

Supporting Students with Mild-to-Moderate Hearing Impairments in Schools

Evidence-Based Best Practices in Supporting Elementary-Aged Children with Mild-to-Moderate  
Hearing Impairments in School Programs

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### **ABSTRACT**

School-aged children with mild-to-moderate hearing impairments are almost always found in inclusive rather than separate educational settings, yet teachers and school-based speech-language pathologists (SLPs) may lack a full understanding of the educational and speech/language needs of children living with these levels of hearing loss. The purpose of this project was to synthesize information about a) the impact of mild-to-moderate hearing impairments on speech, language, and content learning in the classroom and b) the evidence-based best practices that have been shown to reduce the impact of these levels of hearing impairments on children's learning in schools. A broad review of literature and resources has been conducted to achieve this purpose. The information provided in this paper will also be conveyed in a print format to Alberta Health Services SLP consultants and professional-practice leaders who motivated this research; the information will be shared in their annual fall orientation for school-based SLPs. Key information and resources will be designed by these school-based SLPs to use with teachers and parents.

### **INTRODUCTION**

The education system of Alberta strongly supports educational settings that are inclusive of all students, regardless of ability or disability. Thus, it is very common for school-aged children with mild-to-moderate hearing impairments to be included in a regular classroom (Alberta Education, 2010). Having this diversity in the classroom creates a positive learning environment for all students, teaching them that individual differences do not separate them from others while also promoting acceptance. That being said, the speech and language needs

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of students with mild-to-moderate hearing impairments are not commonly fully understood by parents, teachers or SLPs involved in those inclusive settings (British Columbia Ministry of Education (BCME), 2013; Tye-Murray, 2009). Prompted by a request from SLPs with Alberta Health Services, this project was launched to review available literature to summarize best practices for enabling students with mild-to-moderate hearing impairments to receive the equal and effective learning opportunities afforded their school-aged peers. An important component of this project was to highlight, for SLPs serving classrooms, the key elements of such practices to provide the best speech and language consultation to this group of students. It is not within the professional scope of SLPs to diagnose a hearing loss at any level.

Audiologists are responsible for diagnosing hearing impairments; however, it is the SLP's responsibility to provide speech and language services to these students as needed, and it is the teacher's responsibility to teach students diagnosed with hearing impairments. This highlights the importance of this research of best practices for providing services to students with mild-to-moderate hearing impairments. Consequently great emphasis was also placed on summarizing information applicable to teachers of students with mild-to moderate hearing impairments. It was expected that this information would be directly applicable to SLPs as well.

This paper will define mild-to-moderate hearing impairments and identify the impact such hearing impairments may have on the individual. Next, the paper will provide information regarding how to identify students at risk. Last, the paper will feature three strategies sections. The first strategies section will be applicable to teachers with students with mild-to-moderate hearing impairments in their classrooms. The second section will provide strategies for SLPs consulting to these classroom teachers and working with the students. Finally, strategies for

teachers and/or SLPS to use in physically modifying classrooms (i.e., making adjustments to the classroom to enhance acoustics) will be summarized.

## **TYPES OF HEARING AND HEARING IMPAIRMENT**

Imparting a general understanding of hearing, hearing impairment and the definition of mild-to-moderate hearing impairment is a primary aim of this paper. In order to understand the rationale for the strategies and management techniques that will be provided, one must first understand the impairment.

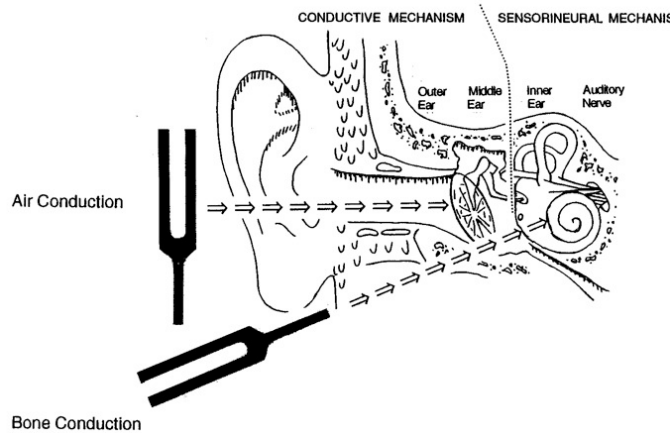
There are two pathways by which we hear sound, one being air conduction and the other bone conduction. Air conducted sound travels through the outer ear, middle ear and inner ear to the auditory nerve, in that sequence. Bone conduction does not rely on the outer or middle ear to transmit sound. The vibration of bone caused by sound waves travels to the inner ear and on to the auditory nerve. Hence normal hearing is the perception of a “mix” of sound transmitted through air and bone.

Consequently there is more than one type of hearing loss. Each type is explained below.

