

This unedited transcript of a AudiologyOnline webinar is provided in order to facilitate communication accessibility for the viewer and may not be a totally verbatim record of the proceedings. This transcript may contain errors. Copying or distributing this transcript without the express written consent of AudiologyOnline is strictly prohibited. For any questions, please contact customerservice@AudiologyOnline.com.

Enhancing the Classroom Experience

Recorded February 6, 2020

Presenter: Candace Depp, AuD
AudiologyOnline.com Course #34158
Partner: Oticon

- [Candace] The modern classroom is filled with challenges for children with hearing loss. Noise, distance and reverberation adds a layer of complexity to communication and learning. To develop language and enhance learning students need to be able to hear the teacher's voice clearly and therefore optimizing the signal to noise ratio is crucial. Direct access to the teacher's voice via wireless microphones can help manage these. Remote microphones are being utilized in schools to improve access to a teacher's voice for children with hearing loss. However little attention has been given to its design or usability by school based professionals and their students. In this session we will introduce you to the research that has impacted development of a new flexible wireless microphone solution, the Oticon EduMic. It ushers in a new era of connection in the classroom to optimize listening conditions and support children with hearing loss.

As previously introduced I am Candace Depp. On the screen you can see my financial disclosures as I am an employee of Oticon working within our learning and development department on behalf of product and sales training and it's with this launch of Oticon EduMic that there is truly a new kid in class. It brings with it a new way to look at educational enhancement that I am so excited to share with you today, so let's get started. What you should expect to take away from today's session is the understanding of those challenges that children with hearing loss face in the traditional classroom. Following a description of Oticon's unique signal processing strategy with OpenSound Navigator and its use in the new EduMic microphone solution, you will better understand how this technology can support listening and learning in the classroom. Additionally we will review evidence to better support the use of these types of devices in the classroom and review the full portfolio available to you from Oticon for use in the educational setting. When we think about and discuss children in general we recognize that speech and language development is one of the most important developmental processes during childhood. For those with hearing loss it's even more so as access to speech may be limited due to the severity of the impairment

or lack of amplification. With the rise of early hearing detection and intervention and new born hearing screening programs worldwide, children with hearing loss are now being diagnosed and fitted with hearing aids at very early ages usually by three to six months. It's according to Mark Ross that this early fitting and consistent use of amplification is a key tool available to us as hearing care professionals. With appropriate amplification, children have the opportunity to develop age appropriate spoken language and reading skills and here at Oticon we could not agree more, we believe that every child should have access to the very best sound experience to insure optimal speech and language development from the very beginning. Built on Oticon's BrainHearing philosophy our solutions are meant to deliver outstanding sound quality and input to the auditory system making it easier for the listener to make sense of sound in everyday situations allowing for more access to speech especially in the presence of noise.

So thinking about a typical day in the life of a child, it is mostly spent in the classroom and the classroom of today is certainly not what it used to be. Modern classrooms are becoming diverse, distracting and more demanding every day. Children have to cope with different teaching styles, desk configurations, flipped learning in case you're not familiar with that where you actually study a concept for homework the day before it's taught. They're also dealing with digitization, group work and a large number of students to teacher ratio. To make matters worse classrooms are considered less than ideal listening situations even for those with normal hearing. It is well documented that children spend over 80% of their day in these environments with a mixture of both speech and noise and noise masking the most important acoustic information for speech perception. Many children are still in their language development phase so they don't have a full knowledge of vocabulary in language, therefore they cannot fill in the gaps of speech that they might miss when listening in the background noise. The most important factor however is not the level of background noise itself but the relationship between the level of speech and the level of noise which we also refer to as the signal

to noise ratio or SNR. Because language and communication systems in children are not as well developed as they are in adults, children with hearing loss need a minimum of plus 15 dB signal to noise ratio to be able to hear fully. The signal to noise ratio encountered in many classrooms according to Jeff Cruckley and his associates found in 2011, range between minus seven to plus 15 dB. This indicates that many classrooms fall short of that plus 15 dB minimum and as a result children are having to work harder to learn and listen. Beyond the noise reverberation and distance are also barriers that make it extremely difficult for children even with normal hearing abilities to fully hear what the teacher is saying. Consider this classroom. While it is empty it is certainly not quite, there is background noise all around. This can include external noise sources that are generated outside the building such as traffic, children playing on the playground or the school gardener perhaps mowing the lawn.

There's also internal noise that's generated within the building, but outside of the classroom such as noise from children walking down the hallway and then there's room noise that's generated from within the classroom like the noise of a ventilation system. Once the classroom becomes occupied the noise gets even louder. There's children talking, chairs scraping against the floor or perhaps computer fans. As you can imagine a combination of all these different noise sources creates a very challenging listening environment. Many classrooms just like this one have much louder noise levels than the ideal even when unoccupied. The ANSI Standard stipulates that the ideal unoccupied classroom level of the background noise is no louder than 35 dBA. However classrooms rarely have noise levels this low. Results from five different studies show that unoccupied classroom noises ranged from 41 to 51 dBA and when the classroom became occupied it could be high as 68 dBA. Reverberation is another factor that affects speech perception. Reverberation occurs when sound reflects off of hard surfaces such as the floor, ceilings, or walls, causing a prolongation of sound. Similarly to noise reverberation causes a smearing or masking of the direct speech signal such as the teacher talking. The longer the reverberation times the worse the

