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Can Streaming Technologies Replace Personal “FM” Systems in the Classroom?

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The number and sophistication of assistive hearing devices that are available to consumers with hearing loss to improve communication in everyday situations such as watching television, talking on the phone, eating out a restaurant with friends, or following along at a work meeting, have exploded in the past few years. Consumers have options for streaming audio from their phones and other devices via Bluetooth technology. Small remote microphones that interface with streamers or hearing aids/CIs/BAHAs directly, allow people to participate in many communication situations that were previously difficult, at a low cost. Streaming technology for hearing devices is amazing. However, have these technologies advanced to the stage where they can replace the traditional personal “FM” systems that students with hearing loss use at *school*?

(Note: in this article, I am using the term personal “FM” systems, realizing that many, if not most, of these systems no longer use frequency modulation technology but rather, digital connections or sometimes infrared. For simplicity, I will use the term personal FM system to represent systems that consist of a teacher worn transmitter, and a student-worn receiver, whether that be receivers attached to hearing aids, CIs or BAHAs or some type of neckloop. I will use the term “remote mic” to represent the small wireless microphones typically sold directly to consumers for home or work use, paired with personal hearing aids, CIs or BAHAs).

More and more frequently, educational audiologists are encountering situations where either parents are requesting that schools use the same assistive technology that they use at home, such as a small remote microphone and a streamer, or more problematic, hearing aids or CIs that have no option for personal FM and can only be used with remote microphones. Parents may say “we have a remote mic and a streamer that came with my child’s hearing aids that we use when we go to the zoo or in the car, I’d like my child to use that at school because she’s familiar with it” or (occasionally) “our audiologist says it will work just as well at school and it’s a lot cheaper than an FM system.” While remote mic technology is a remarkable innovation that opens doors to better hearing and communication for consumers, I would like to argue that it is not yet “ready for school”. FM systems for the classroom need to meet a number of criteria on which remote mic

systems often fall short. To be clear, these are not criticisms of remote mic technology in general; however, the demands of school are very different than home or work, and require different technology solutions.

Criterion 1: Systems Must Be Reliable and Easy To Use for Teachers and Students

Reliability of the Streaming Connection

A classroom teacher's entirely reasonable expectation is that he/she will turn on the FM system transmitter and the student will hear his/her voice reliably until it is turned off or muted. The connection between remote mics and hearing aids/Cis/BAHAs, however, is often very prone to disruption. This occurs surprisingly often on a random basis (where the devices simply lose connection with each other for no apparent reason). However, the connection is reliably lost with the remote mic is out of range for more than a few minutes. This likely is not an issue for an adult, who may be using their remote mic at a restaurant for an hour or so (when the 2 devices are never out of range), or for an adult who can quickly recognize when the connection has been lost and push the correct button to reconnect. Students, however, are frequently out of range of the remote mic during the day (for example, simply walking down to the office with the attendance sheets, or going to gym class and leaving the remote mic in their homeroom). This requires frequent re-pairing of the 2 devices during the school day; this is not a good solution for school, particularly for younger students who need support using their technology. One educational audiologist noted "With support from an educational assistant and using the remote control for the CI and the button push for the hearing aid, this student has to initiate the streaming process when she arrives at school and then again after each recess and lunch... for a total of 4 times each day." I would suggest that 4 times per day is actually less than what many students experience. Re-pairing means time taken away from learning, less independence by the child, and frustration from the teacher who assumed that the child was receiving his/her voice, only to find out that the pairing was lost 10 minutes ago and the child did not report the problem. Use of a remote mic requires that the student be a reliable reporter of technology problems; this can be difficult enough for an older student but is not a reasonable expectation for a kindergarten or grade 1 student. For some devices, we need the student's hearing devices, remote controls for their hearing devices (because sometimes the hearing devices are paired with more than one streaming device and there is no other way to know this), the remote mic itself and sometimes a streamer - most of which require recharging every night, all of them with a different type of charger. This is a lot of hardware for a child and a classroom teacher to understand, use, charge and troubleshoot.

Hardware Reliability

The reliability of something as simple as the tiny plastic piece that clips the remote mic on to a teacher's shirt can make or break use in the classroom. The same is true for personal FM system transmitters, but there is always the option to purchase extra clips, and replace them at school; this is often not true for remote mics. Because the clip is securing the entire remote mic, a button-down shirt really provides the best option for attaching a remote mic securely; however, we cannot dictate what teachers wear to school every day. A fuzzy turtleneck sweater simply defeats the clip on a remote mic. While we can sometimes rig a wearing option using some kind of lanyard around the teacher's neck, the remote mics are so small and light that they simply flop around, and integrity of the speech signal is compromised. One educational audiologist noted "the clip on the remote mic is quite fragile. For at least 2 of my students, their remote mics had to be returned to the company because of a broken clip and the mics were completely replaced (not repaired). I

have been ordering 2 remote mics with each order so that the student always has a back-up. The company recommends charging both remote mics when they are received to ensure they are working properly as there is only a one-year warranty from time of purchase." Almost everything about this audiologist's experience is problematic, from the fact that an entire remote mic has to be replaced to fix a broken plastic clip, to that fact that the educational audiologist needs to order twice as many devices for each student to ensure reliability, to the fact that there is only a 1-year warranty available – after that, if a clip breaks, for example, the school board needs to purchase a brand new remote mic. In education, educational audiologists rely on the comprehensive loss and damage warranties offered by the FM system manufacturers, and these are not available for remote microphone systems. Compounding this is the fact that remote mics are often more prone to breakage, simply because they were not intended for the type of continuous, daily wear and tear that school entails. Their very small size makes them more likely to be misplaced or lost. In the example above, however, the educational audiologist has no choice in using a remote mic, as the students' CIs and hearing aids have no other option for HAT.