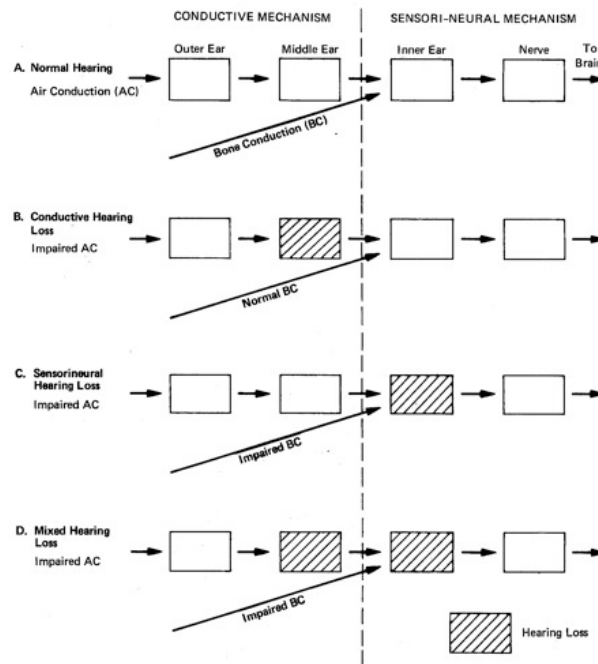
- a) Conductive - the problem lies within the outer or middle ear and hearing via air conduction is impaired.
- b) Sensorineural - the problem lies within the inner ear or auditory nerve and hearing via either air or bone conduction are ultimately impaired.
- c) Mixed - there are problems with the air conduction route of hearing and the bone conduction route of hearing, both contributing to the resultant hearing impairment.

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Figures 1 and 2 below illustrate the natural methods by which we hear and the different types of hearing loss that may be seen in students with hearing impairments.



**Figure 1. How sound is heard (Hodgetts, 2013)**



**Figure 2. Types of Hearing Loss (Hodgetts, 2013)**

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The loudness of a sound is measured in decibels (dB). To put the measurement of decibels into perspective, the sound of someone breathing at an average rate and level is approximately 10 dB, someone whispering is approximately 30 dB, an average speaking voice is approximately 60 dB, traffic in the city is approximately 90 dB, and a gun shot at close range is approximately 130 dB (Hodgetts, 2013). Additional sounds, including speech sounds, and their loudness levels are provided below, in Figure 3. Figure 3 shows sound levels assuming the sounds are presented in isolation and in quiet conditions. According to Alberta Education (2007) a mild hearing impairment is classified as an inability to hear sounds ranging from 26-40 dB (a slight hearing impairment is 0-26 dB hearing loss) and a moderate hearing impairment is classified as the inability to hear sounds at 41-55 dB. Given various sounds and their levels in dB shown in Figure 3, it might seem that having a mild-to-moderate hearing impairment is not a severe issue. One might falsely assume that as long as one can hear an average speaking voice a listener should be able to perform successfully in any listening environment, but the measured levels of those sounds shown in Figure 3 are in isolation and quiet conditions. Consider an elementary school classroom: students chattering around the room, the teacher speaking, computers running, windows open, papers rustling, and chairs moving. Suddenly those sounds ranging from 0-60 dB become much harder to hear because of background noise. Although a hearing impairment that is mild-to-moderate may seem limited in severity, it can actually have a huge impact on students and their ability to learn within the classroom.

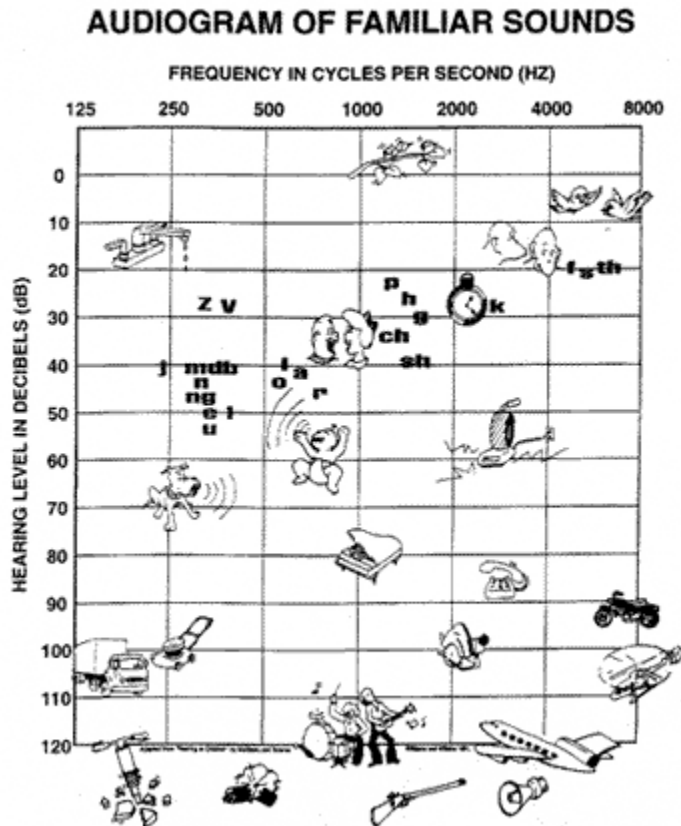


Figure 3. Various sounds and their sound level in dB (Hodgetts, 2013)

### THE IMPACT OF A MILD-TO-MODERATE HEARING IMPAIRMENT

Research has revealed a long list of effects that mild-to-moderate hearing impairments have on various aspects of students' lives. These effects are discussed below.

