JIFUNZE UELEWE

DRAFT: Pilot Screening Report

School-Based Hearing Pre-Screening Using Low-Cost Devices

10th March 2023

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Acronyms

AIE	Arithmetic and Inclusive Education
dB	Decibel
FGD	Focus Group Discussions
Hz	Hertz
GOT	Government of Tanzania
	IELSU Inclusive Education Life Skills Unit
	JU Jifunze Uelewe
	PO-RALG President's Office, Regional Administration and Local Government
MOEST	Ministry of Education Science and Technology
MOH	Ministry of Health
USAID	United States Agency for International Development

1.0 Introduction

Jifunze Uelewe (JU) is a United States International Agency (USAID) Tanzania project that aims to sustainably improve literacy and numeracy skills for all pre-primary and standard 1 to 4 learners in targeted regions by making—and/or improving—all classrooms welcoming and supportive to learners. It builds on the successes of the Tusome Pamoja project and the Arithmetic and Inclusive Education (AIE) project (Hesabu na Elimu Jumuishi). The five targeted regions in JU include the following: Iringa, Morogoro, Mtwara, Ruvuma and Zanzibar.

A subset of JU activities are designed to strengthen United Republic of Tanzania (GOT) systems and personnel to implement and sustain inclusive education and assessment strategies with a focus on improved learning outcomes for learners with disabilities, including learners who are deaf and learners who are blind.

JU aims to identify the weaknesses and constraints preventing students from attaining proficiency in literacy and numeracy and to devise and implement strategies to overcome those weaknesses and constraints. In doing so three outcomes are expected:

1. Improved literacy, numeracy, and social-emotional instruction by teachers
2. Capacity of local and regional government to collect and utilise data to improve learning outcomes increased
3. Increased community support for safe and inclusive learning environments (in and outside of the school)

In order to effectively achieve these outcomes as it concerns deaf and hard of hearing learners, early screening and identification is critical so that they are referred for proper assessment by a medical professional in order to receive the most appropriate intervention(s) for the child to learn effectively.

The field of study of hearing impairment in Tanzania is in a nascent stage, therefore, only a small number of children have access to hearing screening (Ertzgaard et al., 2019). Many deaf or hard of hearing children have not been screened upon arriving at a mainstream school, meaning that they get placed in a learning environment that is not fully accessible to them nor do they receive the reasonable accommodations they need to make the learning environment accessible and often get left behind in terms of speech, language, social and academic development. Often,

learners with hearing loss display symptoms that can be confused with signs of learning disabilities, such as difficulty holding attention, finishing timed tasks, and answering questions (Hayes et al., 2018) or display behavioural challenges simply because they are finding it hard to communicate in a way that works best for them.

Routine, universal school-based hearing screenings are an important intervention to identify students with hearing challenges in the absence of universal screening through the healthcare system and should be provided to all students in early grades and to all new students enrolling in school.

2.0 Selection of Screening Devices

Identifying an appropriate hearing screening device to use in school-based screening activities is important to provide insight into possible challenges that might negative impact learning and development. However, there are challenges to identifying devices that are portable, lower-tech, not reliant on electricity, cost-effective, easy to maintain and contextually acceptable. It is also important to consider the environment in which the screening can take place as ambient noise can negatively impact the results of the hearing screening.

While there are hearing screening devices paired with calibrated headphones, these are often cost prohibitive, especially for lower-middle income resourced countries such as Tanzania. For example, a screening device used earlier in JU, the HearScreen screening device from HearX has an initial cost of $860/unit with annual costs of over $670 for calibration, headphones, subscription fees, and shipping. Additionally, hearing screening devices that are app-based have costly requirements such as smartphones or tablets, headphones, extensive training, internet connectivity, and are often not as user-friendly, especially for young children, as is needed for school-based hearing screening.

On the other end of the spectrum, screening methods such as the “whisper test” or using a shaker to screen children’s hearing are largely unreliable, inaccurate, and, therefore, ineffective. They test both ears simultaneously and the dB level and frequency cannot be controlled.

