearing Loss

For a child, hearing is an essential tool of learning, playing, and developing social skills and hearing loss can significantly affect his/her life. While hearing loss is common with advancing age, it is not common among children and young adults who are in school. Conventional estimates report that, "about three in 1,000 babies are born with hearing impairment" (Shannon, 2009). Hearing loss/impairment occurs when a part of the ear does not work properly. There are three different types of hearing impairment: conductive, sensory, and neural. Conductive hearing loss results from a problem with the outer or middle part of the ear. Conductive hearing loss results in mild hearing which that is often temporary. The second type of hearing loss, sensory hearing, is caused by damage to tiny hair cells on the cochlea, thus causing the cochlea to not work correctly. A person with sensory hearing loss may be able to hear some sounds in quiet places or they may not be able to hear at all. The final type of hearing loss, neural, occurs when there is a problem with the connection between the brain and the cochlea because the auditory nerve that carries the signal is damaged. Neural hearing loss results in profound to total loss of hearing and is permanent.

There are many causes and treatments for hearing impairment depending on the type of loss. A person with a hearing impairment may have been born with parts that do not work or did not develop correctly. For individuals who were not born with hearing impairment, the loss could have resulted from middle ear fluid, serious infections such as bacterial meningitis, a head injury, exposure to loud music/sounds, or ear infections. The type of treatment the person receives for being hearing impaired depends on the type of hearing loss, the severity of the loss, and the person's other needs. Medications and operations may partially or completely correct a hearing impairment. Hearing aids and assistive listening devices (such as cochlear implants) are available to help the person improve his/her ability to hear with what little or no hearing they currently have.

Hearing impairment can make it difficult for a child to do well in school for many reasons. Hearing impaired children might attend special schools, regular schools with special education classes, or regular schools with regular classes depending on the child's needs and the severity of their impairments. According to B. J. Pollack, among the hearing impaired, other disabilities are more likely to be found than within the hearing population. It can be difficult to identify additional learning disabilities because being hearing impaired is itself its own learning disability often causing a child to have "delayed language acquisition," which in turn delays academic skills (Pollack, 2).

Hearing impaired children tend to have slower learning processes because they cannot pick up various concepts and vocabulary incidentally like children who do not have a hearing impairment. This can be problematic in the mathematics classroom. Additionally, hearing impaired children can have delayed learning as a result of receiving differential treatment from teachers and classmates. Hearing impaired children are often treated differently because people do not understand that hearing impairment is not linked to intelligence or ability to learn.

Hearing impaired students can have trouble understanding verbal and written mathematics problems because they might not be able to pick up new vocabulary and concepts without being directly taught. These students do not have the general vocabulary or the basic mathematics vocabulary needed to fully understand verbal and written mathematics problems and understand mathematics concepts and processes. Furthermore, if the child struggles with reading, then the child might also struggle with word problems in mathematics. Hearing impaired students often have trouble communicating with others. These children struggle with explaining their thought processes in a way that makes sense to the teacher and classmates.

Elizabeth Ray states, “the make-up of the learning environment is particularly crucial for deaf/hearing-impaired children as compared to their hearing peers; they are always at a disadvantage because information is generally received via the spoken word” (65). Hearing impaired students have difficulty with verbal information because they often either misunderstand or do not hear what is being said. Also hearing impaired students tend to struggle in busy and noisy environments because they have trouble focusing on the teacher’s voice and the task at hand.

Finding the right accommodations for hearing impaired students in the classroom can be difficult as each student needs his/her own individualized set of accommodations. There are various ways to help a hearing impaired child do well in school. For students who have a “severe lack of vocabulary and simple syntax knowledge, work using pictures and picture symbols to support speech and/or signs” (Pollack, 3). This can be done by the teacher or by another student in the same classroom using the child’s preferred mode of communication. The most obvious way to help accommodate hearing impaired students is to use a variety of visual representations for each concept being taught. If explaining things verbally, the classroom should be quiet and the student should be able to see the teacher’s face and lips. Often hearing impaired students speech or lip read, therefore

seeing the teacher's face and lips is crucial. Additionally, teaching new concepts using visuals and allowing students time to observe the visual is crucial. Hearing impaired students need to watch the explanation within a quiet classroom and then have time to think about the process before allowing the class to offer its responses. With a quiet environment students can focus on what he/she is doing without being distracted by other sounds.

Other accommodations include abbreviated assignments, assignment sheets, modified test formats, a note-taker, preferential seating, specific test environments, captioned videos, and peer tutoring. (Beginnings website). Federal law requires an Individualized Educational Program (IEP) for all students with disabilities to ensure these students get the appropriate accommodations they need to succeed in school. Deaf or hearing impaired children are not automatically classified as having special needs unless they are having trouble in school as a direct result of the hearing loss. The IEP should aid teachers in identifying the needs and how to meet the needs of a specific student.

Having a hearing impairment or being deaf can adversely affect a student's ability to learn. Not only is it difficult to communicate, but since most teaching is done through speaking, the barrier for impaired students can seem insurmountable. In particular, mathematics is a subject with abstract ideas that cannot always be communicated with words. Accommodations that address both the environment and the teaching/learning styles can bridge the gap and enable the hearing impaired student to be successful.

### Attention Deficit Hyperactivity Disorder (ADHD)

Children and students with ADHD act without thinking of the consequences of their actions and often have trouble focusing. Attention Deficit Hyperactivity Disorder (ADHD) has been defined as "a medical condition that affects a person's ability to pay attention, sit still, and follow directions"

(Illness & Disability, 6). Symptoms of ADHD include frequent daydreaming, feeling restless or fidgety, being easily distracted, acting without thinking first, and being unorganized. There are three subtypes of ADHD: primarily inattentive; primarily hyperactive/impulsive; and a combination of the first two. According to Crawford, “most children with ADHD belong to either the inattentive subtype or the combined type” (1).