#### ***Stress and Fatigue***

According to a recent study by Hornsby, Werfel, Camarata and Bess (2014) students with hearing impairments displayed increased levels of fatigue, both general fatigue and cognitive fatigue. Several studies have yielded similar results, indicating that students with hearing impairments are typically more prone to stress and fatigue in the classroom (Fitzpatrick, Durieux-Smith, & Whittingham, 2010; Hicks & Tharpe, 2002; Marschark, Spencer, Adams, &

Sapere, 2011; Weil, 2011). Students with mild-to-moderate hearing impairments likely have to put in greater effort mentally and physically than their fellow typically hearing peers in order to attend to and process information. This extra effort could be a contributing factor to the general and cognitive fatigue exhibited by students with mild-to-moderate hearing impairments.

### ***Academic Challenges***

Unfortunately, because of their hearing impairments and regardless of the effort they put forth in the classroom, these students are prone to missing out on information shared in the classroom and key learning opportunities. Academic difficulties are not uncommon in children with mild-to-moderate hearing impairments (Borders, Barnett, & Bauer, 2010; Downs, 1985; Fitzpatrick et al., 2010; Marschark et al., 2011a). Academic difficulties manifest in a variety of ways: lower than average scores on academic tests (Fitzpatrick et al., 2010; Marschark et al., 2011a); poor mathematics skills (Marschark et al., 2011b; Royal National Institute for the Deaf (RNID) & British Association of Teachers of the Deaf (BATOD), 1985); reading and writing difficulties (Marschark & Hauser, 2008; Marschark et al., 2011b; RNID & BATOD, 1985; Weil, 2011); and greater frequency of grade repetition compared to students without hearing loss (Downs, 1985; Fitzpatrick et al., 2010).

### ***Behavioural Concerns***

While academic areas prove to be challenging for students with mild-to-moderate hearing impairments, behavioural problems also often arise as a result of an inability to focus and/or follow along with typical expectations of students in a classroom (Borders et al., 2010; Charlesworth, Charlesworth, Raban, & Rickards, 2006; Downs, 1985; Fitzpatrick et al., 2010; Marschark & Hauser, 2008; Marschark et al., 2011a). Attention Deficit Hyperactivity Disorder



(ADHD) is frequently diagnosed in children with hearing impairments because the behaviours they exhibit as a result of not being able to hear tend to look strikingly similar to the behaviours seen in ADHD, which can include inattentiveness, hyperactivity, and impulsivity (Charlesworth et al., 2006; Marschark & Hauser, 2008; Marschark et al., 2011a). The question that needs to be considered when a child is diagnosed with ADHD is if it is possible that the behaviours diagnosed as ADHD are an effect of a hearing impairment and not truly ADHD behaviours. In some cases both a hearing impairment and ADHD may be present.

### ***Social Isolation***

According to the American Speech-Language-Hearing Association (ASHA, n.d.), social problems appear in children with mild-to-moderate hearing impairments, as they tend to have a hard time fitting in with their peers and adapting to classroom routines (ASHA, n.d.). These groups of children may have difficulty following the social rules of language (e.g., turn-taking, acknowledging another person's message, topic shifting) to interact with peers because they have not had as much practice using these skills or they have been deprived of the opportunities to overhear others talking and utilizing these social rules (Tye-Murray, 2009). Students with hearing impairments often fail to establish close relationships with their hearing peers and have reported feeling isolated and lonely during their attendance at school (Kluwin, Stinson, & Colarossi, 2002). When one considers the reduced exposure to the social rules of language in some children due to their hearing impairments, the potential for social isolation becomes notable (ASHA, n.d.; RNID & BATOD, 1985).

### ***Reduced Incidental Learning***

Incidental learning occurs when there is not a direct intention for learning, as in a teacher presenting a concept to a class, but rather the type of learning as in overhearing another child get in trouble for doing something and learning that whatever that child did should not be repeated. A great deal of knowledge that children have is picked up through hearing conversations and events happening around them. Children growing up with hearing impairment have fewer opportunities to experience these types of learning opportunities (Alberta College of Speech-Language Pathologists and Audiologists (ACSLPA), 2013; Marschark et al., 2011a; RNID & BATOD, 1985; Tye-Murray, 2009). Thus they are often considered to have less “world knowledge” or general knowledge of things that happen in the world (Downs, 1985).

### ***Difficulty Problem Solving***

Children with hearing impairments often must rely greatly on multiple modes of information; their minds have been trained to pay attention to both aural and visual information. All of the information that these students are taking in can often be overwhelming and distracting, which contributes to the difficulties these children with hearing impairments sometimes display when it comes to problem solving. Students may become distracted by the trivial, unimportant pieces of information during the process of problem solving, impacting their ability to adequately solve the problem at hand (Marschark & Hauser, 2008). Due to challenges with information processing, students with hearing impairments often need more time to process information and solve problems than their same-aged peers without hearing loss. In addition, students with hearing impairments often fail to utilize knowledge that they already have and apply it to new information or problems (Marschark et al., 2011b).

***Impaired Articulation and Phonemic Awareness***

Of specific importance to SLPs, mild-to-moderate hearing impairments are known to affect speech and language development in a number of ways. In a general way, language and speech development are delayed because when children have fewer opportunities to hear various sounds being produced and language being used in a variety of ways, they have fewer natural opportunities to pick up on that information and apply it. Articulation is often a challenging area for students with mild-to-moderate hearing impairments. Tye-Murray (2009) indicated that children with hearing impairments might have problems producing both vowels and consonants. In addition, Downs (1985) and Fairgray, Purdy, and Smart (2010) acknowledged that sound substitutions, deletions, and distortions are frequently noted during interactions with young children with hearing impairments. Overall, articulation errors affect the intelligibility of speech or, in other words, how much of what the children say is understood by listeners.