In identifying a hearing screening device it is important to look for a tool that meets international best practices. As much as possible, a hearing screening device should use pure, isolated tones; it should test each ear individually; it should be administered in the way it was designed to be

administered; it should administer a clear pass/fail without need for interpretation; it should have standardised sound and internal calibration of noise intensity; it should be able to identify both high and low frequency hearing loss; and be used with noise cancelling earphones.

JU seeks to identify a low-cost screening device that can be used at school level by non-medical staff to test all students' hearing with the aim of referring those that might benefit from further assessment to an audiologist or other trained medical professional. This can lead to children with potential hearing difficulties being further assessed and, if identified with hearing difficulty, being paired with an intervention that can improve their quality of education and life.

It is important to note that these hearing screening devices are not meant to replace the assessments done at a medical centre with audiometers, otoscopes, and other medical equipment, but are a means to provide some insight and start a conversation for students who might not otherwise have known that they had hearing difficulty, whether temporary or permanent, and to receive the further assessment and interventions they need to be included in the classroom, not excluded.

Two low-cost devices have been identified: 1) the EAR Inc. Adjustable Hearing Screener and Fit Check device @$35.00/unit, and 2) the Universal Hearing Screener from Hearing Technologies International, Inc. at $20/unit These devices could be viable options for non-medical professionals to use for carrying out screening for all children in schools and, thereafter, to make referrals to local assessment centres for those that might benefit from further assessment with more advanced audiological equipment.

1) Adjustable Hearing Screener and Fit Check device	2) Universal Hearing Screener
	

The first device, the EAR Inc. Adjustable Hearing Screener and Fit Check device has 5 dB levels (40/50/60/70/80 dB) and 4 frequencies (500/1000/2000/4000 Hz) that can be selected in different combinations (for example, 40 dB and 1000 Hz or 80dB and 4000 Hz). The tone is a 2-second pulse tone. It requires 3 1.5V batteries (AAA). It is CE certified, meaning that it has been assessed by the manufacturer and deemed to meet EU safety, health and environmental protection requirements. It was designed by an audiologist, Garry Gordon, who is also the CEO of the company.

The second device, the Universal Hearing Screener from Hearing Technologies International, only produces output of 40dB but, like the EAR Inc. Adjustable Hearing Screener and Fit Check device, it has 4 frequencies (500/1000/2000/4000) Hz. The tone is a 2-second pulse tone. It requires 2 1.5V batteries (AAA).

In considering the recommended practices mentioned above, it is important to note that these devices cost $20-$35 per unit. They do not connect with calibrated, noise-cancelling earphones. However, because of their low cost, they are more likely to be taken up and maintained by the schools and government, used as a tool to provide insight, start a conversation, and make referrals for proper assessment that could lead to appropriate interventions.

Another note is that they start at 40dB and mild hearing loss occurs between 25-40 dB. Therefore, these devices are more likely to catch the students with moderate hearing loss and more. It is important to note that even mild hearing loss can have a significant impact on a child's understanding, especially a young child who has not yet acquired language need to provide context clues (Foust & Hoffman, 2022).

3.0 Purpose

The purpose of this activity was to explore whether, a) the Adjustable Hearing Screener and Fit Check device, and/or b) the Universal Hearing Screener from Hearing Technologies International are potentially effective, low-cost, viable options for teachers to use for school-based screening to provide insight for children who might have hearing difficulties and refer them for further assessment and interventions that may be necessary. The scope of this particular activity did not include testing the specificity or the sensitivity of the device, which is another critical component of this work. This study focused on the usability and acceptability of the devices with teachers who would be conducting the screening.

Research Questions

1. Are the devices easy to use by teachers at a school-level? If so, is one easier to use than the other?

2. Do(es) the device(s) effectively provide insight for children who might have hearing loss and, therefore, need a referral for further evaluation?

3. Do teachers know what to do if a child with likely hearing loss is identified?

4. In terms of cost, do these devices fill a critical gap in the referral process for learners with hearing loss as compared with other similar screening devices, such as the previously piloted HearScreen?

