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Audiology in the Classrooms

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What Questions Should We Be Asking About Artificial Intelligence in Hearing Technology for Children with Hearing Loss?

Discussions about artificial intelligence (AI) are everywhere these days. We have seen the emergence of audiology devices that monitor the listening environment and adjust automatically to improve access to sound for years, of course. AI has even entered the previously quite low-tech area of children's earmolds. As an educational audiologist who does not fit personal hearing technology, I feel sadly behind on AI, Deep Neural Networks, and other advancements (but mildly relieved to think I didn't need to understand it). However, two recent experiences have led me to ask questions about how the uniqueness of children's listening experiences interacts with AI assumptions and algorithms, and how this affects how I support students in classrooms.

The first was encountering two students early this fall who were unhappy with their hearing aids and/or remote microphone systems. This doesn't happen often, but a couple of educational audiologist colleagues have reported similar situations. As best I could tell, the problem was related to environmental input to the devices, either too much or too little. However, it was not at all clear to me what was causing the problem – the students' hearing had not changed, their hearing technology had not changed, and everything was fine in June.

As a result, with some help from colleagues and manufacturers, I began to dig into the research and

educational materials to get a better understanding of what choices are being made within the device to adjust performance over the course of a day (for example, when a device might "choose" to switch to a super directional mode). Decades ago, when we only had analog linear hearing aids, barring a sudden loud sound, you always knew what the hearing aids were doing at any given point, that is, exactly the same unchanging things they did all day long. Today's hearing technologies bear little resemblance to those days. However, our primary simple-but-not-easy goal for hearing technology remains the same – to help users hear what they want or need to hear at any given moment in time. To achieve this, we need to understand what it is that the user wants to hear, such as what is the "signal" in the signal-to-noise ratio at that moment in time? The extent to which today's technology uses sensors, sound scene analysis, and other data sources to identify and isolate what it deems "the signal" is astonishing. However, the algorithms still rely on theories about the best strategy for highlighting the signal. My questions boil down to whether these algorithms and strategies reflect children's real-world experiences, particularly in school. Do they accurately represent, and can they accurately identify, the signals that are important for children? And can they do this in places where adults are unlikely to find themselves, such as on a soccer field, a school bus, a crowded cafeteria, a music class, or the gym? Adults generally don't find themselves in new jobs or new living situations once a year. Still, every student does predictably every September – their new class equals new acoustical conditions, new voices, and new listening demands.

For example, a full-day kindergarten student in Ontario likely spends the day in a large, noisy, reverberant classroom with up to 30 children and at least 2 adults, sometimes 4 or 5. There will always be a teacher and an early childhood educator (ECE), but there may also be an educational assistant, as well as a parent volunteer or two. Over the course of a day, our hypothetical student will go from the playground (where they will need to hear peers) to circle time consisting of all the students participating in a formal-ish lesson with the teacher sitting on the carpet, to a small group lesson taught by the ECE, to 2–3 students listening to a story read by a parent volunteer, to the water table with classmates, to snack time sitting on the carpet, to outdoor play and then back to circle time. It is a day spent sitting down, standing up, and running around, listening to a variety of voices under a variety of acoustic conditions, requiring a variety of language and cognitive skills. How does that child's hearing aid, cochlear implant or bone-anchored device respond in each of these situations? What signals does it prioritize, and what signals does it deem to be noise during these rapidly changing times? If there is a remote microphone system, what assumptions inform how the device achieves its goal of improving signal-to-noise ratio? Grade 1 will look and sound different; a high school student's day will be different again. My working hypothesis for the two students experiencing difficulties was that last year, their hearing aid algorithms were appropriate for their classroom listening demands, but this year, in a different class with a different teacher, different rooms, and different curriculum demands, the way the hearing aids performed no longer matched the needs of the students.

As AI makes hearing technology operate more and more automatically, humans become more and more crucial in determining when that automaticity is helpful and when it could be detrimental. Educational audiologists have the privilege of seeing the impact of a hearing aid fitting in the child's daily life outside of a clinic; we can sometimes identify a problem that is not evident on electroacoustic verification. Fortunately, because today's devices offer so much flexibility in adjusting parameters, the solution is readily available once the source of the problem has been identified. The default settings that may work well for most students, and that worked well for these students in June, may now need to be individualized based on new listening demands. Collaboration between educational audiologists and clinical audiologists provides all of the

necessary pieces to troubleshoot problems or validate fittings. The educational audiologist can see where communication and learning problems have arisen in the child's daily life, while the clinical audiologist understands how the hearing technology has been configured and how it is designed to perform under different conditions; together, they can brainstorm a solution. Manufacturers and educational audiologists can learn from each other about the unique listening challenges of classrooms and whether AI understands them.

Knowing the differences between adults and children has always been crucial for research and development. I would argue that, from a clinical perspective, understanding an individual's auditory life is more important than ever when AI is involved. Back in the day, a linear hearing aid that always produced, say, 40 dB of gain at 4000 Hz no matter what, posed its own challenges for auditory access. However, an AI-powered hearing aid trained on adult data could make sound-scene classification errors that create similar auditory access challenges for a child.

These cautions are not limited to children. Khoza-Shangase (2026) discussed bias in AI, noting "Because many of these advances rely on large, diverse, and high-quality datasets, audiology represents a particularly critical case study: hearing health depends on language-, context-, and population-specific data, making it highly sensitive to the types of bias already documented in broader medical AI." Lots of think about. And so, the questions I am asking myself these days about AI in my practice centre around understanding whether, and how, children have been represented in the development of these Deep Neural Networks, as well as how particular hearing devices have been designed to perform in the kinds of situations in which the students who I see at school find themselves. Wish me luck, there's a lot to learn.

References

- Khoza-Shangase, K. (2026). Artificial intelligence and hearing health: a global evidence review of biases and equity implications for Africa. *Global Health Action*, *19*(1). https://doi.org/10.1080/16549716.2026.2642546