Speech sound development is often delayed in children with hearing impairments, so it is not surprising that their awareness of sounds, also known as phonemic awareness, is limited as well (ACSLPA, 2013; Fitzpatrick et al., 2010; Schlieper, Kisilevsky, Mattingly, & Yorke, 1985). Students with mild-to-moderate hearing impairments tend to have poor short-term phonological memories and poor phonological discrimination skills, which refers to the ability to recognize the differences between various sounds and sound patterns (Briscoe, Bishop, & Norbury, 2001). These limitations may be strong underlying contributors to the limited phonemic awareness sometimes seen in these groups of children.

### ***Impaired Phonological Awareness and Reading***

Phonemic awareness is linked with phonological awareness, which is the cognizance of how sounds can be manipulated to make words. Phonological awareness has been recognized as a strong predictor of reading ability (Nelson, Lindstrom, Lindstrom, & Denis, 2012). Tye-Murray (2009) discussed how children with hearing impairments often show delays and differences in their reading abilities when compared to children without hearing impairments. She attributes these deficits to either an inadequate language system (e.g., vocabulary, word relations, and sentence structure) or lack of associations between sound and print. Without being able to hear the proper sound of every letter and letter combination, the task of decoding during reading can be quite troublesome.

### ***Language Deficits***

Receptive and expressive language difficulties are often identified in children with hearing impairments (Fitzpatrick et al., 2010). Vocabulary development, both receptive and expressive, is usually more restricted in children with hearing impairments because, again, their listening exposure is more limited than for children who do not have hearing loss, and the opportunities to attend to and/or use new words are reduced (ACSLPA, 2013; Charlesworth et al., 2006; Fairgray et al., 2010; RNID & BATOD, 1985; Tye-Murray, 2009; Weil, 2011). Grammar represents the “rules” of language, such as how words should be combined in a sentence or how to add appropriate word endings to change the tense (past/present/future). It is a feature that is important to both understanding and production of language. Students with hearing impairments are often less attuned to these rules, particularly to rules for recognising verb tenses (past/present/future) and making words plural or possessive (Doyle & Dye, 2002)

because they do not hear the cues for such. This can greatly affect their understanding of what has been said (ACSLPA, 2013). According to Tye-Murray (2009) children with hearing impairments may omit function words in their sentences, which makes their speech telegraphic. Children with hearing impairments produce fewer compound or complex sentences, contributing to a simplistic expression style (Tye-Murray, 2009). Grammar is, in fact, one of the most challenging aspects of language for students, with or without hearing impairments, to master (ACSLPA, 2013; Doyle & Dye, 2002).

### ***Impaired Vocal Ability***

Sometimes students with hearing impairments use a pitch level that is unusually high or low (Downs, 1985), speak in a flat or monotone pattern (Canadian Association of Speech-Language Pathologists and Audiologists, 2006), or exhibit a nasal quality in their voices (Doyle & Dye, 2002). Hearing impairments reduce the information typically available via the auditory feedback loop that enables individuals to modify speech production according to perception (Ling, 2002).

## **IDENTIFICATION OF STUDENTS IMPACTED BY MILD-TO-MODERATE HEARING IMPAIRMENTS**

The list of potential effects mild-to-moderate hearing impairment may have on an elementary school student is long, but it can't be assumed that all students will be affected in the same ways. Anderson (as cited in Most, 2004) designed the Screening Instrument for Targeting Educational Risk (SIFTER), which serves to screen children's functioning in a classroom and to identify students with hearing loss who may be educationally at risk and who require more in-depth assessment. SIFTER is a brief, written questionnaire that is completed by the

child's teacher and requires the teacher to rate the child in comparison to other children in the class. SIFTER has been found to be very beneficial in identifying children with difficulties who may otherwise be overlooked due to the minimal nature of their hearing loss (Bess et al., 1986, 1998; Most, 2004; Wray et al., 1997). This screening tool can be invaluable in a classroom to identify: children with hearing impairments who may require classroom assistance or modifications within the inclusive setting; the classroom domains which are more challenging for those students; and students who should be monitored closely throughout the school year (Most, 2004). Understanding hearing impairment and its impact on school children is critical to the development of strategies and techniques to address and reduce possible effects.

### **STRATEGIES FOR TEACHERS**

There are several suggestions in the literature of strategies for teachers to implement when teaching students with mild-to-moderate hearing impairments. Most of the suggestions for teachers are applicable to any individual working with students with hearing impairments, especially SLPs and parents.

#### ***Speak Normally***

People who are unfamiliar with the impact of hearing impairments often incorrectly assume that talking at an excessively louder level benefits individuals with hearing loss. Many resources indicate that yelling or speaking too loudly does not help. ACSLPA (2013) and other sources specify that it is far more helpful to speak naturally to the individual with hearing impairment (BCME, 2013; Doyle & Dye, 2002; Tye-Murray, 2009). It is also suggested that teachers use "Clear Speech" strategies: clearly pronouncing word endings and ensuring that no

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sounds or syllables are dropped; talking slightly slower and louder; stressing (emphasizing) important words or key syllables; using lively, but not exaggerated, speech with intonation; and pausing between phrases and sentences (Campbell, 2013; Tye-Murray, 2009). These Clear Speech techniques can be taught to classmates of the child with hearing impairment, too, supporting communication between the child with a hearing impairment and fellow classmates and increasing opportunities for overhearing conversational exchanges among others.