4.0 Methodology

4.1 Approach

To test the selected hearing screening devices, JU/eKitabu conducted a pre-screening pilot exercise at the two selected public primary schools, Jendele and Kanuni A, in Unguja, Zanzibar on 8th-9th February 2023; in mainland Tanzania the pre-screening activity took place at Nyamakala and Imehe primary schools in Iringa region on 13th -14th February 2023.

4.2 Orientation of Screeners

The JU/eKitabu team led a half-day induction training for a group of teachers, audiologists and government officials in Zanzibar followed by one day of pre-screening activities; and another half-day training for teachers and government officials in Mainland Tanzania followed by one day of pre-screening activities.

In Zanzibar, a total of 6 teachers were selected from the two schools for induction training. Additionally, there was one Ministry of Education and Vocational Training (MOEVT) officer, three Inclusive Education Life Skills Unit (IELSU) officers, two audiologists from the Ministry of Health (MOH), and one teacher who was also trained as an audiologist from Kisiwandui Primary School.

Similarly, in mainland Tanzania a total of six teachers were selected from the two schools in the Iringa region for induction training. Additionally, there was one officer from the President's Office, Regional Administration and Local Government (PO-RALG) and one official from the Ministry of Education Science and Technology (MOEST). No audiologists participated in this particular training. From all four schools teachers were selected based on the classes they taught from pre-primary to grade 4.

The training began by providing introductory information on hearing loss and the importance of early identification of a child who might have hearing loss in order to provide them with the proper intervention that would allow them to best be included in the education system with the support needed. The trainers emphasised that identifying students with hearing loss is not about exclusion, but inclusion.

The two different devices, the Adjustable Hearing Screener and Fit Check device, and the Universal Hearing Screener from Hearing Technologies International, were introduced, and orientation of the various features was provided as well as guidance on how to properly use the devices for conducting a screening, keeping in mind that the screening would be conducted on primary age students. The participants were given time to practise using the devices on each other in order to become comfortable before using them to screen students. Trainees were given time to ask any follow-up questions about the devices as well as provide suggestions to each other. In addition, they were to think through and discuss the contextual nuances that might exist given that they would be used in lower-resource schools, both in urban and rural settings. Similarly, they were asked to consider the differences between the two devices and be prepared to recommend one over the other in terms of its ease of use, its features, and what information it could provide in terms of hearing loss

An observation guide (Annex 1) was developed and used as teachers practised using the tool before testing on the students to make observations of how long it takes the teachers to understand how to use the instrument, where they experience the most challenges, and if they are understanding the purpose of the tool.

4.3 Participants

Screening data was collected from pre-primary to Grade four students from 4 different public primary schools: 2 in Unguja, Zanzibar one urban and one rural and 2 in Iringa, mainland Tanzania one urban and one rural across 2-3 different class levels (table 1). Screening children in four schools provided sufficient data for JU/eKitabu to make informed decisions about the teachers' ability and acceptability in using the devices for eventual scale.

In each school, students from 3 different classes ranging from pre-primary to Grade 4 classrooms were selected randomly so as to be able to observe differences in the way different age learners respond to the device/screening. In a school with more than one stream, only one classroom in pre primary to grade 4 was selected to participate in screening activity.

The pilot was conducted with students who are enrolled in regular primary schools. The rationale behind selecting regular schools instead of schools for the Deaf was that students enrolled in schools for the Deaf are more likely to have been previously screened and referred to these schools. Regular schools might have children that have not yet been screened before and, therefore, might be experiencing hearing difficulty that has not yet been identified.

4.4 Study Sample

A total of 120 children were selected for the screening pilot from four schools in the two regions, Zanzibar, and mainland Tanzania. All 120 children that were screened came from pre primary to grade 4. There were 60 boys and 60 girls as shown in Table 1.

