Original Article
doi: https://doi.org/10.1590/1983-1447.2020.20190446

Nursing training program in children's hearing health: a proposal for interactive tele-education

Capacitação dos enfermeiros em saúde auditiva infantil: uma proposta de teleducação interativa

Capacitación de enfermeros en salud auditiva infantil: una propuesta de teleducación interactiva

Lilian Cassia Bornia Jacob[a]
Eliene Silva Araújo[b]
Heitor Marques Honório[a]
Lucas Bevilacqua Alves da Costa[c]
Orozimbo Alves Costa[a,d]
Kátia Freitas Alvarenga[a]

How to cite this article:
Jacob LCB, Araújo ES, Honório HM, Costa LBA, Costa AO, Alvarenga KF. Nursing training program in children's hearing health: a proposal for interactive tele-education. Rev Gaúcha Enferm. 2020;41:e20190446. doi: https://doi.org/10.1590/1983-1447.2020.20190446

ABSTRACT

Objective: To verify the effectiveness of a nursing training program in the area of children's hearing health using interactive tele-education.

Methods: Interrupted time series with non-random control group pre-test/ post-test. A cohort of 41 nurses, with no previous formal training in hearing health. A "Children's Hearing Health" Cybertutor was employed. The effectiveness of the nursing training was verified by comparing pre- versus post-training performance and by analyzing responses to an evaluation questionnaire.

Results: Following training, the performance was significantly better in all domains assessed and in the total score. The evaluation questionnaire demonstrated that the Cybertutor was well accepted and the performance revealed in the pre-training phase demonstrated the need for children´s hearing health training.

Conclusion: The effectiveness of the nursing training program in the area of Children's Hearing Health using interactive tele-education could be proven, since there was an improvement in performance in all domains evaluated.

Keywords: Audiology. Education, nursing. Health education. Distance learning.

RESUMO

Objetivo: verificar a eficácia de um tutor eletrônico - cybertutor na capacitação de enfermeiros na área de saúde auditiva infantil.

Métodos: séries temporais interrompidas com grupo controle pré-teste/pós-teste não randomizado. Participaram 41 enfermeiros que foram capacitados por meio de um Cybertutor denominado "Saúde Auditiva Infantil". A eficácia da capacitação foi verificada a partir da comparação do desempenho dos enfermeiros, nos questionários pré e pós-capacitação, e a avaliação do Cybertutor foi investigada por meio de um formulário com perguntas fechadas e abertas.

Resultados: O desempenho no questionário pré-capacitação demonstrou a necessidade da capacitação em saúde auditiva infantil. Houve diferença no desempenho após a capacitação em todos os domínios avaliados e no escore total.

Conclusão: A eficácia do cybertutor na capacitação de enfermeiros na área de Saúde Auditiva Infantil pôde ser comprovada, uma vez que houve melhora no desempenho em todos os domínios avaliados.

Palavras-chave: Audiologia. Educação em enfermagem. Educação em saúde. Educação à distância.

RESUMEN

Objetivo: verificar la eficacia de un tutor electrónico - cybertutor en la formación de enfermeros en el área de salud auditiva infantil.

Métodos: series temporales interrumpidas con grupo control pretest/posttest no aleatorio. Participaron 41 enfermeros, que fueron capacitados a través de un Cybertutor denomidado "Salud auditiva infantil". La eficacia de la capacitación se verificó comparando el desempeño de los enfermeros en los cuestionarios pre y post capacitación, y la evaluación del Cybertutor se investigó a través de un formulario con preguntas cerradas y abiertas.

Resultados: El desempeño en el cuestionario precapacitación demostró la necesidad de capacitación en salud auditiva infantil. Hubo una diferencia en el desempeño después del entrenamiento en todos los dominios evaluados y en el puntaje total.

Conclusión: La efectividad del cybertutor en la capacitación de enfermeras en el área de Salud Auditiva Infantil podría demostrarse, ya que hubo una mejora en el rendimiento en todos los dominios evaluados.

Palabras clave: Audiología. Educación en enfermería. Educación en salud. Educación a distancia.

[a] Universidade de São Paulo (USP), Faculdade de Odontologia de Bauru. Bauru, São Paulo, Brasil.

[b] Universidade Federal do Rio Grande do Norte (UFRN), Centro de Ciências da Saúde. Natal, Rio Grande do Norte, Brasil.

[c] Hospital Samaritano. São Paulo, São Paulo, Brasil.

[d] Pontifícia Universidade Católica de São Paulo (PUCSP). São Paulo, São Paulo, Brasil.

INTRODUCTION

Hearing loss in children is a public health problem both because of the impact of sensory deprivation on children's development and because of its incidence. It is estimated that in Brazil 1-3 of every 1000 term newborns and 2-4 of every 100 neonates with risk indicators have sensorineural hearing loss[1]. There are no recent data on the national or state prevalence of sensorineural hearing loss diagnosed by neonatal hearing screening programs, known as "ear test". However, a study conducted at a maternity hospital accredited to the Unified Health System (SUS) reported a prevalence of 0.96: 1000[2]. Worldwide, the estimate is 1.7: 1000[3].

