

Online Learning in Developing Countries: A Critical Review on an Online Hearing Aid Acoustician Program Used to Expand Audiological Service Delivery

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Abstract: *Hearing loss is a prevalent sensory disability globally and in developing countries. Most developing countries are characterized by poverty, illiteracy, low awareness of hearing disorders, severe shortages of medical professionals like Ear, Nose and Throat (ENT) specialists and audiologists as well as shortages of audiological services and resources. Online learning programs open new doors for people across Africa and other developing countries in providing them with educational opportunities that are otherwise not possible. This confirms that online learning can be successfully used as a means to address the growing need for audiological services in developing countries. The purpose of this study, therefore, was to determine the efficiency of an online hearing aid acoustician program in the expansion of audiological services in developing countries. A survey research design was implemented to determine how effective medical professionals, who are currently working in developing countries, found the online hearing aid acoustician program and what adaptations needed to be made to improve such a program. Results indicated that the biggest challenge for online learning in developing countries would be fast and reliable internet connection but major infrastructure expansions are currently underway in Africa and other countries to keep up with the demand for bandwidth, and therefore this challenge should not limit online learning. All the participants were confident that an online hearing aid acoustician program would lead to the expansion of audiological services in their country. Crucial components identified, to make such an online program successful, included a practical component (as opposed to online learning only), online reading material that is easily accessible and understandable, inclusion of videos and interactive e-learning activities, patient case studies, access to virtual patient software and sufficient support from lecturers. During the implementation phase, various changes had to be made to the program based on practical experience to allow participants to continue with the program. Most changes were necessary due to internet constraints. Changes included the use of life supervisors instead of online proctors during examinations, the conversion of video material to MP4 format, documents being sent in Zip folders to reduce their size and Pdf access to the lesson material.*

Ongoing timeline and schedule adaptations were required and additional practical assignments were applicable. An online hearing aid acoustician program can lead to the expansion of audiological service delivery in developing countries but such a program should probably be reviewed individually for each country as country-specific adaptations might be required successfully use the program. Adaptations will be according to the individual situation and challenges of each country and will probably only be learned from practical experience.

Keywords: *Africa, developing countries, hearing loss, hearing aid acoustician, hearing health care, audiological service, online training, online learning.*

I. INTRODUCTION

HEARING loss is the most prevalent sensory disability globally, with the largest prevalence of disabling hearing loss in South Asia, Asia Pacific and sub-Saharan Africa. Most developing countries are characterized by poverty, illiteracy, low awareness of hearing disorders, severe shortages of medical professionals like ENT specialists and audiologists as well as shortages of audiological services and resources [1].

The global online learning industry is growing at a rapid pace [2], with Africa and Asia showing the highest growth rates. It is estimated that by 2025 roughly half of all college classes will be online learning based. Advantages of this include learning being highly efficient, cost effective and with reduced instruction time. Although there is a limited availability of physical higher education institutions in developing countries, internet connectivity is available to most people living in these countries. Online learning programs open new doors for people across Africa and other developing countries in providing them with educational opportunities that are otherwise not possible [3]. This leads us to believe that online learning can be successfully used as a means to address the growing need for audiological services in developing countries.

The need for research that encompasses the feasibility of such online programs and what it should entail are necessary [4] and therefore the purpose of this study was to determine the efficiency of an online

hearing aid acoustician program in the expansion of audiological services in developing countries. By evaluating an eLearning program, one receives feedback which is probably the most essential tool that eLearning professionals have in order to improve their eLearning deliverables and to assess the quality and effectiveness of such a program [5], [9].

II. METHOD

A. Aim

The aim of this study was to determine the effectiveness of an online hearing aid acoustician program used to expand audiological service delivery in developing countries and to determine whether adaptations were needed to improve such a program.