Table 1. Number of children screened per region and school

Region	Schools	Students	Gender	
			Girls	Boys
Zanzibar, unguja	Jendele Primary School	30	15	15
	Kinuni Primary School	30	15	15
Mainland, Iringa	Nyamakala Primary School	33	17	16
	Imehe Primary School	30	15	15
Total		120	60	60

4.5 School-level screening process

After the induction, teachers conducted the hearing screening using the two devices, a) the EAR Inc. Adjustable Hearing Screener and Fit Check device, and/or b) the Universal Hearing Screener from Hearing Technologies International alongside a result sheet (Annex 4) which listed out the various decibel and hertz levels and a column for each the right and the left ears. During the testing, teachers screened at the school they were teachers at to make the children more comfortable. A teacher from the other school recorded the result using a pre-screening results sheet. Each teacher screened ten students with each device, starting with the EAR Inc. Adjustable Hearing Screener and Fit Check device and followed by the Universal Hearing Screener from Hearing Technologies International. The reason for this order was because the EAR Inc. Adjustable Hearing Screener and Fit Check device has higher decibel levels that could be programmed first so the child was more likely to hear the tone that they were to then listen for at lower decibel levels.

The purpose of the activity was to test the usability and acceptability by teachers in using the devices and identifying an environment at the school that could be used for this type of screening (not for testing the sensitivity and specificity of the devices and therefore, not for referral at this stage).

Jendele Primary: The screening was conducted in a classroom at the back of the property, away from most classes. This provided for a more manageable noise level to conduct the screening. There were no windows or doors (it was an open-air classroom) so it was important to monitor the noise level, especially during class breaks. Students were selected from pre-primary, class 2 and class 4 and were not nervous about the activity. There were 3 children being simultaneously screened in one large classroom. Teachers gave instructions to the students about how screening was to take place. A seat was placed facing the wall to avoid any external interruptions during screening. Within the room 3 children were being screened simultaneously, everybody in the room was requested to maintain silence. In total 15 children were screened here.

Kanuni A Primary: This was a large urban school with thousands of children so noise levels were impossible to control even in a classroom with windows that could be shut. The exercise was moved to the neighbouring secondary school where the exercise continued. The exercise took place in the first-floor classroom where windows and doors could be closed and noise levels better controlled. The only challenge here was the heat once the doors and windows were closed.

Teachers for this school screened their own children, having had the experience from watching their counterparts from the previous school. The same process as the one done in Jendele was followed and this made the screening activity to be swifter and completed faster.

Nyamakala Primary: This school had a classroom and office that were used for screening the children as they were easy to manage in terms of noise control. Two students were screened in the classroom, which had windows and doors that could be shut and the 3rd student was screened in the office. Teachers performed the screening rather swiftly but had to be corrected on a few things earlier on in the activity.

Imehe Primary: The classroom where screening was done was about 500 metres apart from the other classrooms, this gave a fairly good environment in regards to the noise level at the time the screening was being conducted, the noise level was 40 decibels.

Three students were screened in one classroom, whereby each student sat in one corner of the classroom. Following the lessons learned in Nyamakala, whereby teachers from Imehe were supporting teachers from Nyamakala to record the data on a results sheet, teachers from Imehe did show improvement on how they are conducting the training.

4.6 Focus Group Discussions (FGD)

In the two regions following each school screening pilot, the team conducted Focus Group Discussions (FGD) with teachers. Feedback on the devices was discussed as well as reactions from the various aged children, the environment where the device was used for screening, the preference for one device over the other, and ultimately, whether they

believe these devices could be a good tool in identifying children with potential hearing loss onto the assessment centre for further evaluation.

4.7 Referral Services

This piloting activity was primarily to test the usability of these devices in this contest, not the sensitivity and specificity of the devices. In Zanzibar, audiologists were present and mentioned that this was a useful screening tool that can be used for early identification of children with hearing loss for referral to their offices for further assessment and evaluation. Audiologists were unavailable in Iringa, however during another JU training that was taking place later in the week, one teacher from Pomerini Primary School, who is an audiologist by training, was briefed on the activity and the two devices. He gave a positive response and he also emphasised that the tools could be used in remote places where screening is even less likely to take place. He requested to be involved in other activities going forward.

