Using the 'Whisper Test' to Identify Hearing Loss in Young Children

Nel, N.M.

Email: nelnm@unisa.ac.za

Gous-Kemp, C.S.

Email: kempcs@unisa.ac.za

Muller, H.

Email: mulleh@unisa.ac.za

Motitswe, J.M.C

Email: motitjmc@unisa.ac.za

Tlale, L.D.N.

Email: tlaleldn@unisa.ac.za

Mahlo, F.D.

University of South Africa, University of South Africa (UNISA),PO Box 392 Pretoria 0003
Email: mahlofd@unisa.ac.za

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Abstract

A hearing impediment or loss can have profoundly negative effects on a child's personal, social and academic growth if it is not identified at an early age. This study used a bio-ecological model of development with an asset-based approach to assessment. The focus was on identifying the strengths of learners and assets in the environment with a view to providing appropriate intervention. During a pilot study, the teachers of the Unisa Centre for Early Childhood Education (UCECE) used the whisper test to assess the hearing of the children in their classes. The results were verified by audiologists using formal hearing tests. As a result of the findings of the whisper test, checklist and formal hearing tests affected children could be referred for further medical diagnosis and interventions. The main aim of this study was to provide training guidelines for early childhood teachers on how to screen children with hearing loss with the assistance of audiologists.

Keywords: *inclusive education, teacher training, rural areas, early identification, preventative measures.*

1. Introduction

It is estimated that six of every 1000 babies are born with a significant hearing loss. This is an alarming fact, especially in the South African context, where "hearing loss has the second highest prevalence rating on the disability scale" (Pillay, Moonsamy & Khoza-Shangase, 2010, pp 92). Another matter of concern is that there is a significant number of young children who have some type of hearing problem that can be temporary or permanent (Wilson, 2003, pp 109–110). Temporary hearing loss can be caused by middle ear disease (otitis media) which affects up to 75% of children during the first two years of their lives. On the other hand, permanent hearing loss is caused by a damaged cochlea or auditory nerve (sensori-neural), and can vary from being mild to profound. Such hearing loss causes major communication as well as academic and social problems. The critical period for language development is during the child's first three years, however, approximately 50% of infants with hearing impairments are not identified during this phase and manifest serious language and learning problems as a result. Sometimes hearing loss in young children is misdiagnosed as cognitive

delays as they do not respond to language stimuli such as questions, demands and greetings. They also fail to use appropriate expressive language. Yet when they are tested on non-viable measures, they score within the normal range of intelligence.

The whisper test is a simple yet effective way of detecting hearing loss. This test was proposed by a group of professional audiologists, who had tested thousands of learners, under primitive conditions, all over Africa. In fact, they claimed that the whisper test is more effective for screening purposes than is widely believed (Kassner, 2012). A more elaborate exposition of the strengths and weaknesses of the whisper test is presented below. Based on the discussions with this group, and despite contradicting reports in literature regarding the whisper test, the researchers in this study decided to test its effectiveness.

The purpose of this research was to test the effectiveness of the whisper test in detecting hearing loss in young children at the Unisa Centre for Early Childhood Education (UCECE) and to provide training guidelines for teachers to screen young children for hearing loss, using the whisper test and an accompanying checklist. In this article background information is presented by means of a discussion on early identification and intervention and assessment of hearing loss by means of the whisper test, followed by the theoretical framework for this study, and a description of the research conducted.