When speaking with individuals who have a hearing impairment the recommended distance between a talker and a listener is about one metre (RNID & BATOD, 1985); however, that distance varies based on classroom environment and noise levels. For every doubling of distance between a speaker and a listener (as when a teacher moves from one metre to two metres distance from a student with hearing loss) the speech signal falls approximately 6 dB (Crandell & Smaldino, 2000), or the equivalent of lowering a typical conversation level to a quiet conversation level. (Refer back to Figure 3 for more examples.)

Being nearer to a student is better than being far away, but there is no need to be “in the student’s face.” Everyone is able to hear speech more accurately when a speaker’s face is visible, as opposed to a speaker being turned away. Facing a student with a hearing impairment while speaking is critical (ACSLPA, 2013; Doyle & Die, 2002; Marschark et al., 2011a). It is also important for instructors to be aware of the light source in the room to allow the student to see the teacher’s face. Ideally, light should be directed on the teacher’s face, not coming from behind the teacher or in the student’s eyes. Even desk and table placement is important because these can sometimes reflect light in unintended directions (ACSLPSA 2013; BCME, 2013; RNID & BATOD, 1985).

### ***Know Your Students***

Teachers are always encouraged to get to know their students. Teaching students who have mild-to-moderate hearing impairments can be challenging, but when teachers understand their students' needs, this helps to alleviate some of those challenges. If a student's hearing impairment affects one ear more than the other, the teacher needs to be aware of this and ensure that s/he speaks at the side of the student's better ear (ACSLPA 2013; RNID & BATOD, 1985). If students have hearing aids or any additional assistive listening devices, the teacher needs to be familiar with this equipment: how it works (on/off; volume adjustment); recognizing when the device is not working; and back-up options in case the battery dies (ACSLPA, 2013; RNID & BATOD, 1985). Finally, it is very important for teachers to be able to differentiate between signs of frustration or fatigue in their students compared to misbehaviour, as these often look very similar (RNID & BATOD, 1985). Developing a good rapport with students can encourage them to tell teachers when they are having difficulties or are frustrated, before they reach the point of acting out in class.

### ***Repair Communication Breakdowns***

Often children with hearing impairments will miss out on information or instructions, especially if given only once. Teachers can encourage the children to let them know when they have missed out on information or have not fully understood the information that was given (ACSLPA, 2013). To do this, students with hearing impairments must be taught the skill of self-monitoring and how to be aware of their understanding and misunderstandings (Marschark et al., 2011b) so they know when they have missed information or not understood. When students request information again, it is recommended that the information be repeated only



once. If the child still does not understand, then the information should be rephrased for them, not just repeated over and over again (ACSLPA, 2013; BCME, 2013; Doyle & Dye, 2002; RNID & BATOD, 1985; “Working with Deaf/Hard of Hearing Kids – What Teachers Can Do,” n.d.).

Though they are very useful, repetitions and rephrases are not the only methods that can be used to repair a communication breakdown when an individual with hearing impairment has not understood a message. Tye-Murray (2009) provides a list of additional helpful “repair strategies” that can be taught to and used by individuals with hearing impairments when communicating with others. These strategies include elaborating (e.g., “Tell me more”); simplifying (e.g., “Can you say that again with fewer words?”); identifying the topic (e.g., “You’re talking about ...?”); confirming (e.g., “You said ... right?”); providing feedback (e.g., “I got the part about...but what did you say after?”); and writing.

Typically, a classroom session promotes comments, questions, and discussion amongst students and is valuable for engaging students. When students throughout the classroom are speaking during discussion opportunities, it can be challenging for students with hearing impairments to track what is being said, let alone visually locate who is speaking. The classroom teacher can direct the attention of the student with hearing impairment to the student who is speaking. The teacher could verbally identify who is speaking, discuss a signal with the student beforehand (e.g., a hand wave when someone is speaking) or tap the arm of the student with a hearing impairment and guide him to direct his attention to the speaker (ACSLPA 2013; BCME, 2013; Doyle & Dye, 2002). In addition, teachers can repeat and, if needed, rephrase the comments and questions of other students or consider teaching the child with hearing impairment to develop self-advocacy by encouraging use of one of the repair strategies

described earlier (Doyle & Dye, 2002; RNID & BATOD, 1985; Tye-Murray, 2009; “Working with Deaf/Hard of Hearing Kids – What Teachers Can Do,” n.d.).