Previous work under JU and other USAID projects have collected data on the medical and professional services available within each district and region. These should be updated and made available to each school.

5.0 Key Findings and Discussion

During this activity, JU/eKitabu were able to train a total of 12 teachers from four schools; 6 teachers from Zanzibar and 6 teachers from Mainland Tanzania. At these same four schools, we screened 120 children ranging from pre-primary to class 4 with the intention of better understanding and observing whether the teachers were using the low-cost hearing screening devices correctly, what the environmental constraints were by conducting the screenings at the schools, how much time was needed to screen each student, and how children respond to the hearing screening with the devices used.

The following observations and feedback were the focus of the findings, rather than the results of the hearing screening. The results from the screening provided some insights into the importance of the screening environment and practices of the teachers during screening.This particular screening was not to be used for referral purposes as

sensitivity and specificity of the screening device has not yet been tested and this would need to be done to use the data for referral. We also understand the importance of ensuring that the whole system is prepared to provide for the child who is identified with hearing loss and further investigation needs to take place to ensure that there are sufficient numbers of assessors/audiologists, that they are equipped with working equipment, and that they fully understand the interventions that can be provided to children with different levels of hearing loss and that those interventions are available.

After induction, the teachers had the time to use the devices to practise screening on each other. This enabled them to hone their skills and become comfortable with the devices in addition to asking any questions that would allow them to improve upon their screening skills. The observation guide that was developed before the training was used during this time of practice and the following observations were noted;

- **Initial setting:** It is important to start the screening with the 80dB tone so that the child has a chance to know what type of tone they are listening for (this is a bit counterintuitive since the device automatically turns on at 40dB). This point needs to be emphasised in the training.
- **Output:** Ensure the “output” blue light is flashing which signifies a tone is being produced. Ensure it is off when switching tones. Some teachers held the device up with the correct combination of dB and Hz but forgot to press “START” and therefore no sound output was being emitted.
- **Training:** Need a bit more training on the difference between loudness (dB) and frequency (Hz).
- **Cultural nuance:** In Zanzibar, most females wear hijabs which cover their ears. The female teachers conducted the screening through the scarves which didn’t seem to inhibit the sound but should be tested as it might actually decrease the distance between the device and canal and the cloth might muffle the sound.
- **Randomization:** The production of tones for screening needs to be a bit more randomised and include some instances of no sound

being produced to check that the child is not just raising their child when they “feel” that the device has had a change in tone (because of movement of the screener’s hand).
- **Device positioning:** Teachers sometimes held the device too far from the ear canal of the student being screened or held it backward (with the noise output going away from the ear instead of into the ear).
- **Unnecessary prompting:** Teachers were asking the students being screened if they could hear the tone or not. Teachers should not prompt the students t during screening.

During the hearing screening with students from the various schools, another observation guide was used and the following notes were taken.

- **Confidence**: Initially teachers had challenges screening children because of lack of confidence in using the tool. This improved drastically over time.
- **Time**: The time taken to screen one child with the EAR Inc. Hearing Screening and Fit Check device was 7-10 minutes and reduced down to 6-7 minutes. The time taken using the Universal Hearing Screener was 6-7 minutes initially and reduced down to 3-4 minutes per child.
- **Support**: The screening was done by two teachers: one doing the actual screening and the other one recording the results. This allowed for more efficiency and allowed the teacher conducting the screening to focus a bit more on the process. The presence of an audiologist in Zanzibar made this initial screening easier as each audiologist was paired with the teacher to assist in case the teacher was making a mistake in positioning of the device.
- **Ambient Noise**: In one school in Zanzibar, there was some noise interference due to rains (the activity stopped for a little while), nearby students during school breaks, student noise at the urban school where there were thousands of students. A sound metre app was used to measure the ambient noise and while 50dB or less was what we aimed for in terms of the screening environment, sometimes the noise level escalated to up to 70dB at the schools with larger populations. In Iringa, shutting the windows was a

possibility so this was done to reduce the noise level. This was not possible at the rural school in Zanzibar where windows didn't exist. At the urban school, where the screening was conducted on the second story of the neighbouring secondary school, the heat made it uncomfortable to close all of the windows. Need to ensure that there is no chatter from teachers/ screeners/ others in the room.