2. Early Identification, Assessment of Hearing Loss and Intervention

Bolat, Bebitoglu, Ozbas, Altunsu and Kose (2009, p 1621) and Jones (2009, pp 15–16) emphasize the early identification of hearing loss of new-born babies in the first three months, and intervention implementation within the first six months of their lives. Opportunities for screening babies for hearing impairment within the first three months are not readily available in South Africa, especially in the rural areas where parents are often illiterate and still believe that babies born with impairments are cursed. In many cases, the first opportunity for young children to be assessed for hearing problems might be when they go to school. Only those who are fortunate enough to attend a preschool and have an alert or knowledgeable teacher will be supported to develop and to learn to read and write. Thus it is crucial that preschool teachers should able to assess learners by means of a simple screening test as early as possible. In this way they will be able to identify learners with hearing impairments and refer them to the relevant professionals for appropriate intervention. As most causes of conductive hearing loss can be treated by means of medical interventions, education intervention is vital (Wilson, 2003, p 110). Early childhood development (ECD) centres, and specifically knowledgeable ECD teachers, can play a determining role in the lives of young children by providing early stimulation, educating parents, accessing services, encouraging resilience, preventing risk and linking people to essential services, particularly in rural areas (Ebrahim, Killian & Rule, 2009, pp 387–396).

3. Assessment of Hearing Loss Using the Whisper Test

Kochkin (2009, p 16) explains that mild hearing loss in children can have an impact on their school performance, which necessitates early detection and intervention. S'liwa, Hatzopoulos, Kochanek, Pilka, Senderski and Skarzynski (2011, pp 483–484) allude to more sophisticated procedures that have "higher sensitivity and specificity, and allow a more precise evaluation of hearing". However, they also advocate the use of older, simplified hearing tests, including the whisper test.

Sabo (2004, p 97) asks the question: *How accurate is the whisper test in detecting hearing impairment in adults and children?* and concludes that the whispered voice test used to detect hearing impairment is simple as well as accurate. However, true responses are lower when the test is used on children, a fact that can be ascribed to methodological issues. Sabo goes on to suggest that further investigation is needed, and that the test should be standardized. The whisper test is a subjective method of assessing hearing loss because factors such as loudness of the whisper, the choice of stimuli (words, letters or numbers) and the distance of the speaker from the testee have a huge impact on the outcome of the test. Of particular concern is the loudness of the examiner's whisper, something that is almost impossible to control. It is imperative to control the audiometric data in order to draw conclusions regarding the efficacy of the whisper test as a screening tool to detect hearing loss.

Little research has been done to determine the effectiveness of the whisper test, though it is clear that there are positive as well as negative opinions. The reason for negative reports from certain researchers in developed countries (Jones, 2009, pp 15–16) is mainly that the objectivity and reliability of the whisper test can be challenged. These researchers assert that the test should be used only in developing countries where there is no other alternative. On the other hand, when Pirozzo, Papinczak and Glasziou (2003, p 967) tested children's hearing using the whisper test, they determined that the performance of the test "compares favourably with the portable audioscope". The ages of their

subjects ranged from three to 12 years, and children under the age of six were asked to point to a picture which represented the word. The research concluded that the whisper test is simple, yet accurate in detecting a hearing impairment. However, they were concerned about the "lower sensitivity in children and the overall reproducibility of the test, particularly in primary care settings". They recommended further studies to standardize the testing protocol. This challenge has been taken up by the researchers of this study as they have attempted to justify the effectiveness of the whisper test in a pilot study. However, more research is needed to standardize the testing protocol.

4. Theoretical Framework

This study conducted assessment from a bio-ecological perspective, using the whisper test together with an accompanying checklist. Bouwer (2011, p 56) asserts that one needs to take cognisance of four principal components when implementing the bio-ecological approach, namely process, person, context and time. This means that the learner's level of development and the influence of the context (the family, school, peer group and community) of the learning need to be considered. The learners' proximal process of interaction with their environment is pivotal to interpreting their performance and planning support from their life worlds. Bouwer stresses the "interrelatedness and mutual dependency of systems as well as individuals" to form the framework for assessing and interpreting the information and developing a collaborative intervention plan.