### ***Be Clear***

Children with hearing impairments often miss out on information. It is critical to be straightforward when addressing these students; such strategies benefit the whole class, too. Beginning the day with an outline of the schedule (visual or written) is a great way to prepare students for what to expect during their day and takes away the unnecessary pressure of students trying to guess what will happen next (BCME, 2013). The literature also suggests that providing students with hearing impairments information on the topics/activities of the day ahead of time, as well as informing their parents, is a beneficial way for them to prepare, reducing the amount of time required to figure out what the teacher is talking about (RNID & BATOD, 1985). During class instruction teachers always need to clarify the topics that they are covering and provide clear indicators of transition between topics or activities (e.g., the teacher could write the topic being discussed and list what activities s/he will do within the topic on the board) (ACSLPA, 2013; Doyle & Dye, 2002; RNID & BATOD, 1985). When giving instructions to the class, the literature suggests that using short sentences containing only the most necessary information and avoiding words such as “this” and “that” is the best way to ensure the students will understand what they are to do (ACSLPA, 2013; BCME 2013). It is helpful to make the expectations of the students clear by directly stating them while also guiding the students to the most important information (Marschark et al., 2011b). Classes like music and physical education tend to have even more background noise than regular classroom sessions, which can make it hard for students with hearing impairments to understand instructions. Pairing

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these students with a typically hearing buddy can help them out during such classes and keep them on track (RNID & BATOD, 1985).

Students with hearing impairments often have difficulties tying new concepts to familiar concepts. Teachers can help to develop this skill in their students by explicitly identifying these relationships when possible to assist the student's learning process (e.g., In one Social Studies lesson the teacher might contrast the concept of work in two different countries. At the next lesson she might briefly review the previous lesson and then link those contrasts with associated differences between those two different countries in terms of their natural resources.) (Marschark et al., 2011b).

### ***Use Visual Aids***

The literature suggests using visual aids when teaching to enhance the learning opportunities for all students, including those with hearing impairments who sometimes understand information that they both see and hear more effectively than if they were to only hear the information. Whiteboards, smart boards, and bulletin boards are very valuable tools to use in a classroom with students who have hearing impairments. Doyle and Dye (2002) promote writing instructions, key points or concepts, new vocabulary, and summaries on the board or having them on display somewhere around the room for reference (ACSLPA, 2013; BCME, 2013; RNID & BATOD, 1985). Doyle and Dye also suggest that providing students with hearing impairments with written copies of information can be very valuable. These could include a written copy of the daily announcements, a homework answer key when going through homework as a class, the daily schedule, or reminders written in the agenda at the end of the day. Concept maps, diagrams, picture sequences, and charts also provide students with

greater means to represent and understand information and also can help to effectively tie concepts together (Marschark et al., 2011a). When available, teachers can opt for videos that include captions for students to follow (Doyle & Dye, 2002).

### ***Support Social Skills Development***

As discussed in the “Social Isolation” section of this paper, children with mild-to-moderate hearing impairments tend to have difficulty fitting in with peers and following classroom routines (ACSLPA, 2013). It is very important that teachers make the classroom and school rules clear and ensure that students understand the rules. This will support their acquisition of routines and also enable them to fit in with their peers more appropriately (RNID & BATOD, 1985). It is important for teachers to model equal treatment of all students in the class. Students with hearing impairments need to be addressed and asked questions just as often as their hearing peers (Marschark et al. 2011a), and the behavioural and achievement expectations must remain the same for students with and without hearing impairments (“Working with Deaf/Hard of Hearing Kids – What Teachers Can Do”, n.d.). Finally, teachers need to be aware of and monitor the social interactions of their students to ensure that students are being treated fairly and included by their peers (RNID & BATOD, 1985). Pairing students with peers in a buddy system also promotes good peer relations. The empathy that children feel for classmates is often overlooked by adults but is a quality that is of great value and needs to be cultivated in all classrooms. Teaching the whole class about hearing impairments and what it is like to have a hearing impairment is a great way to promote acceptance and understanding among the students. It is also very important to ensure that the

child with a hearing impairment has a clear understanding of his hearing impairment. Talking about it with the student can help to promote better self-understanding (Doyle & Dye, 2002).

### ***Check for Understanding***

Given evidence that students with hearing impairments are susceptible to missing information or misunderstanding instructions and tasks, it is helpful for teachers to check for understanding by asking open-ended questions, requiring more than a yes/no response (e.g., “Please restate the steps we will follow.”) (BCME, 2013; Doyle & Dye, 2002). Closed questions, requiring a simple yes/no response (e.g., “Do you understand?”), are less effective at checking for understanding because the student may respond, “yes”, even if s/he has not clearly understood. Tye-Murray (2009) defines this pretending to understand as “bluffing” and notes that bluffing can have a very negative impact on the overall self-concept of the individual with hearing impairment, sustaining a belief that s/he is an inadequate communication partner. When any student, with or without a hearing impairment, is required to respond to an open-ended question, any gaps in understanding will be more apparent to the teacher as compared to a closed-question response. Hence those gaps can be remediated in a timelier manner.

### ***Get the Child’s Attention***

Students with hearing impairments may miss out on aural cues signalling when it is time to pay attention. ACSLPA (2013) indicates that it is important to ensure that students with hearing impairments are aware that they are supposed to be paying attention. Calling the student’s name before giving instructions may suffice, but including regular classroom visual cues, such as switching the lights on and off, or tactile cues, such as tapping the student gently

on the shoulder, are effective means of getting the attention of the students with mild-to-moderate hearing impairments as well as of the other students in the class.

### **STRATEGIES FOR SLPs**

All of the strategies and tips included in the “Strategies for Teachers” section are highly applicable to SLPs working with students who have mild-to-moderate hearing impairments, whether it be individually or in groups. As with teachers, SLPs need to acquire adequate information about their clients’ hearing impairments and their strengths and weaknesses (Talbot, n.d.).