Study design: The most popular way to evaluate an eLearning course is by conducting a survey at the end of the course [5]. Therefore, a survey research design was implemented, and a self-developed questionnaire was distributed via Survey Monkey. There were a 76% response rate on the questionnaires. The higher response rate could be attributed to the fact that the researchers had previous personal contact with the participants during the time that they were enrolled in the Hearing Aid Acoustician program. Personal contact is known to ensure subsequent higher response rates on surveys and questionnaires [6].

Participants: A non-probability sampling technique was used to select participants who represent certain types of characteristics. The specific type of non-probability sampling used in this study was the purposive convenient sampling method. According to this method, participants (n=25) were chosen because they articulated with the aim of the study [7]. Participants met the following selection criteria:

- Working as medical professionals in developing countries.
- Completed the online Hearing Aid Acoustician program presented by Eduplex Training Institute (ETI).
- English language proficiency and literacy.

Participants included 9 males and 16 females. Their ages ranged between 18 and 60 years with most of the participants (48%) being between 25-30 years of age. 64% of the participants were from Ethiopia and 20% of the participants from South Africa. Participants from other countries included Zimbabwe, Kenia, Bahrain and the Czech Republic. Participants worked in the following medical fields:

- Hearing aid assistant/technician (6)
- Nurse (5)
- Ear, Nose and Throat Specialist (ENT) (3)
- Medical laboratory assistant (3)
- General practitioner (3)
- Counsellor (3)
- Speech therapist (1)
- Special needs therapist (1)

Material: Participants were asked to complete an online questionnaire in order to review different aspects of the Hearing Aid Acoustician program presented by ETI. They were presented with five different options for each criterion and had to choose the one that they most agree with. The options included: strongly disagree; disagree; neutral, agree and strongly agree. The questionnaire also included open ended questions where participants had the opportunity to make suggestions for improvements to the program.

Procedure: Each participant received a letter that explained the purpose of the study. The questionnaire was then mailed to each participant via SurveyMonkey and they were asked to complete it before a cut-off date. By completing the questionnaire, participants gave consent to take part in the study and that their participation was entirely voluntarily. If chosen, participants could withdraw from the study at any time.

Data recording: Data from the questionnaires were quantitatively coded and analysed with Microsoft Office computer software.

III. RESULTS AND DISCUSSION

Most of the participants (84%) agreed that an online training program can be effective to teach professionals on hearing tests and hearing aid fittings. Only 16% of participants responded no, but all of them stated that they do feel such a program cannot be online only and should include a practical component to be effective. This is not an unfamiliar concept in audiology distance learning programs as most of the audiology distance programs presented by Salus University in the USA also include hands-on, face-to-face sessions to give students the opportunity to practice what was learnt in theory [8].

Fig. 1 displays the components of the Hearing Aid Acoustician program that was of the most value to participants.