speech perception becomes. All rooms have some sort of reverberation. Recommended reverberation times for classrooms is between 0.4 and 0.6 seconds. However typically the range of reverberation times in classrooms can fall between 0.4 and 1.2 seconds. While speech perception is not compromised for a typical normal hearing adult until reverberation exceeds one second. For those listeners with a sensory neural hearing loss to achieve maximum speech understanding the threshold should be 0.4 to 0.5 seconds, unfortunately noise and reverberation tend to go hand in hand when it comes to classrooms. Combined effects of noise and reverberation have been reported to equate to a possible 40 to 60% reduction in speech perception. Finally the distance between the person speaking and the person listening also can impact speech perception. Direct sound travels from the speaker to the listener without striking any other surfaces in the room. It travels the shortest path so it's the first sound that reaches a listener.

However the power or the loudness of the direct sound does decrease over distance. That is why only the listener seated closest to a speaker are able to hear direct sound. Early sound reflections reach listeners seated at slightly longer distances within a short period of time. For example within 50 milliseconds after the direct sound. As for listeners who are seated further away from the speaker, they are predominantly hearing reverberated sound. The critical distance from a speaker to a listener in most rooms is about six to eight feet. So speech perception can only be increased by moving the listener closer to the speaker within that distance. Current solutions to overcome obstacles of the modern classroom and support users when hearing aids alone are not enough has evolved significantly from large bulky systems to discretely designed devices that transmit a signal wirelessly. Oticon's history with hearing assistive technology can be traced back to as early as 1976 with the launch of our R15 and T16 devices, but it was truly the introduction of the full Amigo FM portfolio in 2006 that allowed Oticon to become a major player in the educational arena. Most recently the addition of the Oticon ConnectClip allowed for a successful one to one connection in

the classroom to support children that were wearing wireless Oticon hearing aids giving them clear access to the teacher's voice, but with it's limitations a one-to-many solution has been highly requested. So the burning question probably on everyone's mind as we discuss this is why has it taken so long to replace Amigo? Well trust me when I say that we've been pretty busy paving the way for some new technology. We been pushing the boundaries of innovation with new and unique ways to provide signal processing and preparing a platform in technology that can keep up with that processing and utilize it to its fullest extent. We also have been busy studying the current hearing assistive technology solutions in the market. What are their barriers to consistent use and how can we reconfigure its usability to appeal to both teachers and listeners alike? So let's look at what we've learned from the existing research we've conducted. Not only have remote microphone systems been shown to improve the signal to noise ratio successfully for a number of years, but further studies show that the use of remote microphone systems have aided in the support of students and their good classroom listening contributing to increased academic performance, speech and language development, behavior and attention and have resulted in reduced stress among both students and teachers.

Remote microphone systems have also proven to be a very viable option for use outside of the classroom. Researchers at Vanderbilt found that these devices provided more access to a caregiver or a parent talking. While recent remote microphone system technology has become very sophisticated, I stated earlier that little attention has been given to the actual importance of the design and the usability of the systems by school based professionals and their students. For supplemental information we conducted our own internal insights to build more evidence to create the best possible solution. We completed a few surveys where we've evaluated the ConnectClip with children and teens with hearing loss. These studies included a tween and teen focus group that was conducted in November of 2017 that also had a field component conducted in 2018 and then in 2019 we included clinical professionals within that trial.

Beginning with the tween and teen focus group we asked participants if you could create an FM system, what would it look like? And what would it do? Your thoughts are likely the same as theirs. Responses involved around design as we all know that receivers attached to hearing aids is less than cosmetically appealing which adds to the size and visibility. Ease of use, rechargeability, and surprisingly sound quality was also found to be a pretty hot topic. The Canadian field study was conducted with tweens and teens in the large Toronto and Edmonton school districts. What we wanted to evaluate was overall how satisfied were you with the ConnectClip remote microphone and how did it compare to the old FM systems that they were currently using. They were asked to rate their remote microphone technology in the categories of sound quality, design, comfort and functionality. Here we see a large preference for ConnectClip with its small design and wearing comfort and it performed equally as well in the categories of sound quality and functionality.

There was little for non-educational usage as a 100% of the students only used the remote microphone technology at the school. Educational professionals also chimed in on their request if they could change existing systems and here's what they said, transmitters of today are too heavy as such many teachers do not like to wear them. In addition to weight more options for microphones as well as faster charging was also requested and we can't forget usability. Having devices that are easy to use goes a long way for teachers who already have a lot on their plate especially as it relates to technology. So if we summarize these findings, what we've learned is that a flexible and discrete option which is simple and intuitive to use is the need of the hour. Students require equipment that provides an improved signal to noise ratio with great sound quality and plug and play capability. Additionally the solution needs to work within the financial constraints of many academic systems while still providing compatibility and connectivity to a range of different setups that may already exist in the classroom. Well the wait is over. Oticon EduMic. Oticon's new wireless microphone solution is a well timed device that supports children with hearing loss in the

classroom. Taking our outstanding legacy of providing optimal sound quality even further. With EduMic teachers can communicate clearly and effectively with their students with just the press of a button. When paired with Oticon hearing devices, it's the gateway now for the classroom between learning and connection and it's a partner for life among school years and beyond. Let's look at the key pillars of what makes this product so unique. EduMic delivers excellent sound quality even in the most challenging environments as it comes equipped with Oticon's BrainHearing technology. Unlike the ConnectClip EduMic was specifically designed for the classroom and it's been given the thumbs up by many teachers as an easy to use solution compared to a competitor's remote microphone system. EduMic is compatible with and provides connectivity to other classroom systems such as Oticon's Amigo, Front Row Juno, and even Phonak Roger. With its advanced capability existing classroom technologies should no longer be the decision maker for hearing aid selection.