An SLP begins by observing the student in the classroom and noting how s/he functions in various activities (Talbot, n.d.). In addition, getting to know the student one-on-one, as well as through parent and teacher interviews, will paint a comprehensive picture of what the student’s daily life and activities look like, who the student is, and what bearing his/her hearing impairment has on his/her life. A thorough assessment consisting of observations, an interview, and individualized assessment tools employed in a variety of settings must be conducted, as it typically would be with any client, to identify areas of lesser and greater strength. This process may be aided initially by use of SIFTER screening as discussed above. The assessment process will highlight areas that the SLP may need to focus on with the student. Every child is unique and thus will likely be affected in individual ways by his/her mild-to-moderate hearing impairment. Teachers, SLPs and parents can form dynamic and effective teams when together they wisely select learning goals for children and identify effective strategies to achieve those goals, applying the evidence for such discussed above.

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There are many potential speech and language areas that may need to be targeted with a particular student. Often prominent among them is production of specific speech sounds the student with hearing impairment may not have yet acquired, such as high frequency sounds (s, th, f, sh) (Doyle & Dye, 2002). In providing therapy to students who are lacking sounds or producing sounds in error, auditory modeling, often with visual and tactile support, can be very helpful (Tye-Murray, 2009). Much like a child without hearing impairment, sound acquisition for a child with mild-to-moderate hearing impairment is highly dependent on multiple listening exposures and shaped and reinforced practice.

Since children with mild-to-moderate hearing impairments tend to have more limited vocabularies (e.g., mostly verbs and nouns) (Tye-Murray, 2009), vocabulary development could be an important area for SLPs to focus on. SLPs will find helpful vocabulary-building techniques and suggestions designed for classroom teachers and parents (e.g., word walls; word of the day) (Northern Illinois University, n.d.; RNID & BATOD, 1985).

Grammar is also an area for SLPs to explore with these students; assessment tools such as language samples can be useful (Doyle & Dye, 2002; Schlieper et al., 1985). Structured language activities (e.g., arranging/re-arranging word cards into syntactic patterns), vocabulary building (e.g., function words, pronouns, adverbs, adjectives) and natural and meaningful conversations are potential means to target and improve children's grammar (Tye-Murray, 2009).

Schlieper et al. (1985) and CASLPA (2006) identified phonemic and phonological awareness as potential learning areas to target, especially in younger children with mild-to-moderate hearing impairments. Sound identification and practice, development of sound-letter

correspondences, activities that require breaking words down into sounds and syllables, and listening for or generating rhymes are excellent strategies for fostering the development of phonological awareness.

### **MODIFICATIONS AND STRATEGIES FOR TEACHERS AND/OR SLPS TO USE IN THE CLASSROOM**

It is important that SLPs working in the educational setting have an adequate knowledge base concerning the acoustic variables that can compromise the perception of speech. These acoustical variables include: level of background noise, level of the speech signal relative to the level of the background noise, reverberation time (RT), and distance from the speaker to the listener (Crandell & Smaldino, 2000). These factors are important because “background noise in a classroom affects the child’s ability to perceive speech by masking the acoustic and linguistic cues that are available in the teacher’s spoken message” (Crandell & Smaldino, 2000, p. 364). On a larger scale, background noise can negatively affect academic performance, reading and spelling skills, concentration, attention, and behaviour in children with mild-to-moderate hearing impairments (Crandell & Smaldino, 2000). The impact of background noise becomes clearer once the concept of signal-to-noise-ratio (SNR) is understood. The SNR refers to the relationship (ratio) between the intensity of the desired signal (e.g., the teacher’s speech) and the intensity of the background noise (e.g., air through windows, children talking, chairs moving) at the child’s ear (Crandell & Smaldino, 2000). Jamieson, Kranjc, Yu, and Hodgetts (2004) found kindergarten, grade 1, grade 2, and grade 3 students all performed well on a listening task in quiet conditions, but performance declined as SNR decreased. When SNRs decrease, the sounds of interest and importance become less distinguishable from the background noise and



are thus harder to hear. Reverberation is defined as “the persistence or prolongation of sound within an enclosure as sound waves reflect off of hard surfaces” (Crandell & Smaldino, 2000, p. 365). It may be better understood as the “echo effect.” Just like background noise, reverberation affects speech perception within the walls of a classroom, which can contribute further to the problems children with mild-to-moderate hearing impairments often have in the classroom.

Improving the acoustical conditions within classrooms could potentially be one of the most critical, not to mention straightforward, strategies to improve the learning experiences and opportunities of children with mild-to-moderate hearing impairments. A discussion of effective strategies follows.

### ***Use Amplification Systems***

The literature has demonstrated the potential benefits of amplification systems in classrooms for students with hearing impairments. Bess and Humes (2009) noted that amplification systems help create a more favourable SNR which helps increase speech recognition; however, Crandell and Smaldino (2000) dispute the effectiveness of a whole-class amplification system, also known as a sound-field amplification system, for students with mild-to-moderate hearing impairments in that they typically need greater than the 15dB SNR that most amplification systems apply. If the sound-field amplification system is connected directly to the child’s hearing aid, benefits may be greater. This is explained in more detail below.