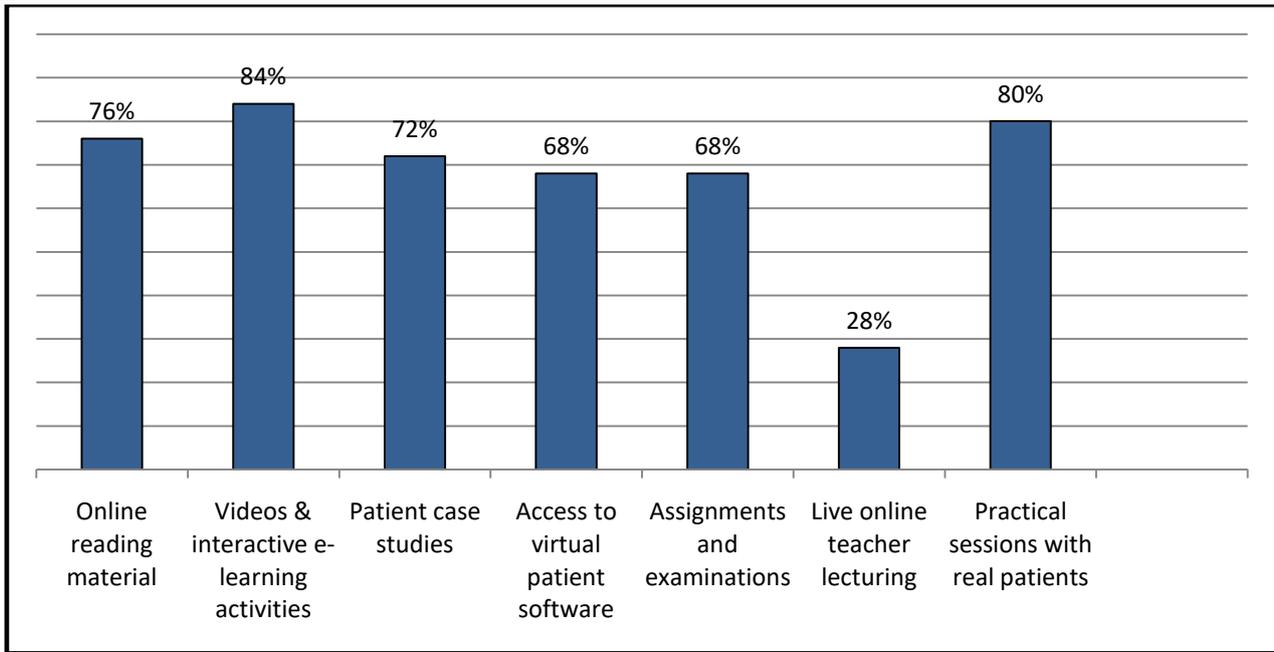


Fig. 1 Most valuable components of the online Hearing Aid Acoustician program

Participants found the videos and interactive e-learning activities of most value (84%) followed by the practical sessions with real patients (80%). Other valuable components of the program included the online reading material (76%), patient case studies (72%), access to virtual patient software (68%) as well as assignments and examinations (68%).

Participants were asked to review the online Hearing Aid Acoustician program in terms of accessibility, content, structure, visual design, text, timing, eLearning resources, multimedia, assessments, tutor contribution, personal expectations of the program and the overall value of the program. Definitions for each of these terms are provided in the discussion of the results below. The first component of the program to be reviewed was **accessibility** which was defined as: "The online material was easily accessible and I could find the information I needed quickly" [9]. Participants' rating of the accessibility of the program is displayed in Fig. 2.

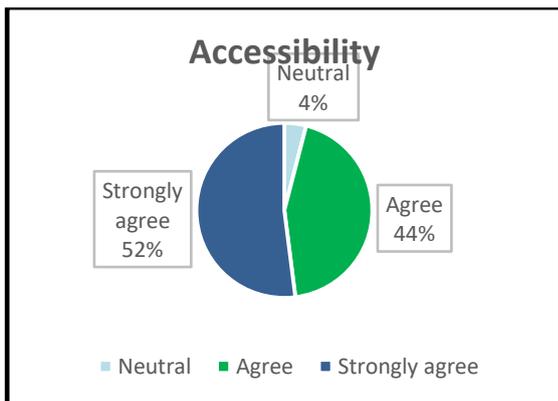


Fig. 2 Participants' review of the accessibility of information included in the online Hearing Aid

Acoustician program

Fig. 2 displays that almost all of the participants (52%=strongly agree; 44%=agree) felt that the online material of the program was easily accessible, and they could find the information easily. Only one participant (4%) indicated neutral with none of the participants who disagreed or strongly disagreed. The next component to be reviewed was the **content** of the program. Participants were asked to review content in terms of relevance and completeness and whether examples used were appropriate [9].