Children can now have world class sound quality both in and out of the classroom. Finally as icing on the cake it is super affordable which is absolutely critical in the educational system where sometimes budget constraints can impact the equipment purchasing process. So what makes EduMic so different from its competitors and so very beneficial for students. Well EduMic is based on the latest Velox S platform from Oticon, using 2.4 gigahertz Bluetooth technology, Edumic transmits seamlessly to all hearing aids not only those on the Velox S but is backwards compatible to those as well on the Velox platform. This includes Oticon's Siya, Opn, Opn Play, Xceed and Xceed Play products, further too this EduMic works together with other hearing aids from within the Demant group on those platforms including the Oticon Medical Ponto 4. Oticon EduMic includes a broad bandwidth of 10,000 hertz as well as OpenSound Navigator technology which insures that the child is getting the best possible clear signal streamed to their hearing instruments. It also includes wind noise management for those times when EduMic is used outside of the classroom. We'll look deeper into

these two features in more detail in just a moment. EduMic offers excellent compatibility in today's modern classroom. With four different modes, EduMic can quickly and easily connect to existing systems and finally EduMic has been built to last. It's gone through more than 200 tests and inspection points including harsh environmental testing, drop and impact testing, all of which secures a robust and durable design. So I'd like to turn attention now to the factors that contribute and make up the exceptional sound quality found within Oticon EduMic. Oticon Pediatric hearing aids are currently equipped with OpenSound Navigator which gives students 360 degree access to sounds in both simple and complex listening environments. This technology allows children to hear the teacher clearly while also interacting with their classmates. EduMic uses the same innovative OpenSound technology to analyze, balance and remove noise. It delivers stable and clear access to a teacher's voice by continuously monitoring the environment and removing unwanted noise even so precisely that it does between words.

The OpenSound Navigator feature is optimized for EduMic with a new prioritized target direction. In Oticon hearing aids the assumed target talkers are somewhere in front of the user although other talkers are also available. In EduMic the assumption however is that the target speech is actually coming from above in the direction of the wearer's mouth, therefore the main focus will always be weighted towards the teacher's voice. The OpenSound Navigator in EduMic consists of the same three modules that also exist in hearing aids, analyze, balance and noise removal. The first step is analyzing the sounds in the environment. The environment is scanned rapidly and the sounds are categorized as either speech or noise. The level position and frequency characteristics of the sounds are also analyzed. Based on the data from the analyze step individual sound sources are balanced so that sound and focus, that of the teacher, is clear and other sounds are accessible but not disturbing. The teacher's speech will always be seen as the most important sound source and will therefore be preserved. In the balance step the polar plot will always tend to adapt towards the teacher's mouth

when she talks based on the new optimized target direction. The last step is noise removal. This attenuates the noise rapidly and effectively. It can even attenuate the remaining noise in between words. Overall the OpenSound Navigator system is updated over a 100 times per second. Certain phases are even 500 times per second. The result is an enhanced listening experience. EduMic is cleaning up and delivering a stable and clear transmission of the teacher's voice removing unwanted noise even between words. At the same time OpenSound Navigator in the hearing aids will insure that the student has access to sound in 360 degrees allowing them to engage in class discussions and participate actively. OpenSound navigator in the EduMic stream signal benefits the child regardless of the OpenSound Navigator's setting within their hearing instrument or even if they're wearing devices where OpenSound Navigator may not be available. In the classroom it is equally important that a student can hear their classmates during lessons and discussions. An omnidirectional fitting is most commonly prescribed in pediatric fittings to allow children to have access to speech from all around them however this does not provide good speech understanding in the presence of noise.

Traditional directional microphone technology limits the ability for children to overhear people talking around them which is extremely important for incidental language learning. We know that children don't always look or turn in the direction of the talker when they listen which can limit the benefit that traditional directional microphone technology provides, but with OpenSound Navigator enabled in Oticon Opn Play and Xceed Play hearing aids it gives students 360 degree access to sounds in both simple and complex school listening environments with fast and precise noise removal. It's generalized then that when sitting around a table a conference mic may not be needed as OpenSound Navigator should prioritize the child's voices. Working hand in hand Oticon hearing instruments and EduMic provides students with outstanding opportunities to learn and grow with innovative hearing technology. Today's learning environment goes well beyond the traditional classroom setting, therefore it's important