- **Environment**: The environment provided by the schools for screening had some challenges, for example some classrooms were open-air with no ability to shut windows/doors. The metal roof was quite loud during the rain. One positive was that the classroom used for testing was further away from other classrooms so ambient noise from classrooms was not an issue except for when students were going from one class to the next or were on recess/break.
- **Setup**: 3 children were screened at the same time in one classroom: each facing the corner or the wall to avoid external distraction . Since there was no speaking during the screening (once instructions had been given), this was not an issue but not ideal. The other sampled remaining children yet to be screened were kept in the next classroom this caused a bit of anxiety as the children waited. Teachers must conduct screening standing behind the student, not to the side as was noticed on some occasions.
- **Early ages:** Screening young children (pre-primary) was a bit more challenging as it took a little bit longer time (there was a need to repeat the instructions, reminding the child to raise their hand upon hearing the tone) than for older children who understood instructions the first time.
- **Feedback**: No feedback to the child (some teachers were telling students "good job", or "ehh' ' in a disappointed way). This is not a good practice.

Finally, FGDs were conducted with the teachers (and audiologists in Zanzibar) and others who were participating as observers. The following feedback is noted:

- **Preference**: Teachers observed that the two devices were good for testing the children for hearing loss, however the E.A.R. Inc. Adjustable Hearing Screener and Fit Check device was preferred to the Universal Hearing Screener from Hearing Technologies International. The Universal Hearing Screener from Hearing Technologies International was a bit simpler to use but doesn't provide as much information which is important for proper identification of learners with possible hearing difficulties and referral. It was noted that the device provides the insight needed to start a conversation if a child does seem to be experiencing hearing loss but understood that this was a screening tool to be used for referral to further assessment, not an assessment tool itself.
- **Additional time to practise**: Teachers reported that orientation/training time was too short and they could have used more time to practise doing the screening during the training.
- **Battery Power**: Both devices could be used in rural areas, as neither relies on electricity.
- **Lack of fear**: Children of all ages that were screened (pre-primary to Grade 4) did not show any signs of fear/concern/discomfort during the screening.
- **Clear instructions**: Children need very clear instructions before the screening is conducted. Ensure the child doesn't have their hand up still when the screener moves to the next tone.
- **Environment**: The screening environment is critical and needs to be taken seriously: roads near the school, weather, proximity to other classes, school scheduled breaks.

Finally, as mentioned, results from the screening were recorded but for the purpose of checking the differences in the two devices, whether students of different ages/grades had clear difficulty with the tools, and if there were trends that might point to environmental considerations. The following were of note when reviewing the results sheets;

- With the EAR Inc. Adjustable Hearing Screener and Fit Check device, students displayed higher rates of hearing difficulties at 40 and 50dB. This makes sense as the environments were not always ideal in terms of the ambient noise and the lower dB tones might

be difficult to hear simply because the background noise was too much.

- Younger students have a bit more difficulty with the screening requiring the instructions to be repeated several times, not putting their hand down without prompting, and generally taking longer to complete the screening as opposed to older children. Older children also seemed to have less challenges hearing the range of tones which might be due to maturity and understanding the task at hand a bit better.
- The EAR Inc. Adjustable Hearing Screener and Fit Check device seemed to be more reliable. Many children had difficulty hearing the tones from the other device, the Universal Hearing Screener despite being set at 40dB which the EAR Inc. Adjustable Hearing Screener and Fit Check device also produced.