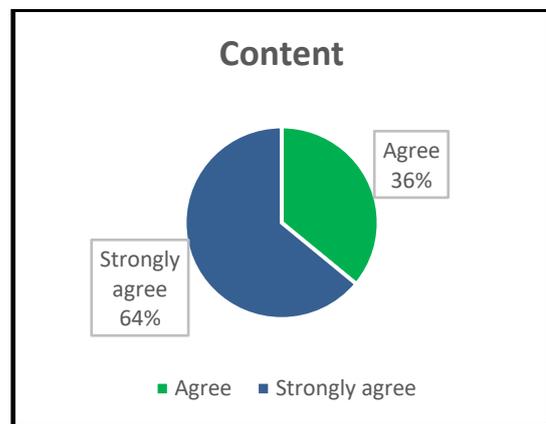


Fig. 3 Participants' review of the content of the online Hearing Aid Acoustician program

Fig. 3 displays that all the participants were satisfied with the content of the program. 64% of them strongly agreed that the content of the program was relevant and complete while 36% of participants agreed to this.

The **structure** of the program was reviewed next and these results are displayed in Fig. 4. Structure was defined as: "The learning material was presented in a logical sequence. I could easily understand it and it was

well organised” [9].

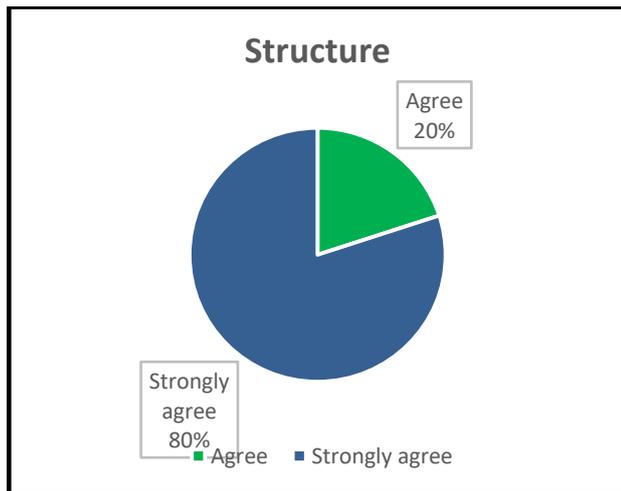


Fig. 4 Participants’ review of the structure of the online Hearing Aid Acoustician program

Again, participants were very satisfied with the way the program was structured as 80% of them strongly agreed to this and 20% of them agreed.

Information on the **visual design** of the program is presented in Fig. 5. This is another important component of an eLearning program as a poor visual impact disengages learners. If there are unnecessary visual elements included, this might also distract students from the actual content [5].

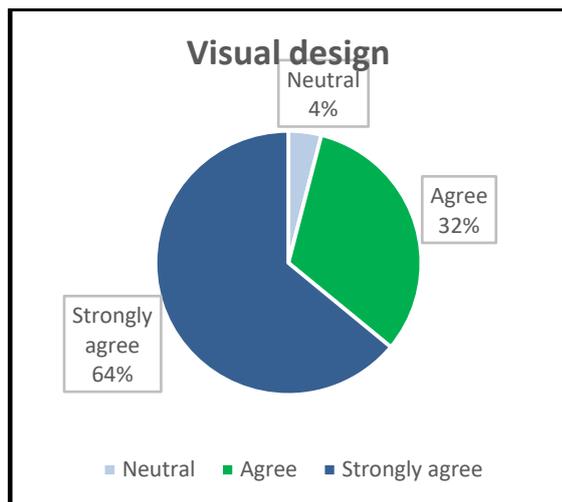


Fig. 5 Participants’ review of the visual design of the online Hearing Aid Acoustician program

Fig. 5 displays that 64% of participants strongly agreed to the fact that the visual design of the program was attractive in terms of colours and fonts used and that they found the images included and graphics to be effective and relevant [9]. Another 32% of participants agreed to this while only one participant (4%) was neutral.

Participants’ review of the **text** used in the program are presented in Fig. 6. Text was rated in terms of the appropriateness of the language used and how easily

understandable it was. It also referred to little or no spelling and grammatical errors included in the text [9].