to take into account other challenges such as wind the students may encounter while they're busy learning and exploring outside the classroom walls. Wind can cause issues because when it reaches a microphone opening on a device such as the EduMic, it generates a swirl. This swirl can be amplified and heard as a loud harsh and occasionally disturbing sound in the receiving hearing instruments. In devices with two microphones the effect may be doubled. EduMic is equipped with Wind Noise Management and can be used outside the classroom very effectively. Wind Noise Management attenuates the wind noise insuring students have better access to speech in windy environments. It enables students to have an excellent hearing experience during school sports classes, outings and other outdoor after school activities making it the ideal remote microphone system for any outdoor activity including soccer practice, field trips and even golf. Thanks to OpenSound Navigator combined with Wind Noise Management, it can also be used in other personal social or recreational settings that may present with challenging listening conditions. For example EduMic can be used in the car allowing the user to have clear access to speech from others present. In senior centers and nursing homes and even business settings, EduMic can be worn by staff or presenters to insure the direct and clear voice transmission happens to multiple hearing aid users.

From the classroom to the spots field EduMic is designed to make teaching, learning and playing easier. It allows teachers to really focus on what's most important which is connecting and teaching children. EduMic is robust and designed to handle the demands of every day life and withstand accidental dropping. EduMic uses a single rechargeable lithium ion battery that can be left in its charger over night and will not overcharge. It only needs to be paired once and can transmit to an unlimited number of hearing instruments that receive sound in a dedicated EduMic program. The volume on EduMic to increase or decrease can be programmed in Genie 2 when it's been paired to the hearing instruments. Please note that Genie 2019.2 is compatible with EduMic.

This a new version is not needed for this launch to manage settings. To improve the ease of use as Genie is not readily available for all educational settings, sound streamed from the EduMic to the hearing instruments can also be controlled using the Oticon ON App which is found free of charge in the App or Play Store. Select Streaming to adjust the volume of the sound streamed from the EduMic to the hearing aids. To adjust the volume of the external sound picked up by the hearing instruments themselves select Environment. EduMic offers excellent connectivity and compatibility in today's classroom. As previously discussed, using the latest 2.4 gigahertz Bluetooth low energy technology, it transmits seamlessly to all hearing aids on the Velox and Velox S platforms. Unlike Amigo FM EduMic utilizes digital modulation and dual frequency transmission to provide a stable interference free signal even when the teacher's facing away from the student, hidden behind objects or located in a typically WiFi heavy environment. Using EduMic for daily classroom activities such as plugging into a computer, smartboard, tablet or smartphone, can be done easily through the 3.5 millimeter audio jack connection.

Easily unplug EduMic from the audio source when the media content has ended and resume microphone mode. When moving to another classroom the student or teacher can easily unplug the EduMic and take it with them to the next class. The integration options and flexibility of EduMic gives students with hearing loss full access to audio sources and insure that children are connected for today's modern classrooms. EduMic can be used in four different modalities to transmit stereo sound to hearing devices. Microphone mode and Jack mode both work with up to a 65 foot range. Additionally FM mode and Telecoil mode can be utilized within in nine feet of the student. The expected primary function for EduMic will be in Microphone mode, therefore when EduMic is turned on by pressing the push button for two seconds it will automatically start up in this mode with the microphone ready for use. Assuming that the hearing aids have already been paired they will automatically switch to the EduMic. This sends a direct transmission from the EduMic to the compatible Velox or Velox S

device that's within 65 feet. It is designed for both one to one and one to many communication. So for example if there is more than one child in the classroom with an EduMic compatible hearing instrument the teacher only needs to wear one EduMic and will stream their voice through the microphone mode. The same goes for the audio jack modality. Daily classroom activities can easily plug in using the three and a half millimeter audio jack connection. After media content has ended easily unplug from the audio source and resume with Microphone mode. The audio jack input allows for easy integration with existing sound filled systems such as Front Row Juno. When EduMic is in this Jack mode, the microphone is disabled. It's possible to mute and unmute audio streaming by briefly pressing the button on EduMic. However as long as the cable is plugged in to the jack of the EduMic even if it is muted the microphone remains disabled. EduMic can also be used in Jack mode by students at home if they wish to stream directly from a laptop, tablet or a phone to their hearing aids. FM mode is likely to be used in the classroom where another system such as Amigo or Roger is already in place for another student. In this FM mode the EduMic does not work as a microphone, it simply works as a gateway device to transmit the other signal to the child's hearing aids.

This will be especially common when competitor systems or hearing aids are being utilized and a child now joins the class with Oticon Velox or Velox S devices. When a universal Europin receiver such as the Amigo R2 is connected to EduMic, EduMic automatically switches to FM mode and streams audio from another wireless classroom system to the listener's hearing aids. By using a compatible Europin receiver, teachers can now use EduMic with their existing solutions without having to wear two microphones. In this FM mode the EduMic requires the receiver to be plugged into the bottom and the EduMic then needs to be placed within nine feet of the student that's wearing the Oticon hearing instruments, preferably on their desk. The key message here is that with EduMic parents no longer need to compromise when choosing a hearing aid for their child. Children can now be fitted with the Opn