6.0 Conclusion and Recommendations

6.1 Conclusion

Following the training and orientation of teachers for the two hearing screening devices and testing the devices on 120 students across 4 schools in Unguja, Zanzibar and Iringa, mainland Tanzania, the EAR Inc. Adjustable Hearing Screener and Fit Check device which measures various decibel (loudness) levels as well as hertz (frequency) levels seemed to be the preferred option of the two devices. The reason being that the device was able to provide adequate information to make a referral for a student to further assessment. With adequate practice, the teachers were able to comfortably use the screening tools with younger students and mark results on a results sheet. Further information needs to be gathered to determine when the child warrants further assessment although the tool was user friendly by a non-medical professional, and could quickly screen a child within 5-7 minutes. Further piloting needs to be done to test the sensitivity and specificity of the device. Audiologists in the training were very pleased and applauded this device as something that could both ensure that students are sent to their centres that would not otherwise make a trip to their centres for further

assessment while also preventing their centres from having to conduct all screening/assessment.

6.2 Recommendations

Based on the pretesting findings, the team recommends the following:

1. Conduct a concurrent validity study for the specificity and sensitivity of the EAR Inc. Adjustable Hearing Screener and Fit Check device alongside audiometers and other medical equipment used in the medical centres.
2. Training should be at least 2 days with more information about the referral process and interventions.
3. Audiologists should be involved in this process.
4. Deaf people and organisations of persons with disabilities (OPD) should be brought in to discuss the importance of deaf children being provided the proper support and accommodations to be able to access inclusive education.
5. Need to develop a hearing screening guide with thorough protocols for the entire process
6. Update the data on the medical and professional services available within each district and region that was previously collected by JU staff.

Annex 1: Observation Guides and FGD Guides

Observation Guide (for teachers during training)

- Do teachers understand the purpose of each tool?
- Do teachers understand the differences between each tool?
- Do teachers hold the tool correctly?
- Do teachers use the tool correctly? (switching between dB/Hz levels appropriately)?
- Do teachers show fear or dislike of this technology?
- Do teachers record the results correctly?
- Do teachers experience any confusion when using each tool? If yes, where do teachers experience the most confusion when using each tool?

Observation Guide (for teachers during piloting)

- Do teachers introduce the screening activity correctly?
- Do teachers hold the device to the student's ear correctly?
- Do teachers use the tool correctly? (switching between dB/Hz levels appropriately?)
- Do teachers record the results correctly?
- Is the screening environment quiet enough to be able to conduct the screening activity?

Focus Group Discussion Questions

- Which of the two tools would you recommend to be used for screening in a school setting?

- On a scale of 1-5 how will you rate your confidence level to conduct screenings among students of all ages?

1	2	3	4	5
very low	low	not sure	high	very high

- Do you think hearing screening will help you to identify students who might have hearing difficulty and get them the support they need?

Annex 2: Sample numbers

Data from Unguja - Zanzibar

Number of children in Jendele Primary School:

Grade	Number of pupils registered schoolwide			Number of pupils screened		
	M	F	Total	M	F	Total
Pre-Primary	21	25	46	5	5	10
2	24	21	45	5	5	10
4	32	23	55	5	5	10
Total	77	69	146	15	15	30

Number of children in Kanuni A Primary School:

Grade	Number of pupils registered			Number of pupils screened		
	M	F	Total	M	F	Total
2	81	63	144	5	5	10
3	56	66	122	5	5	10
4	72	70	142	5	5	10
Total	209	199	407	15	15	30

Data from Iringa Mainland Tanzania

Nyamakala Primary School - Iringa

Grade	Number of sampled Girls screened	Number of sampled Boys screened	Total
3	8	8	16
4	9	8	17
Total			

Imehe Primary School - Iringa

Grade	Number of sampled Girls screened	Number of sampled Boys screened	Total
Pre-primary	5	5	10
2	5	5	10
4	5	5	10
Total	**15**	**15**	**30**

Annex 3: Photos from the screening activity

A teacher from Kinuni A Primary School, Unguja, Zanzibar screening a female student

A teacher from Imehe Primary School, Iringa screening a male student

JU/eKitabu team engaging with teachers and audiologists during a FGD at Kinuni A Primary School in Unguja, Zanzibar

Screenshot of an app-based sound metre to obtain a reading of the ambient noise in the screening environment

Annex 4: Pre-Screening Results Sheet

Pre-Screening Results: EAR. Inc Adjustable Hearing Screener & Fit Check

Make sure you are in as quiet of a spot as possible. Use the sound metre to test the level of ambient sound. You want it to be below 50dB. You will need one chair for the child facing towards a wall, with space behind the chair for you to stand so the child can not see you. You can stand in front of the child as you explain the instructions, but while you are testing them, you will stand behind them so that they don't receive any visual cues.