It is at this point that the asset-based approach together with dynamic assessment becomes the initial acts of assessment. The aim is to arrive at a point where learners with barriers to learning are able to actualize their potential in a self-regulatory way within their context, and to make maximum use of available resources (assets that include extrinsic resources which include personal, institutional or inanimate things). Donald, Lazarus and Lolwana (2010, p 43) explain that one may need to concentrate on one particular level of a system more than on another while addressing a challenge. For example, with regard to the education process, the learner's learning may be influenced by the family's degree of emotional support. Bouwer (2011, p 57) emphasizes that trust is an important component where all people in need of support are recognized and appreciated for who they are, and their personal strengths and positive disposition ("qualities of intentionality" such as interest and motivation) are also respected. At the heart of the asset-based approach is collaborative support.

As the learners in this study were screened using the whisper test and checklist, the results could be verified by a team of audiologists who, in turn, referred those who presented with hearing loss to appropriate medical practitioners. Thus it is important to note that while the asset-based approach recognizes the learners' needs, an asset-based intervention concentrates on the identification and access of the learners' assets and mobilising it for sustainable support (Ryan, 2008). Mitchell, De Lange and Thuy (2008, 109) stress the importance of employing an asset-based approach to counteract exclusionary practices in ECD centres and schools. It calls for effective inclusive education practices which need community involvement efforts in order to ensure that all voices are heard.

5. Research Methodology

A pilot study was undertaken to explore the effectiveness of the whisper test concept on a small scale before embarking on a large, comprehensive study.

UCECE in central Pretoria, South Africa, was identified for this study. This school was selected because of its ties with the University of South Africa (where the researchers are based) in that the university has financial and training links with the school and regards its input as a community outreach initiative. The school accommodates approximately 200 learners between the ages of three months and six years in eight classes. The whisper tests were conducted on an individual basis in the classroom environment, and the effectiveness of the test was measured against paired audiology test results (also conducted in the classroom environment). Per-class assessment was conducted with the three- to six-year-olds as the participating audiologists advised that the younger children were too young to respond to the tests. In total 51 learners were assessed. The audiologists were able to test only 37 of these 51 learners, which reduced the number of observations available for the comparison of the two tests (Tables 2–4).

The research question to be answered by the study was: *Does a statistically significant correlation exist between the results of an audiology test and those of the whisper test*? A statistically significant correlation would prove the trustworthiness of the whisper test since the audiology tests had been proven to be accurate. The predictive potential of additional ear health-care variables were of interest to the research as well. These variables are discussed in more detail in the next section.

6. Measuring Instruments

6.1 The whisper test

The whisper test was administered individually and consisted of ten words whispered to a learner by a test administrator seated directly behind the learner, 50cm away. The words were whispered using a constant volume; they were clearly audible but said in a whisper-tone. An assistant was seated in front of the learner to ensure that the learner kept his/her head turned to face the assistant and concentrated on the task. Thus the assistant could reinforce the required behaviour by making encouraging signs and displaying positive facial expressions. This method excluded the possibility of lip reading and masking any hearing deficiency. The test administrators were trained in advance to ensure that their tone of voice, pronunciation and volume were very similar to ensure consistent test administration conditions. Learners had to repeat what they had heard each time a word was spoken by the administrator. The ten monosyllabic words were specifically selected by a speech therapist as they are words used in speech discrimination. These words were: *food, bike, ship, fish, fun, bed, jam, cat, pot* and *hug*.

The test administrator recorded the number of incorrect responses to these ten words. The number of incorrect words recorded for each learner served as the learner's whisper test score. During test administration, the incorrect "word", which the learners offered in reply to the test-word, was also recorded (for example learners offered the word "foot" in response to the whispered word, "food"). The test was administered during school time in prearranged school periods in the classroom. The rest of the class watched while their fellow learners completed the test. This created a relaxed atmosphere among learners as they knew what to expect when they were assessed. Once the learners had completed the test, they were rewarded with a chocolate. This approach reinforced the relaxed atmosphere. The sequence of the words was changed with each administration to ensure that the learners did not learn the word sequence before being tested. As they were subject to the programme of the school, four test administrators and four assistants administered the whisper test in one day.