Play or Xceed Play hearing aids getting access to BrainHearing technology even when other remote microphone systems are already in use. So the child will have the best OpenSound experience in the classroom and outside as well. It's very important to remember that EduMic is not directly compatible with hearing aids that are not on the Velox or Velox S platform. This means that EduMic can not stream directly to the other manufacturer's hearing aids for example Phonak but could utilize FM setups as have been shown with the universal receivers. Both the FM and Telecoil modes are designed for one to one communication and this is because of the nine foot distance range. This means that the EduMic must be placed within nine feet of the Oticon compatible hearing aids during use. The fourth and final function is Telecoil mode. It would rarely be used in the classroom but may be applicable for use by older students as some lecture theaters have teleloop systems that are installed. Outside of an educational setting, telecoil mode would be used in a public arena when attending a cinema, theater, or place of worship. These options provide connectivity opportunities for both the miniRITE and custom instrument wearers that may not have previously had telecoil or FM access. Last but certainly not least Oticon EduMic has been built to last. Durable equipment does not need to be replaced as often and that contributes to the affordability of EduMic. Additionally it comes with a fully integrated receiver eliminating the need to invest in additional components and its initial price is substantially less than the price of a full system from competitors.

You spoke and we listened thus EduMic is truly a product of the people and the professionals that utilize these type of devices day in and day out. We began our development of EduMic by taking a very raw working prototype to classroom teachers testing its user friendliness in very early days. Based on their interactions with the prototype these were fed back into R and D and changes were made. We also invited key opinion leaders, Carrie Spangler and Erin Schaefer to our Denmark headquarters to share their thoughts with our engineers. At this time I'd like to review the evidence package that's been compiled thus far utilizing EduMic, evaluating not only the

usability and functionality of the solution but also showcasing the speech understanding benefit that we discussed as critical to development and the learning of children with hearing loss. Research on teacher use of classroom technology tells us that there are two factors towards adoption of the technology that's used in the classroom. The ease of use and understanding why it's important for their students. This is referenced in more detail in the EduMic whitepaper and taken into account during the study. In this usability study Gordi and Rumley in 2019 looked at teachers perspectives on ease of use, discreteness, attractiveness in relation to design and also wearing comfort. 20 teachers were asked about their backgrounds and experience working with students with hearing loss and also their experience with remote microphone systems. The 20 teachers were then given the task of performing certain activities with both a white system, the Oticon EduMic, and a black system which was the competitor Roger Touchscreen. Of the 20 educational professionals in the study, 85% were experienced remote microphone system users also 85% expressed having had experience with a student with hearing loss in their classroom or on their case load. 45% worked in elementary school settings that were kindergarten through grade A, 5% were high school teachers grade nine to grade 12 and remaining 50% were teachers of the deaf and hard of hearing in specialized classrooms.

They were asked to consider the ease of use, design, comfort and connectivity between the white device and the black device. Let's look at some of the results from the study. In terms of ease of use teachers rated EduMic as more user friendly than the competitor. Results are from the 20 participants across five ease of use activities turning on, muting, pairing, connecting to an iPad with jack mode and placing the lanyard. EduMic received a mean score of 1.45 on a scale from one to five where one is considered very easy and five is very difficult. The competitor device received a main score of 1.8 which is also very good but in comparison EduMic was significantly easier to use. Participants were asked to consider the overall look and design of the white and black remote microphones. 84% preferred the look and design of the white

EduMic remote microphone system while only 5% preferred the look and design of the black remote microphone system. Participants were also asked their preference in terms of discreteness. 85% felt that EduMic was much more discrete as compared to the competitor. In terms of wearing comfort EduMic was voted very comfortable by 85% of wearers. Overall teachers showed strong preferences towards the EduMic compared to competitor remote microphone solution. They rated EduMic as easier to use and very comfortable to wear and the charging and muting functions were rated as very user friendly. Best of all teachers shared a lot of love for EduMic during the study. Here's just some of the great feedback that EduMic received. Now let's take a look at the EduMic speech understanding studies. The first performed with adults, the second we will address in a moment that was performed with children. This study explored the effects of noise on speech understanding and three different fitting configurations, each using Oticon Opn S 1 BTE Plus Power devices with OpenSound Navigator at default. In scenario one the hearing aid alone, scenario two with Amigo and scenario three with EduMic. The Danish HINT speech material was used to obtain speech intelligibility performance in four different conditions. The 10 adult subjects had bilateral severe to profound hearing loss and were asked to listen to the HINT sentences at 65 dBA in culmination with four different levels of diffused cafeteria noise. The noise was presented through four masker speakers placed within the room.

The four levels of noise used were zero or quiet with no background noise, 55, 65, and 75 dBA respectively. The four levels were randomized for each test person. As expected the results of the study showed that speech understanding decreases as noise level increases. In the no noise condition all three fitting configurations, Opn S alone, Opn S with Amigo, and Opn S with EduMic performed similarly. As you can see use of the remote microphone system yielded significantly better results than a hearing aid alone, especially when noise was added. If we look at the noise condition of 75 dB or a minus 10 dB SNR, participants performed significantly better with EduMic than with Amigo. Supplementing the study for speech understanding with adults a

secondary study was conducted with children. What you'll see is an independent external study conducted by Boys Town National Research Hospital. This is very preliminary data but more is expected to be shared at a conference in early 2020. The study investigated speech understanding when listening in noise alone and noise plus reverberation. A total of 21 students participated in the study and were aged between seven and 18 years. One speaker presented the target speech material, the Pediatric AZBio sentences at a level of 60 dB SPL. Diffuse noise which was speech babble was presented from seven surrounding loud speakers. The level was based on 50% correct score with hearing aid alone for a speech recognition task. There were two device configurations, hearing aid alone and hearing aid plus EduMic in two different acoustic environments, speech and noise and speech and noise plus reverberation set at a time of 0.4 seconds. The box plot graph on the screen shows the preliminary results from the study. On the x axis of the graph we have the different devices, hearing aids alone and hearing aids with the EduMic, on the y axis we have the speech and noise ratio where participants got a 50% sentence recognition score, then you have the different colors within the box plots that are red to the left.