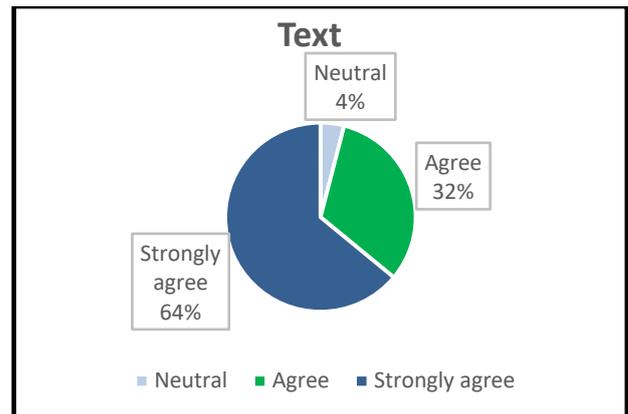


Fig. 6 Participants’ review of the text included in the online Hearing Aid Acoustician program

Again, a positive review was received from most of the participants with 64% of them who strongly agreed and 32% of them who agreed to this. Only one participant (4%) had a neutral review for this component. Language is a key element used as part of the text of a program and it is important to establish whether students were able to completely comprehend what they read or heard, that examples were relevant to all students and did not exclude or offend some [5]. By checking this, one can ensure that the language used, and the text of the program is comprehensible, respectful and to the point.

Next, participants reviewed the **timing** of the program, also referred to as seat time. This was defined as: “I feel that time indications given to me in the beginning of the program were accurate and I did not have to spend a lot of extra time on the program” [9]. These results are displayed in Fig. 7.

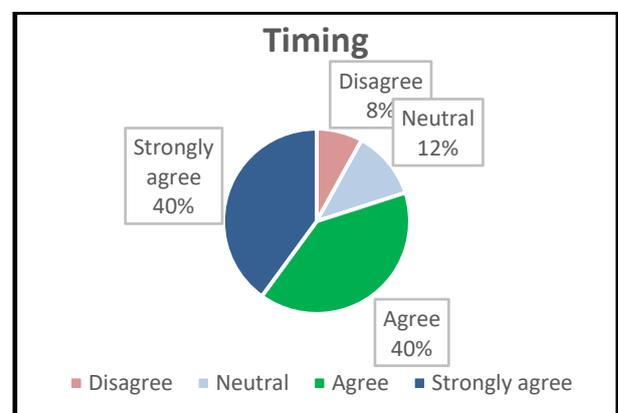


Fig. 7 Participants’ review of the timing component of the online Hearing Aid Acoustician program

This is the first component of the program where 8% of participants disagreed and another 12% of participants were neutral. 40% of participants strongly agreed with this and another 40% of participants

agreed. An effective length of time for a topic is between 15 and 30 minutes [5] and the program developers will re-assess this aspect of the program to make sure that lessons are not too lengthy and adjust the time expectations of students in order to ease prior planning and time management.

Participants were also asked to review the **eLearning resources** that were included in the program. The inclusion of eLearning resources is essential in an eLearning program as this boosts students' engagement and knowledge retention which lead to a more effective eLearning experience in the end [5]. These results are displayed in Fig. 8.

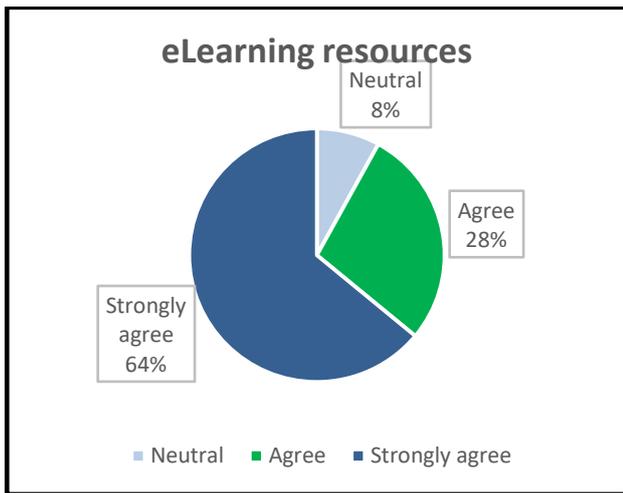


Fig. 8 Participants' review of the eLearning resources included in the online Hearing Aid Acoustician program