Treatments for ADHD include behavioral therapy and/or medication such as Ritalin and Adderall. Crawford states that “research has shown that the most effective treatments of ADHD involve both therapy and stimulant medication” (1). However, combining treatments is only slightly more effective than choosing one treatment over the other. ADHD is not a learning disability; however, like with hearing impairment, students with ADHD also have an increased chance of having a learning disability. Seventy-one percent of the students with ADHD have been identified as having a learning disability, and about twenty-six percent of these students have a mathematics learning disability. This means approximately one fourth of the total ADHD population additionally have a mathematics learning disability (Hale, 1).

Students with ADHD tend to struggle in the “traditional American classroom: which [consists of] straight desks, teacher lecturing at the front of the room, textbooks and worksheets, and lots of listening, waiting, following directions, reading and writing” (Armstrong, 36). ADHD affects student’s working memory, defined as the part of the brain that temporarily stores and manipulates new information. A student who struggles with his/her working memory, might not recognize patterns nor automatically recall facts and rules needed to quickly solve problems. Additionally the student might have trouble retaining information and steps of a multi-step mathematics problem, or remembering to go back and check his/her work on completion of a problem.

Students with ADHD tend to have slower processing speeds. Because it takes energy for the student to focus and not get distracted, the student has trouble processing problems. Students tend to rush through problems without thinking because they have trouble remembering each step for the problem. Combine this with being easily distracted and impulsive, students can make careless mistakes. Impulsiveness can affect handwriting resulting in careless mistakes due to not being able to read the handwriting.

Many students have trouble keeping their school work organized; however, students with ADHD also struggle with keeping their thoughts and ideas organized. They have trouble with mastering their thoughts, emotions, memory, motivation, and attention. This makes it difficult for the student to focus on listening to the teacher and remembering what the teacher says. According to Miller, “they may have trouble getting the ideas organized in their mind and understanding how all of the pieces fit together” (2). Due to this, students have trouble with sequences and keeping the steps in order.

The main reason that students with ADHD struggle in the classroom might be due to the fact that there is not enough movement throughout the day. It has been suggested that many teachers do not incorporate the different modes of accessing and engaging students. Students might prefer to learn linguistically, logistically, spatially, kinesthetically, musically, interpersonally, intrapersonally, or naturalistically. Generally classrooms focus on linguistic and logical-mathematical intelligences and thus students labeled as having ADHD struggle since they need to release some of their energy through hands-on activities. Because students are required to sit through each class and focus on paying attention to detail, ADHD students are likely to feel frustrated (Armstrong, 38).

There are accommodations teachers can make in their classrooms to help students with ADHD focus and improve their performance. Teachers can implement time management and

organizational strategies by breaking large, multi-step mathematics problems into smaller parts and creating a checklist of each step. In addition, having notebook checks for students to make sure they have their notes together and organized as well as keeping the classroom organized and predictable is preferable for ADHD students. Manipulatives can be used by teachers to provide students with a hands-on method of learning where students can learn by developing their own strategy on how to do a certain task. Teachers can have students create index cards with mathematics skills and topics so that they can go back and easily find how to do a certain task. Teacher or student devised mnemonic devices (such as Please Excuse My Dear Aunt Sally, PEMDAS for order of operations) might help students learn the steps/sequences of mathematics topics.

Teachers can incorporate each of the different methods of learning into their lessons since they “work quite well as a means to develop specific *attention-grabbing* techniques” (Armstrong, 60). Having the students know about the differentiated styles of learning helps them to understand why they learn in the way they do and what style of learning the student might prefer. Together, the teacher and student can come up with different ways to teach/learn mathematical topics and ideas.

Helping students learn through incidental learning is one of the best ways to make sure the student has a full and complete understanding of each mathematics topic. In addition to using manipulatives, teachers can introduce new vocabulary a week early by putting the words and definitions in clear view on the walls. Through this method students whose minds tend to wander, will read the definitions and possibly recall the words the following week. Students will feel more confident about learning new material because they already recognize some words and definitions. Furthermore, teachers can use drama as a means to promote incidental learning. Students can be asked to create or modify a song about a certain topic that helps them remember how to do those types of problems and present their song to the class.

Technology is commonly used in our society today. Incorporating technology such as computer programs and smart boards in the classroom is considered beneficial by some. Teachers can use programs such as Geometer's Sketchpad or GeoGebra to teach students about geometry and about graphing functions. These programs allow students to manipulate the shapes and graphs in ways they cannot on paper and discover properties in a more individualized method.

Students with ADHD often have difficulty in the classroom and with the learning process. Impulsiveness can rush the student through work, not allowing adequate time to process the information, nor being able to commit it to their working memory. Mathematics can be particularly difficult since there are frequently multiple steps involved in problem solving, and organization of this work is critical. Accommodations should allow the child to move more freely about the classroom, extending energy, and should help the child develop his/her organizational.

## Conclusion

Mathematics can be a difficult subject for any child to learn. The subject has its own language and the concepts are often abstract and difficult to grasp. Hearing impairment and ADHD are two disabilities which can greatly affect a student's ability to learn mathematics which, in turn, can adversely affect the person's ability to function in life. Accommodations to assist the student are critical in fostering his/her success in mastering this subject.

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