Frequency Modulated (FM) systems, including the sound-field system mentioned above, are one option to employ when students in the classroom have hearing impairments. There are different types of FM systems that can be used, either personal or sound-field systems (Tye-

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Murray, 2009). Both systems require the instructor (speaker) to wear a microphone that transfers the speech signal to a transmitter. If using a personal FM system, the sound travels directly to and is amplified at the individual's hearing aid or cochlear implant. If using a sound-field FM system, the sound is transmitted to loudspeakers located throughout the classroom; the child's personal hearing aid or cochlear implant picks up the signal while the sound is also amplified for all of the children in the class (Tye-Murray, 2009). Sound-field systems are costly but may be beneficial to other students as well. Maag and Anderson (2007) state that improving the listening conditions [with sound field amplification] in a classroom appears to positively impact the ability of students with ADHD to attend and to comply with teachers' directions by providing a clearer sound signal. Crandell and Smaldino (2000) advocate that personal FM systems are more useful than sound-field systems in noisy environments, but that they could also drain the battery of the hearing aid and be quite costly (\$1000-\$3000). Anderson and Goldstein (2004) found improvements in the speech perception of students using personal FM systems and a preference by students for the personal FM system over their hearing aid(s) alone.

Hearing aids amplify ALL sounds, not just the speaker's voice, unlike FM systems that amplify primarily the speaker's voice because the microphone is close to the teacher's mouth rather than on the body of the hearing aid fitted at the child's ear (Crandell & Smaldino, 2000). While the speaker's voice is louder for the individual using a hearing aid alone, so is every other sound, which can make hearing the important sounds (the speaker's voice) challenging. FM systems reduce the challenge of separating the speaker's voice from other noises by amplifying primarily the speaker's voice.

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Sometimes the set-up and overall cost of amplification devices fall outside a school's budget. Fortunately there are other, more cost-friendly strategies that can also help to address the acoustical challenges found in classrooms. These strategies follow.

### ***Limit Background Noise***

Minimizing background noise in a classroom can enhance the learning opportunities of all students, especially those with mild-to-moderate hearing impairments. Recognizing where noise is coming from around the classroom is the first place to start when looking at ways to reduce noise. Keeping windows closed blocks out the outside noises of cars rushing by, construction, birds, etc. Keeping the classroom door closed serves a similar purpose in reducing the amount of hallway noise that is transmitted to the classroom. Classrooms are full of technological devices such as computers, laptops, keyboards and smart boards. Ensuring that none of these devices are running at times when they are not in use helps to reduce background noise in classrooms (Talbot, n.d.; Weil, 2011). Classroom noise also includes children moving around and fidgeting in their chairs. It is not uncommon to enter a classroom and notice tennis balls, socks, or felt pads on table and chair legs. These reduce the noise created by furniture every time a child moves and can have a surprisingly positive impact on reduction of background noise in classrooms (BCME, 2013; Weil, 2011). Finally, classroom location for children with hearing impairments can be considered at the start of every school year. Selecting a classroom away from noisy areas such as a gymnasium or music room is very important (BCME, 2013).

### ***Reduce Reverberation***

As discussed earlier, reverberation is a common problem in regular classrooms and has a negative impact on students' abilities to hear clearly. Hard surfaces are a common cause of reverberation in classrooms, but there are simple strategies to reduce hard surfaces including carpeting, curtains, bulletin boards and artwork on walls (ACSLPA, 2013). An absorptive ceiling may also be beneficial, but installing acoustic panels and ceiling tiles can be more costly than the strategies listed above (Shield, Greenland & Dockrell, 2010). All of these methods serve to absorb sound rather than reflect it.

### ***Develop a Seating Plan***

When teachers design a seating plan there are multiple variables for them to consider such as student relations, distractibility and vision. It is just as important to consider a child's hearing when arranging a seating plan. Semi-circular seating is often suggested because it allows the child to see all of his peers' faces, which is important during class discussions and when other students are speaking (ACSLPA, 2013). Since it is nearly impossible to reduce all noise in the classroom, ensuring that the student(s) with hearing impairments are seated away from noisy equipment such as computers, windows, and central heating systems takes away the extra noise right at the ear (ACSLPA, 2013). If semi-circular seating is not an option in the classroom, then it is more helpful to have the student with the hearing impairment situated closer to the front of the classroom where the teacher will be speaking, so that the optimal speaking distance of at least one metre can be met. It is also important not to place the student so close to the teacher that the teacher's face is not easily visible for the student. Avoid having

light shining in the student's eyes, affecting visual access to the teacher. It is best if light sources are on the student's back (ACSLPA, 2013).

### **CONCLUSION**

Throughout Alberta and across Canada, students with mild-to-moderate hearing impairments are found in many inclusive classrooms. Unfortunately the knowledge base of the teachers and other professionals working with this population is sometimes limited. Though a mild-to-moderate hearing impairment may seem minor, evidence has shown that children with more severe hearing impairments are actually faring better in regular schools because they receive greater support, while students with less severe hearing impairments receive less (Most, 2004). Every student deserves the same learning opportunities and learning experiences as their same-aged, classroom peers. Hence many of these students may not be reaching their potential. The aim of this project was to find and compile information into one resource to be used by teachers and SLPs to aid them in meeting the learning needs of students with mild-to-moderate hearing impairments in school programs. Classroom strategies for students with mild-to-moderate hearing impairments have been discussed. Increasing one's understanding of hearing impairment is the first step to being able to meet its impact effectively.

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