During the whisper test sessions, the class teacher also completed a checklist on each learner's medical history and auditory classroom behaviour to complement the whisper test data (the format of the inventory is detailed in Table 2). Additional information collected in this way included:

- *a medical health history* which queried six ear-health symptoms. For example: "*Does the learner suffer from seasonal allergies?"*
- *speech patterns of* learners identified by three speech behavioural symptoms that manifest in children with hearing disorders. For example: "*Does the learner speak too loudly in the classroom?"*
- *auditory classroom behaviour* of learners assessed in 16 auditory behavioural pattern queries. For example: "*Does the learner often ask for the volume to be turned up?*"

The collection of additional *auditory behavioural pattern* information was regarded as a probable supplementary identifier of hearing problems.

Participatory consent was arranged with the university, school committee, principal and parents before the research were undertaken. The letter of consent communicated to parents prior to the whisper test administration, informed the parents of the additional information that would be collected on each learner's auditory health.

6.2 Measures of hearing loss

Five measures of hearing loss detection were defined and calculated from the information collected during the whisper test sessions. This included the primary whisper test measure calculated as the numbers of incorrect word responses offered by each learner. The value range for this variable was 0 to 10. In the same way, an auditory classroom behaviour measure was calculated as the number of auditory classroom behaviour traits exhibited by each learner (range 0–16); a medical hearing-symptoms measure derived from the number of health (ear-health) symptoms recorded for each learner (range 0–4); a second allergy or infection health measure on the presence of allergies or infections reported for each learner; and a speech-pattern deviation measure of the number of deviations in the speech pattern of learners. These measures are reported in Table 3. The data were electronically captured and named variables were calculated once test administration had been completed.

6.3 The audiology test

The audiology tests were administered by five trained audiologists from a hearing systems company with whom the

University of South Africa (Unisa) had entered into an agreement. The company was willing to cooperate as part of its community outreach. The audiologists visited the school during the same period that the whisper test was administered, and conducted their audiology tests independently. They tested 91 learners.

Three tests were administered by the audiologists, namely a pure tone audiometry test, a tympanometry test, and an otoacoustic emission (OAE) test. The three tests are briefly outlined:

1. Pure tone audiometry is the basis of hearing evaluation. With pure tone audiometry hearing thresholds are measured for pure tones at different test frequencies. Hearing thresholds are typically defined as the lowest or softest sound level needed for a person to detect the presence of a signal approximately 50% of the time. Threshold information at each frequency is then plotted on a graph known as an audiogram (Bess & Humes, 2003).
2. A tympanometry test is a sensitive and objective diagnostic tool that is used to identify the presence of fluid in the middle ear, to predict audiometric findings, to determine the nature of physical hearing loss and to assist in diagnosing the site of auditory lesion. (Bess and Humes, 2003; Gelfand, 2001)
3. Otoacoustic emission is an objective tool that measures the signal generated in the inner ear and signal-transferrance to the ear canal. In the ear canal the signal is recorded by a microphone (Gelfand, 2001; Roeser, Valente, and Hosford-Dunn, 2007). Otoacoustic emissions are generated in functioning outer hair cells within the inner ear.

The audiology data entered into the research data base was the final diagnosis of the audiologists, and was coded as follows: '1' signified *passed the test/no hearing disability*; '2' signified *referred to a medical doctor/temporary hearing disability suspected due to a medical condition such as middle ear infection*; and '3' indicated *referred to an ear specialist/permanent or serious temporary hearing loss suspected*. This variable defined *the audiology test outcome*.

7. Analysis Results

In this section, hearing test results are reported in one-way; two-way; and composite one-way frequency tables. The relationship between the whisper test, supplementary tests and audiology test results is expressed by means of Pearson's Chi-square (and Cochran-Armitage trend test for two-way frequency tables), and Spearman's correlation coefficients. The results of 50 learners were included in the analysis (one learner could not complete the tests due to illness).