These are the results from the acoustical environment that are noise only and the box plots that are blue to the right being results from the acoustic environment that contain noise plus reverberation. The line in the middle of the box is the median and the upper and lower edges of the box are the 25th and 75th percentile which means that 50% of the scores fell within the box. First let's look at comparing the same device configurations in two different environments. First hearing aids alone score in the noise and the noise plus reverberant environments and then hearing aids plus EduMic's score in the same two environments. What we see is that when adding reverberation, that is moving from a red box to a blue box within the circle a better signal to noise ratio is needed in order to get a 50% correct score. This detrimental effect of reverberation is expected. Now if we look at the different device configurations in this same environment. In other words we're going to compare red against red and blue

against blue to show that in both environmental conditions adding an EduMic yields better speech understanding as compared to using hearing aids alone. If we look at the hearing aids alone in noise condition, the listener could only tolerate a mean signal to noise ratio of approximately minus seven dB to get a 50% correct score. In contrast when the listener used hearing aids in EduMic the signal to noise ratio could be decreased to approximately negative 13 dB to get the same 50% correct score. Which means this device configuration of hearing aids plus EduMic was able to handle a noisier environment. A similar pattern is seen for noise plus reverberation conditions with users being able to do better in noise plus reverberation when using EduMic as compared to using hearing aids alone. In conclusion researchers found a significant improvement with EduMic and speech understanding for both adults and children particularly focusing on noisy and reverberant environments. The results clearly show the effectiveness of the EduMic solution for children in a typical classroom. So let's quickly take a moment now to review some basic functions of the EduMic and practicalities for use.

Upon receipt of the EduMic here's what you can expect the packaging to consist of. You'll have one EduMic device, its only color option at this time is the white and also an adjustable lanyard that includes a safety breakaway, a three and half millimeter jack cable for audio streaming, a protective skin for use when attached to an FM receiver. This will ensure longevity of the device and the receiver itself. The protective skin is also only available in white at this time. An instructions for use booklet is also included which provides detailed information about how to use and look after to maintain the EduMic. A wall charger with an adapter that will vary from country to country as well as a USB charger for charging on the go. If we take a look at the EduMic device itself on the front there are two microphones, on the left side a single push button which turns EduMic on, off, mutes the microphone, enables Telecoil mode and can also be used to clear the hearing instrument pairings. On the bottom of the EduMic there is a three and half millimeter jack input which allows for connection of the EduMic to external audio

sources. This allows for direct streaming to the student's Oticon hearing instruments. The FM connector allows for connection of a three pin universal FM receiver which can be an Amigo R2 or a Phonak Roger X universal receiver. When a receiver is connected, EduMic switches to the FM mode we discussed earlier and streams the audio from another wireless classroom transmitter such as the Amigo or Roger system to the student's Oticon hearing instruments. On the back of EduMic there is a rotating clip, it allows for correct attachment to clothing or to the lanyard. The clip has been reinforced as compared to ConnectClip with a larger rubber surface for more security when moving around. On the right hand side of EduMic a micro USB port will allow for charging. EduMic is easily charged using the provided USB charging cable or wall charger. Insert the micro USB into the charging socket on the EduMic. If using the wall charger you'll insert this into a power outlet. If using the USB charger cable connect it to a source such as a laptop computer. The power status indicator will flash yellow during charging. When charging is complete the power indicator will turn green. This indicates the battery is fully charged. When the battery is running low the power status indicator will begin to flash red, there is now two hours of usage left before the battery runs out. A fully charged battery will give up to 10 hours of usage. Battery performance varies depending on the usage mode.

For example streaming stereo sound in Jack mode will consume a bit more battery power than streaming in Microphone mode. EduMic can be used while charging, however it is not recommended to charge the EduMic while in FM mode as the signal quality may be affected. Charging time will vary depending on the remaining power of the battery. If the EduMic battery is completely drained normal charging times are as follows, a full charge in two and a half hours, 50% charge within one hour and a 25% charge in just 30 minutes. Battery charging will automatically stop when the battery is fully charged, this will prevent overcharging of the battery unit. On the top portion of EduMic there are two LED status indicators, one for power and one for status. The power indicator is depicted by a battery symbol, it can let you know when EduMic is in

Startup mode by showcasing a white LED or whether the battery is in a charging capacity, whether it's fully charged, charging, or a low battery. These are indicated by green, flashing yellow or flashing red respectively. The status indicator is depicted by a microphone symbol. It indicates when pairing is in process, again a startup as a white LED, an on or Microphone mode, Jack or FM mode, pairings cleared, Telecoil mode and mute. I know that there are a lot of color choices it seems here but once you get started using it, it actually becomes very simple. This overview on the right hand side of the screen shows the status indicators. These are also included in the teacher's guide and the instructions for use manual. EduMic can be worn by connecting it to the clothing using the rotating clip or to the provided lanyard. It is essential that EduMic is placed with the microphone pointed upwards to the mouth at a distance of approximately six inches. This insures an optimal speech signal is picked up by the microphones. Another way to explain this to either a teacher or parent that you may be counseling as to wearage is to spread their fingers, put their thumb on the bottom of their chin and see where their pinky finger lands directly in line from the thumb to the chest.