Criterion 2. Batteries Must Last the Entire School Day

Personal FM systems may not be used during every minute of a 9 am to 3:30 pm school day, but they are used for the majority of this time, so battery life for transmitters, receivers and hearing aids/CIs/BAHAs needs to be dependable. The use of streaming technology, however, decreases battery life, sometimes significantly. This means that students using remote mics instead of personal FM systems may find themselves suddenly with dead batteries in the middle of class. Educational audiologists and teachers of the deaf (in Ontario at least) are adding many hundreds of dollars in extra hearing aid batteries to our FM system claims to account for this, as it is unfair to expect parents to shoulder the extra cost involved for batteries for a system used at school. In addition, remote mics' rechargeable batteries typically have a shorter life span; some companies will indicate that the remote mic is expected to have only, say 365 charges (not much more than the length of 1 school year). In education, we expect our personal FM systems to have a lifespan of at least 3 years; having to purchase 2 or 3 remote mics because each one only has one year of rechargeable battery use means that orders are becoming very expensive.

Criterion 3. Systems Must Be Flexible Enough to Accommodate A Variety of Classroom Needs

Ability to integrate with personal FM systems

In theory, some remote mics have the capability of interfacing with a personal FM system, if they have a port for a personal FM receiver. However, what does this mean in practice? A student using this option will have the teacher using the personal FM transmitter, as usual. However, the receiver consists of a personal FM receiver plugged into the remote mic, a combination that the student somehow needs to wear on his/her body. The remote mic is small with a fragile plastic clip, so clipping it onto a small child's clothing is not ideal. Wearing it in his/her pants pocket is a recipe for loss. Clipping it to a waistband also invites loss, and assumes that the student will always be wearing clothing with a waistband. The connection between remote mic and hearing aid/CI/BAHA is more stable, but the wearing options are awkward and not secure.

Ability to accommodate for different learning situations

In addition, if there is another student in the class with a personal FM system, there is no way to avoid requiring the teacher to wear 2 transmitters (unless the system described above is implemented). Not only is this uncomfortable for a full day of teaching, it means more equipment for teachers to learn, charge, use and troubleshoot. In cases where there is a student with a personal FM system and another student with a sound field system in the same class, we often patch the 2

systems together so that only one transmitter is needed. Although we must be careful to ensure the integrity of the signal when patching, this option can have the additional benefit of incorporating the sound field system pass-around mic(s), providing better access to sound for everyone. While remote mics may have a port for patching into a sound field system, I think it is fair to say that this was not an intended use for the remote mic and the sound quality when patched into a sound field system is really unknown (and in the case of CIs and BAHAs, unknowable because the response of these devices cannot be measured electroacoustically).

There is no option for a lapel or boom microphone into a remote mic if educational audiologists or teachers of the deaf wish to use these options for better and more consistent sound quality. There are also no options for adding pass-around mics when a remote mic system is used. We know that access to peer input is a universal problem in the classroom which we try very hard to address with pass-around mics, so not having this option means potentially poorer learning for students.

There can be some instances where streaming technology can add something to the equation for older students. For example, streamers can sometimes be effective when used with personal FM systems. I recently worked with a university student using a personal FM system with audio shoes and receivers, because he liked that the audio shoes and receivers were discreet. However, his one complaint was that every day, he would walk into class, give the professor the transmitter and take his seat. For the next 10 minutes or so, until class started, he heard noise from the surroundings through the FM transmitter, and there was no option to turn off the FM system other than taking his receivers off. He had deliberately chosen not to show the professor how to mute the transmitter for 2 reasons (and, I am in agreement with both). He feared that the professor would mute the transmitter and then forget to unmute it when class started. In this case, the student would then have to either raise his hand in front of 300 other students and ask the professor to unmute the transmitter (and then, in the likely scenario where the professor forgot how to unmute), he would have to walk up in front of 300 classmates and show the professor. Because he already owned a streamer that had a port for an FM receiver, he was able to use his streamer as well as the FM system that was his preferred choice. An added bonus was the app that accompanied the streamer, which allowed him to be on his phone before class the same as the rest of the students, although he was adjusting his FM system while the rest of the students were watching Netflix.

My take home message here is that there is no doubt that streaming technologies using streamers and remote mics are an amazing and much needed innovation that provide a degree of access for adults and children that we have not previously been able to provide. However, we need to be cognizant that the demands of school are very different than at home or work, and so, we need to ensure that hearing aids, CIs and BAHAs for students have the flexibility for use at school. Sometimes clinical audiologists have a choice of different devices and are able to choose a classroom-friendly hearing aid. Sometimes (for example in the case of CIs and BAHAs), audiologists do not have this choice and so, while we will of course continue to do our best as educational audiologists and teachers of the deaf for these students, we need to call on manufacturers to ensure that hearing devices intended for children to use have the flexibility to meet their learning needs at school. The university student I described above said it best – when I said “good for you for asking for an FM system, a lot of students stop using them after high school”, he replied “Really? Why would anyone do that?” We want all of our students to be so successful in their use of classroom amplification in elementary and high school that they have the same attitude.