7.1 General overview

An exploratory one-way table (not included in this article) on the number of incorrect responses to the 10 whisper test words (total of 104 incorrect responses) revealed that the words learners most often had difficulty with were, *bed* (14.42% of incorrect responses); *fun* and *fish* (12.5% and 12.5% of incorrect responses), and *food* and *hug* (in both instances, 11.54% of in correct responses). This was followed by *cat* (8.65% of incorrect responses); *bike* and *pot* (7.96% of incorrect responses for both words), and *ship* and *jam* (6.73% of incorrect responses in both instances).

Table 1a reports on the number of *medical symptoms* (ear-health and allergy/infection); *auditory classroom behaviour* traits and *speech pattern* deviations observed for the previously mentioned variables: *health history, classroom behaviour, and speech pattern deviations*. For example, an *auditory classroom behaviour* score of 3 implied that a specific learner exhibited three behaviour traits of the 16 queried.

Table 1a also presents details of the symptoms and traits assessed. Table 1b presents the frequency distributions of the totals of symptoms and behaviour patterns or traits observed from each learner. These totals represent ***auditory classroom behaviour; medical hearing-symptoms;*** *allergy or infection* ***health measure*** and a ***speech-pattern deviation measure***.

Table 1a: Medical history, speech pattern and auditory behaviour-inventory
Number of symptoms or behaviour patterns (and % of total) extrapolated from the data on medical history, speech pattern and auditory behaviour

Medical history*:* items on the *hearing-symptoms* measure		**Auditory behaviour:** items of the *auditory classroom behaviour measure*[#]	
1. Discharge from ear	6 (23.08)	1. Say a "huh"	23 (15.97)
2. Ear ache	4 (15.38)	2. Slow to react	8 (5.56)
3. Ringing in the Ear	3 (11.54)	3. Daydreams	6 (4.17)
4. Child covers ears	13 (50.00)	4. Reads facial expression	15 10.42)
Total no of symptoms	26	5. Requests volume increase	9 (6.25)
Medical history: items on the *allergy or infection health symptoms measure*[&]		6. Searches for direction of sound	9 (6.25)
Allergies	3 (60.00)	7. Mumbles	7 (4.86)
Infection	2 (40.00)	8. Fidgets	9 (6.25)
Total no of symptoms	5	9. Experiences difficulty listening	17 (11.81)
Speech pattern: items on the *speech-pattern deviation measure*		10. Slow response	11 (7.64)
1. Too loud	8 (44.44)	11. Learning tempo slow	12 (8.33)
2. Speech distorted	6 (33.33)	12. Attention span short	9 (6.25)
3. Turns head to sound	4 (22.23)	13. Verbal practice	9 (6.25)
Total no of symptoms	18	Total no of symptoms	144
The symptoms 'breathes laboriously' and 'hearing loss' not reported for any learner		Behaviour of 'limited vocabulary', 'aggressive behaviour' and 'misunderstandings' not reported for any learner	

The first impression gained from the results in Table 1a seems to indicate that some of the learners evaluated had hearing problems. This statement is based on the fact that Table 1a reports a considerable number of *auditory behaviour*, *speech pattern* and *medical health* symptoms or traits exhibited by the 51 sampled learners. The symptoms and behaviour traits investigated all relate to potential hearing problems or hearing loss (be it permanent or temporary due to illness). For example, 144 *auditory behaviour* indicators were reported for the 51 participants. The measures calculated for these variables and reported in Table 1b substantiate the findings, and the *auditory behaviour score* reflects that for 10 (19.6% of 51) learners more than six *auditory behaviour patterns* were observed. Table 1b also indicates that of the nine learners with observed speech pattern deviations, nine exhibited all three speech deviations.

Table 1c identifies three learners who scored at least 1 on all four measures – indicating potential hearing disorders. These preliminary findings are based on medical and classroom information.