Teacher: "Hello, I hope you are well today. Today I am going to test your hearing with a small device. It has a beep that has different levels of loudness and different levels of pitch. High pitch like a bird singing and low pitch like a drum. I'm going to hold the device up to your ear and when you hear the beep, I want you to raise your hand. It will not hurt, you will just be listening for a sound. Is that okay with you? First, I want to ask you a few questions and then we will begin the hearing screening."

What is your name? (Fill in below)
What is your age? (Fill in below)
What class are you in? (Fill in below)

Thank you for answering those questions. Are you ready to begin?

(*The rest of the answers can be provided by you ahead of time)*

Name of child: _____
Name of school: _____
Gender: _____
Age: _____
Class: _____
Date Tested: _____

(Now, you will turn on the screening device and switch the decibel level to 80 (the loudest sound), so that the child knows what sound they are listening to. As you test different dB levels and Frequency (Hz) levels record whether they raised their hand to indicate that they heard the tone by placing a tick where they raise their hand correctly, and an X where they don't raise their hand when a sound is played.

Decibel Level (dB)	Frequency Level (Hz)	Right Ear	Left Ear
80 dB	500 Hz		
80 dB	1000 Hz		
80 dB	2000 Hz		
80 dB	4000 Hz		
70 dB	500 Hz		
70 dB	1000 Hz		
70 dB	2000 Hz		
70 dB	4000 Hz		
60 dB	500 Hz		
60 dB	1000 Hz		
60 dB	2000 Hz		
60 dB	4000 Hz		
50 dB	500 Hz		
50 dB	1000 Hz		
50 dB	2000 Hz		
50 dB	4000 Hz		
40 dB	500 Hz		
40 dB	1000 Hz		

40 dB	2000 Hz		
40 dB	4000 Hz		

Tested by: _____ Sign_____

Teacher: Thank you for letting me test your hearing. You can go back to class now.

Pre-Screening Results Universal Hearing Screener

Make sure you are in as quiet of a spot as possible. Use the sound metre to test the level of ambient sound. You want it to be below 50dB. You will need one chair for the child facing towards a wall, with space behind the chair for you to stand so the child can not see you. You can stand in front of the child as you explain the instructions, but while you are testing them, you will stand behind them so that they don't receive any visual cues.

Teacher: "Hello, I hope you are well today. Today I am going to test your hearing with a small device. It has a beep that has different levels of pitch. High pitch like a bird singing and low pitch like a drum. I'm going to hold the device up to your ear and when you hear the beep, I want you to raise your hand. It will not hurt, you will just be listening for a sound. Is that okay with you? First, I want to ask you a few questions and then we will begin the hearing screening."

What is your name? (Fill in below)
What is your age? (Fill in below)
What class are you in? (Fill in below)

Thank you for answering those questions. Are you ready to begin?

(*The rest of the answers can be provided by you ahead of time)*

Name of child: _____
Name of school: _____
Gender: _____
Age: _____
Class: _____
Date Tested: _____

(Now, you will turn on the screening device and switch the decibel level to 80 (the loudest sound), so that the child knows what sound they are listening to. As you test different frequency (Hz) levels, record whether they raised their hand to indicate that they heard the tone by placing a tick where they raise their hand correctly, and an X where they don't raise their hand when a sound is played.)

Decibel Level (dB)	Frequency Level (Hz)	Right Ear	Left Ear
40 dB	500 Hz		
40 dB	1000 Hz		
40 dB	2000 Hz		
40 dB	4000 Hz		

Tested by: _____ Sign_____

Teacher: Thank you for letting me test your hearing. You can go back to class now.