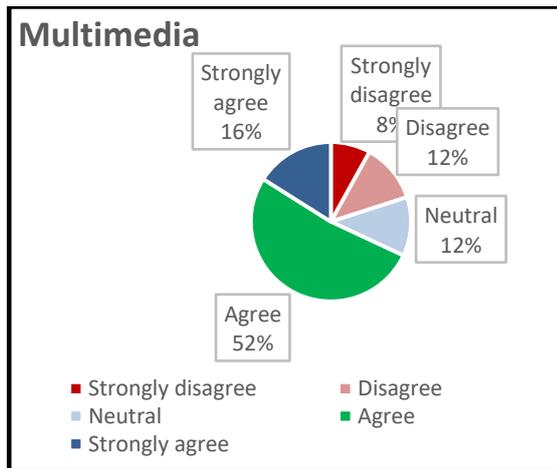


Fig. 9 Participants' review of the multimedia components used in the online Hearing Aid Acoustician program

From Fig. 8, it is evident that 64% of participants strongly agreed to the fact that the eLearning resources that were included in the program, was relevant and complete in terms of content and examples were appropriate [9]. Another 28% of participants agreed to this with only 2 participants (8%) that had a neutral rating.

Multimedia include videos, audios and animations. Participants were asked to indicate if they did not experience technical problems using multimedia and whether the amount of multimedia used was adequate and of a high quality [9]. These results are displayed in Fig. 9.

This was the component of the program that participants experienced the most trouble with. Although 16% of participants strongly agreed and 52% of participants agreed that they did not experience technical problems when using multimedia, 8% of participants strongly disagreed to this. Another 12% of participants disagreed and 12% of participants were neutral. In Fig. 10, participants' review of the **assessments** included in the program, are given.

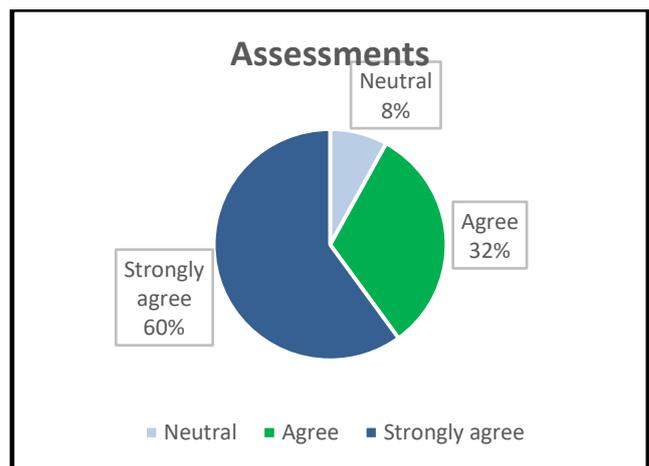


Fig. 10 Participants' review of the assessments used in the online Hearing Aid Acoustician program

The majority of participants (60%) strongly agreed that the questions used in the quizzes and tests were relevant and that they received constructive and clear feedback after assessments [9]. Another 32% of participants agreed to this with only 8% of participants that were neutral.

The **tutor contribution** was reviewed next. Here participants were asked to indicate whether the tutor was available for online discussions, if the tutor provided valuable feedback and responded to questions on time [9].

From Fig. 11, it can be seen that 40% of participants strongly agreed and 24% of participants agreed to the tutor being available, giving valuable feedback and responded to questions on time. Only one participant (4%) disagreed with this while another 32% of participants were neutral.

Next, participants were asked to reflect on the **program expectations** they had. This was being defined as: "My personal learning goals and expectations were met during the program and all the topics that I expected, was covered in the content [9]. These results are presented in Fig. 12.