Table 1: Frequency distributions of the scores of the measures of *auditory behaviour, speech deviations, medical hearing-related symptoms and medical allergy or infection symptoms.* (The scores are tallies of the number of behaviour patterns or symptoms observed per learner)

Score value	Measures			
	Auditory behaviour (score 0–13)	*Speech pattern (score 0–3)*	*Medical hearing-related symptoms (score 0–4)*	*Medical allergy/ infections (score 0–2)*
0	24	41	14	46
1	2	3	2	3
2	6	3	0	1
3	1	3	2	Four learners with allergies or infections that could cause temporary hearing loss reported
4	4	Nine learners with speech deviations that could relate to hearing problems reported	Eighteen learners with medical hearing-related symptoms reported	
5	2			
6	1			
7	3			
8	1			
9	2			
10	1			
11	0			
12	1			
13	2			
	26 learners			

Table 1c: Learners that exhibit behaviour and speech pattern deviations as well as medical symptoms				
Learner id. no	Measure			
	Auditory behaviour	Speech pattern	Medical hearing- related	Medical allergy/ infections
1	4	1	1	2
46	2	2	1	1
47	12	3	1	1

A positive, statistically significant correlation and trend between the two variables would imply that lower-range whisper test scores (*0–2/3 incorrect words*: thus no obvious hearing problems) tend to coincide with low audiology ratings (a *pass* decision, indicated with a score of '1') and higher-range whisper test scores (*4 or more incorrect words*, which will suggest possible hearing problems) tend to coincide with higher audiology ratings ('2' or '3', which indicates *refer to a medical doctor*', and '3' indicating *refer to an ear specialist*).

Tables 2–4 describe the relationship between the audiology test and the whisper test assessment, as well as the relationship between secondary ear-health care variables and the two named variables.

7.2 Relationship between the audiologists' audiology-test score and the whisper-test score

The first indication of a statistically significant agreement between the outcomes of the formal audiology tests and the whisper test was established by a positive and statistically significant Spearman correlation of 0.45 (significance on the 0.01% level of significance) between pair-wise whisper-test-scores and audiologist-final-results scores.

This positive and significant relationship is further described in the cross-referenced frequencies of the audiologists-final-scores and whisper-test-scores presented in Table 2. The significance on the 1% level of significance (which verifies a statistically significant dependency between the whisper test and audiology results) is indicated by Fisher's exact probability of 0.01, which is associated with the calculated Chi-square value of 8.57.

The dependency (and thus relationship) between the audiology and whisper test results is illustrated in the frequency ratios in Table 2. The pass or refer ratios for the 0–3 and >3 whisper test categories illustrate the predictive power of the whisper test: the ratio of pass referred to in the '0–3' whisper test category is 27/4 = 6.75, which is substantially greater than the ratio of pass referred to in 2/4 = 0.5 in the '>3' whisper test category. The ratios of 6.75 and 0.5 imply that for '0–3' incorrect word responses, most probably 7 of 10 learners (6.75 is rounded to 7) will be evaluated as not having hearing problems, as compared to the category '>3' incorrect words, where approximately only 1 of 10 learners will be evaluated as not having hearing problems. This shows agreement between the outcomes of the whisper test and the final audiology test scores. The cut-off point of three incorrect whisper words was taken as a guideline for deciding that a learner should be referred to an ear specialist.

Note that only 37 observations are included in Table 2. Due to unforeseen circumstances at the school, tests administered by the audiologists and the whisper test team coincided for only 37 learners, even though both teams evaluated more learners. This is seen as a limitation of the study.

The audiology test results identified eight learners with hearing problems, while the whisper test identified six learners and four learners were identified by both tests. Table 3 lists these learners by means of identification numbers to protect the confidentiality of the learners.

Table 2: Frequency and raw percentages for audiology test score categories and the whisper test score categories[#]			
Audiology test scores	**The whisper test scores: # incorrect words**		**Total**
	0–3	**>3**	
'1' : *Pass*	27 (93.10)	2 (6.90)	29 (100.00%)
'2' : *Refer to medical doctor or audiologist*	4 (50.00)	4 (50.00)	8 (100.00%)
Total	31	6	37[&]
Fisher's exact probability associated with a calculated Chi-square value of 8.57 is equal to 0.01**.			
**: Signifies a significance level of 1% ;			
[#]: The whisper test scores grouped as categories of ≤ 3 and > 3 incorrect whisper word responses			
[&]: The audiology test was conducted in respect of 37 learners.			