This is considered the perfect placement for the EduMic system. If preferred the included lanyard may also be utilized. EduMic is attached to the adjustable adapter and the lanyard placed around the neck. The lanyard includes a safety breakaway in cases where urgent removal is needed. For example if the lanyard gets caught on something by accident while wearing it, it's constructed to break apart automatically. When using EduMic with the lanyard insure again that the distance from the mouth to the top of EduMic is roughly six inches or so. Here are a few more practical aspects of using EduMic. All of these images and text are taking from the instructions for use so you can review these functions there as well at any time. To turn on press the push button for two seconds until both indicators turn white and release the button. Wait for 10 seconds until the status indicator turns green. To turn off EduMic press the push button for another two seconds until the status indicator turns off. Here you can also

mute and unmute as seen on the screen. To mute press briefly on the push button until you see a flashing green status indicator. To unmute press the push button briefly again. Before users can get started actually listening through the EduMic it must first be paired with the hearing instruments. Pairing hearing aids with EduMic is fast and easy and it only needs to be done once. An unlimited number of hearing aids can be paired with EduMic. So let's start the process by turning EduMic on, wait until the status indicator turns green, enable Pairing mode in the hearing aids by first turning the hearing aids off and opening the battery draws completely, then turning the hearing aids back on by closing them. The hearing aids are now in pairing mode for the next three minutes, place the hearing aids close to EduMic at a maximum distance of six to seven inches. If pairing more than one set of hearing aids to EduMic it's recommended that you pair only one set at a time. The status indicator on EduMic will flash blue while pairing is in process. When the status indicator stops flashing blue and turns green, pairing is now complete. EduMic is ready to be used with the hearing instruments. Repeat these steps to pair more sets of hearing aids as necessary. For rechargeable instruments the process is similar.

Start the pairing process by turning EduMic on and waiting for the status indicator to turn green. Enable Pairing mode in the hearing aids by first turning the hearing aids off, you do this with a rechargeable unit by pressing the lower part of the hearing aid push button for three seconds, turn the hearing aids back on by pressing the lower part of the push button for two seconds. The hearing aids are now in Pairing mode for the next three minutes. Place the hearing aids close to EduMic at a maximum distance of six to seven inches. If pairing more than one set of hearing aids to the EduMic again it's recommended to pair only one set at a time. The status indicator on EduMic will flash blue while pairing is in process. When the status indicator stops flashing blue and turns green pairing is now complete. EduMic is ready to be used with the rechargeable hearing instruments. It is possible to clear all pairings that have been placed into EduMic when they are no longer needed. You do this by turning the EduMic on,

pressing that push button for two seconds, waiting until the status light turns green. Now hold down the push button for a longer 12 seconds until the status light turns red. Now all pairings are cleared from the EduMic. So here's one additional thing I want you to keep in mind as you begin working with the EduMic particularly if you have more than 10 students that will be paired to it at any given time. It has been mentioned previously in this session that an unlimited number of hearing aids can be paired to the EduMic and this of course is true however one thing is that the internal bonding list of the EduMic only stores up to 10 sets of hearing instruments at a time. When an 11th student's hearing aids are paired to the EduMic this set will take up the place of the first set of hearing aids on the bonding list. However all 11 students still are hearing the teacher. So while there's not a limit to how many students can pair to EduMic for broadcasting it does require a manual switching beyond the 10th user. So here's a little bit about what that would look like. For the 10 users that are first within the 65 feet range of EduMic being turned on, these 10 users will automatically change their program from a P1 to the Tv adapter EduMic program. Turning off, muting, unmuting the EduMic will also initiate a program change from their EduMic back to P1.

When more than 10 sets of the hearing aids need to be paired to the EduMic, a manual switching is required and this again is due to the bonding list limitation where not all paired hearing aids are stored in the EduMic at a given time. In this case the student will need to manually switch to their EduMic program. This can be done on the hearing aids by pushing the push button if a program's been added, by using a personal remote control or utilizing the Oticon ON App. EduMic shares a program slot with the TV adapter, a total of four EduMic's TV adapters can be paired to one set of hearing instruments that are on the Velox S platform. Currently including Opn S, Xceed, Opn Play and Xceed Play products. Only one EduMic or TV adapter can be paired to hearing instruments on the Velox platform. This would include Opn and Siya. This also applies to multibrand hearing instruments from Bernafon Sonic or Phillips. The hearing aids can only be connected to one EduMic or TV adapter at a time. Switching between