Mostly participants' expectations of the program

were met with 60% of them who strongly agreed with this. Another 36% of participants agreed that the program fulfilled their expectations with only one participant (4%) being neutral. Lastly participants were asked to review the **overall** value of the program.

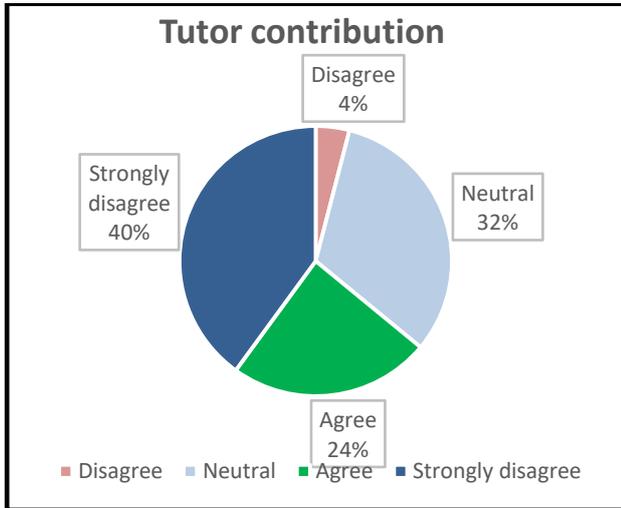


Fig. 11 Participants’ review of the tutor contribution as part of the online Hearing Aid Acoustician program

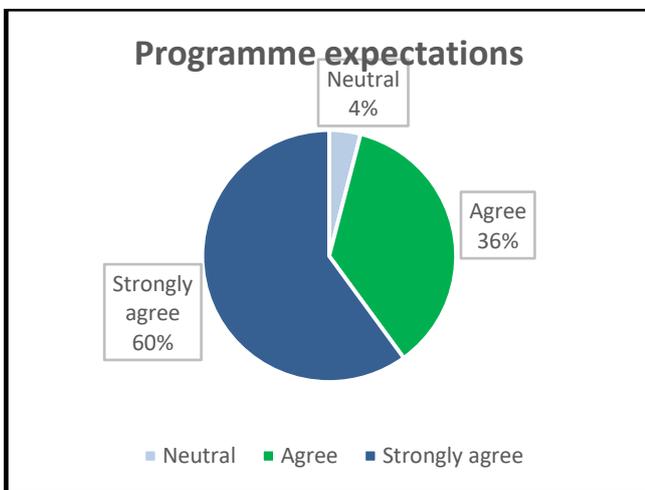


Fig. 12 Participants’ review of their expectations of the online Hearing Aid Acoustician program

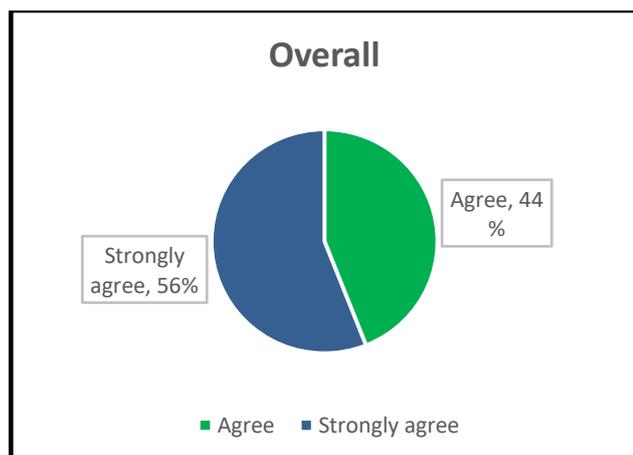


Fig. 13 Participants’ review of the overall value of the

online Hearing Aid Acoustician program

All the participants found the course of value and indicated that they learnt a lot from the program [9]. 56% of them strongly agreed to this with another 44% agreeing to this.