Table 3 indicates that the four learners identified by both tests all required referral. This included the 21 learners who were referred by the audiologist to an ear specialist. The whisper test identified one learner with true hearing loss. It can be deduced from these results that in general the results of the whisper test agreed with those of the audiology test.

However, closer inspection of Table 3 reveals that another two learners who were identified by the whisper test had actually received a 'pass' verdict from the audiologists, and an additional three learners (6; 20; 46) had been 'overlooked' by the whisper test. To improve the effectiveness or predictive power of the whisper test, the effect of the additional hearing loss variables (*behaviour; speech; symptoms and history*) calculated during the whisper test administration was considered. The *speech* and *behaviour* variables correlated positively and significantly with the audiology test and the whisper test (Table 3) results. Spearman correlations verified that statistically significant relationships existed between both the audiology test results and the whisper test results in relation to the *auditory behaviour* variable (correlations of respectively 0.35 and 0.40) as well as the *speech deviations variable (*correlations of respectively 0.04 with the audiologists-test results and 0.37 with the whisper-test results) on at least 5% significance level. It was argued that the predictive power or effectiveness of the whisper test could be improved by considering the effect of *behaviour* and *speech* in conjunction with the number of *incorrect word* responses. For example, learners 5 and 44 were excluded from the list because two or fewer *behaviour* instances were considered as an additional guideline to the number of incorrect words. If, in addition, the effect of *two and more speech incidences* were considered as another guideline in conjunction with the number of *incorrect words*, the whisper test model would include learner 46.

To conclude, these results suggest that the whisper test results correlate with the audiology tests, and that consideration of the *speech* and *behaviour* variables increases the effectiveness of the whisper test.

Table 3: Serial numbers of learners (Learner ID no) indicated with potential hearing problems by the whisper test (W) and those assessed by audiologists (A).
Audiologists' final findings, the whisper test scores, and scores on *auditory behaviour, speech pattern, medical hearing-related symptoms* and *allergy/ infection symptoms*

Learner ID no		**Audiology, whisper test, speech, behaviour, medical scores**					
Test used						***Medical symptoms***	
A	**W**	**A**	**W**	***behaviour***	***speech***	***hearing***	***allergy***
Learners identified by both tests							
1	**1**	r (m)	5	3	1	1	2
17	**17**	r (m)	10	9	3	3	0
21	**21**	r (a)	10	9	3	3	0
48	**48**	r (m)	4	6	0	1	0
Learners identified only by audiology tests							
4		r (m)	1	1	0	0	0
6		r (m)	2	2	0	0	0
46		r (m)	1	1	2	0	1
20		r (m)	2	0	0	0	0
Learners identified only by the whisper test							
	44	p	4	0	0	0	0
	5	p	4	2	0	1	0

r(m): referred to a medical doctor; r(a): referred to ear specialist; A: audiology tests; W: the whisper test; Behave: *auditory behaviour score; speech: speech pattern score; hearing: hearing related medical symptom score; allergy: allergy/infections score*

8. Limitations

The learners at UCECE come from homes where parents do not seem to neglect health care. Thus these learners are perhaps not a representative cross section of the whole population. They do not represent children in rural areas where ear-health care does not receive the attention it ought to. As a result, the number of referrals at the sampled school was low, which could have brought bias into the results and lowered the reliability of the findings.

The fact that the audiology tests and the whisper tests were administered independently resulted in a degree of miscommunication between the two teams. Some learners were tested by one of the two teams but not by both. This limited the sample size considerably because the objective of the research was to measure the effectiveness of the whisper test against a scientific and acknowledged hearing loss identification test norm. The results of both tests were required for each learner and missing data thus affected the reliability of the research.