the EduMic and TV adapter is actually very easy. When the hearing aids are in the range of the EduMic the hearing aids will automatically change to the TV adapter EduMic program and the listener will be able to hear the EduMic wearer's voice being transmitted directly to the hearing aids. When the EduMic is switched off, the hearing aids will automatically revert back to the program one in the hearing aids. This takes approximately 90 seconds. When the hearing aids are in the range of the TV adapter the user will need to manually switch to the TV adapter EduMic program using the push button on the hearing aids, a remote control or the Oticon ON App. Please note that the EduMic is the primary device. This means that if a paired EduMic is switched on when the hearing aids are connected to the TV adapter, the EduMic will take over the transmission and the user will be disconnected from the TV adapter. So that concludes the practicalities and basic uses of the EduMic. Should you wish there are additional resources available to you. The product brochure can be found in your launch box that was shipped on January 27th. How to guides for teachers and hearing care professionals are also available. These are especially valuable for helping to set up the EduMic and connecting it to the existing classroom systems that may be in place. The whitepaper includes new research on the usability study we shared with teachers as well as the results with children and adults using the EduMic.

In addition there is also a verification guide as well as the instruction for use manual that are not shown here. A series of short instructional how to videos can be found on the oticon.com website in addition to MyOticon as well as on the Oticon YouTube channel. The videos provide an overview of the most common task and showcase just how easy it is to actually work with the EduMic. Note that the videos do not have audio and are visual only. Now with the addition of EduMic there is a full range of easy to use solutions from Oticon to choose from. Regardless of the existing classroom system hearing instruments or even learning styles, there's something to meet every need. Our traditional Amigo FM setup is available for purchase with the transmitter and receiver of your choice. From the T5 or T30 down to the R2, R12, R12 G2 or the Amigo Arc as

shown here. Now with EduMic our new wireless 2.4 gigahertz solution no additional receiver or parts and pieces is needed. So to reiterate some of the common use case scenarios of EduMic, this slide breaks down how to manage these setups when the existing classrooms system is an Oticon Amigo FM. Further information can be obtained when a competitor system is being utilized in the classroom. So the first one to consider is the main or primary usage where the teacher wears an Oticon Amigo T30 or 31 transmitter and is transmitting the sound to an Oticon BTE hearing aid with an FM Receiver attached. The FM receiver may be attached either directly to the hearing aid, for example utilizing a Sensei plus Amigo R12 or an Opn Play plus Amigo R12 G2. The FM receiver may be attached also via an FM adapter, this would include a Safari with an FM9 adapter and an Amigo R2 universal receiver plugged in or an Xceed Play with an FM10 adapter and an Amigo R2 receiver plugged. This solution is not feasible for mimiRITE, designRITE or many BTE styles as an FM receiver cannot be attached to the hearing instrument. You can refer to the Oticon hearing aid and DAIFM overview for receiver and adapter compatibility. This was shown on the previous slide. Option A will now include an FM plus an EduMic.

The teacher would wear the Oticon Amigo T30 or 31 transmitter and the EduMic remote microphone system is also being used. An FM receiver together with an adapter If required is attached to a non 2.4 gigahertz BTE hearing instrument. Oticon 2.4 gigahertz instruments receive the direct transmission from the EduMic. This solution works for Oticon 2.4 gigahertz miniRITE and custom instruments also. It's also a great solution when the Oticon Medical Ponto 4 is being utilized. The teacher however is required to wear both the Amigo transmitter as well as the EduMic transmitter. Now option B the teacher wears the Oticon Amigo T30 or 31 transmitter. The student can wear any Oticon hearing instrument with a T-coil plus an Oticon Amigo Arc. The teacher's voice is now transmitted to the hearing instrument via the T-coil program. In those scenarios where the teacher does not wish to wear two transmitter microphones, the teacher can now wear an Oticon Amigo T30, 31

transmitter, which will not directly transmit to Oticon 2.4 gigahertz hearing instruments. The student wearing the EduMic compatible devices Oticon 2.4 gigahertz hearing aids can now use EduMic as a gateway device. An Oticon Amigo R2 receiver is connected and plugged into the EduMic. The signal from Oticon Amigo is now transmitted via the EduMic to the Oticon hearing aids. I hope that by viewing these different options you'll understand a bit clearer about how Amigo and EduMic can be utilized together in today's classrooms. With the launch of EduMic, Oticon offers students a new wireless remote microphone system that overcomes listening challenges faced inside and outside of the classroom. It's truly a bridge builder connecting them to the teacher, multimedia sources, and existing remote microphone systems. The EduMic has also been voted by teachers as easy to use, discrete and comfortable, with its wide range of connectivity options, students are no longer limited in their choice of hearing instruments. It's with this release of EduMic that Oticon now offers students a powerful choice of accessory that they compare with their dedicated range of pediatric solutions.

All of which are designed to provide outstanding sound quality in and out of the classroom. Once more it's a very cost effective solution as compared to other FM and remote microphone systems that are available in today's market. EduMic is breaking barriers and enhancing the classroom experience for those with hearing loss. I wanna thank you for participating in this session today introducing the need and support behind the unique benefits of Oticon EduMic. As always thank you for your interest in Oticon, we value your partnership and look forward to working with you as you begin to choose EduMic for your students.