All the participants indicated that they would recommend this online Hearing Aid Acoustician program to others. It is evident that this program is highly rated and recommended but some adaptations had to be made to the program to ensure its efficiency. It is important to not only evaluate an eLearning program when the program is completed, but also throughout the process in order to know what needs to be changed and to accommodate students [5]. This can be done by observing students’ behaviour while they are participating and arranging online discussions [5]. Changes that were made to the program came from difficulties that students experienced during the program and included the following:

- Initially the program made use of online examinations with ProctorU but many participants experienced problems due to internet connectivity constraints. The online examinations were reduced and, in many instances, replaced with the use of life supervisors.
- Initially the tutor communicated with the students via Skype. Due to the unreliable internet and connectivity issues the Skype sessions were replaced with BigBlueButton which is an open-source web conferencing system. To reduce life online discussions, tutorial videos was made and converted to MP4 files. Students were also asked to complete reflection forms to ensure that they received relevant information as preparation for examinations.
- Online reading material was converted to pdf documents which students could download.
- Interactive video material was replaced with downloadable video material and was emailed via WeTransfer and sent as Zip folders to reduce the size of the folders.
- Additional practical assignments were made available per module. As many of the students did not have access to a hearing aid centre for additional practical exposure, this gave them additional opportunities to practice what was learnt in theory.
- Timeline and schedule adaptations and updates were made according to students’ programs. Public holidays differ in each country and had to be taken into account as well.
- Viber was added on cell phones to ensure quick and important communication between tutors and students.

- The practical component was presented in two parts to ease time and employment constraints for students. Initially it was stated that a two week practical will be held at the end of the program but because all the students are full time employed it was not possible for them to stay away from work for so long at once. Therefore, it was decided that a one week practical will be included in the middle of the program and another week of practical at the end of the program.
- When there is a large group of students in one country, it is advisable to appoint a program coordinator within that country. Students can easily communicate with this coordinator and also has the opportunity to have face-to-face time on a regular basis.

Additional suggestions made by students for improvements to the program that was not mentioned above, included a need for information about paediatrics and paediatric testing and one student mentioned that the content was at times too simplified and additional reading material could be included. Currently information on paediatrics and paediatric testing will not be included in the program as the program developers feel that paediatrics is a specialist field and that students should first be comfortable and skilled in working with adults before continuing to working with children. It is important for the program developers that the content is simplified as most students from developing countries are not first language English speakers and by keeping content simplified, it ease the understanding for second language learners. A list with additional reading material will however be added for students who feel the need for more information.

From the information above and the difficulties experienced by participants, it is evident that unstable and slow internet connectivity is the main challenge for online learning in developing countries – this is confirmed by another study performed in 2015 in a developing country [10]. Although the portion of the African population that has access to the internet increased drastically during the last years, it is still far behind the global average. Africa is currently undergoing major infrastructure expansions to be able to supply in the increasing demand for bandwidth. These expansions include upgrading and installing of submarine cables and networks to improve internet accessibility of rural and peri-urban Africa [11], [12].

IV. CONCLUSION

Results indicated that the biggest challenge for online learning in developing countries would be fast and reliable internet connection. Despite challenges, all the participants were confident that an online hearing aid acoustician program would benefit service delivery and lead to expansion of audiological services in developing countries.

All participants agree to online audiological training but it should be emphasized that online training alone would not be sufficient and that such a program should incorporate a practical component as this adds most value to the learning experience. Other crucial components identified to make such an online program successful, included easily accessible and understandable reading material, inclusion of video material, patient case studies and access to virtual patient software. Mostly students were very satisfied with the current program but attention should be given to time indications for all modules and the use of multimedia material as internet constraints make it difficult for student to access it. One should keep in consideration that changes will likely have to be made to any online program used in developing countries based on the individual situation and challenges of each country and will probably only be learned from practical experience.

To conclude, online education in hearing health care can assist with the expansion of audiological service delivery in developing countries and further research should be performed to improve and expand the use of such programs. Although the current program is highly rated and recommended by students, this post-course evaluation provided valuable feedback and suggestions for improvements to the program in order to deliver an even better program to future students.

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