The cut-off point of a score of '3' on the whisper test was an intuitive decision: data analysis was repeated with several possible cut-off points and the choice of cut-off point '3' seemed to deliver results that agreed best with the audiology data. This decision will have to be further investigated in a larger study with a more heterogeneous cross section of the population.

Another limitation of the study proved to be the fact that the learners were all English second-language speakers and in this early stage of their development (3–6 years old) were probably not proficient in English. The possibility of a lack of language proficiency as a partial cause of the mispronunciation of words (recorded as "incorrect") should not be ignored in the interpretation of results.

9. Conclusion

This research serves to confirm that there is a positive correlation between the results of audiology tests and the whisper test. This proves the accuracy of the whisper test in detecting hearing impairment**.** As this screening procedure is simple, it could be taught to and used by teachers as an accurate alternative method of detecting hearing impairments in any situation where formal tests are not available. Together with the observation check list (a probable supplementary hearing problem identifier), the teacher will be able to obtain a good indication of the hearing ability of the learner in classroom situations.

Once hearing impairments have been detected by means of this screening procedure, medical interventions should be sought. The protocol reflected in this article may be a stepping stone towards the development of a standardized screening test using the whisper method. Early Childhood Development teachers can use the same procedure as they do when they implement formal protocols.

The first step in the identification of assets in the community was taken by the researchers themselves. Those assets are, among others, the families, schools, professionals training as speech therapists at a neighbouring university, hospitals and peers of the hearing-impaired children. This is in line with the bio-ecological approach. As Donald, *et al*. (2010, p 165) assert, intervention is necessary at individual and societal levels. Bouwer (2011) purports that all four principal components of the bio-ecological approach, namely process, person, context and time, need to be considered. For this reason this study took into consideration the learners' ages (3–6 years) and their life-world contexts. All these factors were informed by the check list in which the influence of the learners' family, school, peer group and community was reflected. In terms of the proximal process of interaction, systems such as the school system affiliated with Unisa and individuals within the system, namely the teachers, audiologists, referral doctors or specialists and Unisa researchers, came together to assess, interpret and collectively arrive at an intervention plan for identifying learners with hearing loss. Once the children who needed medical intervention, or hearing aids, begin to receive the necessary support, it is very important that such support should be sustainable. A once-off intervention could be more harmful to the self-concept of hearing impaired learners than no intervention at all.

Parents, especially mothers and caregivers, should assist learners to keep hearing aids in a good working condition, by cleaning them and regularly replacing batteries. The remaining level of hearing of the learner (which is an intrinsic asset) must be utilized as effectively as possible. As learners grow older, they should know where to find support in order to become more independent, thus directing their own development in a self-regulatory way. Storbeck (2011, p 388) explains that parents need to face a number of choices ranging from accepting early intervention to the form of amplification.

Principals and teachers are key persons in the chain of support in the school environment. They must be knowledgeable about the whole process needed to support learners who use hearing aids. Storbeck (2011, pp 382–398) emphasizes the team approach to meet the needs of learners experiencing barriers to learning. Teachers need to have in-depth knowledge of the learner's profile. They must offer support strategies to develop an individual support plan, attending to aspects such as vocabulary building strategies; reading comprehension; following instructions; teaching strategies; preparing for learning new concepts; group work and dynamic teaching and assessment.

Donald, *et al.* (2010, pp 40; 166) explain that at proximal levels of system (where reciprocal influences in the family, peer groups, schools and communities is powerful in child development), the learners' internal assets and external resources of their family, school and support networks need to be recognized in order to turn negative cycles into positive cycles – for the learner with hearing loss.

When teachers become aware of hearing-loss or other problems that children experience, they should know which community assets to use to either solve the problem or to access as appropriate sources of help. Those assets should be identified with the help of the members of the community. Bouwer (2011, p 57) asserts that "at the heart of the asset-based approach is collaborative support". The identification of community assets still needs attention.

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