The concern with early detection of hearing loss dates from the mid-1960s. The diagnosis of hearing impairment in children should be made as early as possible. A late diagnosis makes it difficult to restore the neuromaturation of the central auditory nervous system. Thus, ideally, hearing loss should be diagnosed until the age of three months and therapeutic intervention should begin until the age of six months. Children with hearing impairment identified up to the sixth month of life, and who started the therapeutic intervention before six months, showed a significant difference in language compared to children who had their hearing loss identified after 6 months of age[4]. Thus, newborn hearing screening (NHS) has been recommended[5] and performed in several countries[6] for early identification of hearing impaired individuals.

In Brazil, Law No.12,303 of August 2, 2010 was enacted, which provides for the mandatory free evoked oto-acoustic emissions (OAE) testing in all hospitals and maternity wards for children born on the premises of these facilities [7].

For the implementation of a newborn hearing screening (NHS) program, it is necessary to create a local support network and raise the awareness of professionals in the area and the community, through educational programs. These programs are intended to draw attention to the importance of early detection of hearing loss and the consequences of late detection, so that both the hospital and the community can support the program and comply with the follow-up recommendations. Multidisciplinary cooperation is key to the success of a hearing screening program. Thus, the involvement of pediatricians and nurses is essential not only for the successful implementation and progress of the NHS program, but also for the success of the follow-up program[8].

Our experience with a newborn hearing screening program has shown that, despite the guidance provided to family members on the importance of carrying out NHS for the diagnosis and early intervention of hearing loss, the results obtained in the early years of the program indicated an average adherence rate of 90.52%, with evasion occurring both in the 2nd stage of hearing screening (retest) and in the diagnostic process[2]. The role of the nursing staff is considered critical to the success of NHS[8–10]. According to a previous study, of the total number of newborns undergoing hearing screening at a maternity hospital in São Paulo, 52.4% underwent the procedure after hospital discharge, that is, the procedure was scheduled based on guidelines provided by the nursing staff at the time of hospital discharge[9].

Another important aspect is the role performed by nurses as members of the team of the Family Health Strategy. In Brazil, the FHS, which began in 1994, is a strategy that reorganized the primary health care model: the traditional disease-centered program, focused on cure, has been turned into a model centered on prevention and health promotion[11]. The Family Health Strategy teams that perform monthly home visits are composed of at least one general practitioner, a nurse, a nursing aid and six community health agents.

Some studies stressed the importance of the training and the actions carried out by community health agents in Hearing Health, such as promoting hearing health, as well as supporting families' adherence to the diagnostic audiology and rehabilitation process[12–14], and the importance of training nurses in children's hearing health has been documented in more recent international studies[8,10]. Given the key role played by nurses in hearing health and the need to train these professionals to work satisfactorily in this area, there has been a growing interest in carrying out studies on teaching methods that facilitate access to knowledge and the improvement of nursing professionals in children's hearing health, with emphasis on interactive tele-education tools.

There has been an increase in the number of studies on distance learning (DL) in Brazil, especially in the field of nursing, which comprises approximately 21% of all the publications on distance learning, according to a study conducted in early November 2019, in the library virtual health[15]. A strategy to improve nursing care and, consequently, health care is the training of health professionals. In the health units, the use of Telenursing has contributed to the process of education in the work environment, allowing health professionals, especially nurses, to carry out their professional training in the workplace[16]. Distance learning has been used mainly for the training and qualification of nurses in care and in health education for the population.

Tele-Education emerges as an efficient strategy, capable of promoting exchange of experiences and supporting the professional qualification of people living in distant areas[17].

Thus, the present study aimed to verify the effectiveness of an electronic tutor – cybertutor - in the training of nurses in children's hearing health.

METHOD

The present study is part of the research line Telehealth in Speech Therapy, Department of Speech Therapy and was approved by the Research Ethics Committee of the Dental School of Bauru, University of São Paulo (FOB-USP), under protocol no 100/2009. The participants were fully informed about the objectives and procedures of the research and were asked to sign the informed consent form, in which they consent in participate in the research and allow the use of the data obtained for scientific purposes. Anonymity was ensured, and the participants were free to withdraw from the study at any time.

The sample consisted of 41 nurses who worked in basic health units, in the maternity ward or Family Health Strategy in the city of Bauru – São Paulo, who were invited to participate in the training through the municipal health department.

Report of prior knowledge in children's hearing health informed by the participant was an exclusion criterion. However, no participant has been excluded.

The *Cybertutor Hearing Health for Nurses* was used as an interactive tool developed in partnership with the discipline of Telemedicine of the Medical School of the University of São Paulo.

The Cybertutor is a web-based distance learning system for tele-education. It is an interactive model that allows verification of performance by both the students and the teachers (content of the session and number of wrong and right answers). User access is done through registration and password on the São Paulo Telehealth Center website[18]

At the first meeting, as the participants had different levels of computer literacy, they received training in basic computing and in the Cybertutor functioning, so that they could develop the minimum skills necessary for the correct use of the tool. The training was carried out at FOB-USP, during a single 8-hour session and was led by the researchers. On the same day, a Cybertutor access register was created for each participant.

Before obtaining access to the Cybertutor content, nurses were instructed to answer an online questionnaire consisting of 20 multiple-choice questions, related to the theme. The referred questionnaire is an adaptation of the version used to analyze the effectiveness of different tele-education tools in the training of community health agents[12]. This stage called pre-training aimed to verify the prior knowledge about hearing health of each participant. Thus, the questions were divided into domains: 1. Basic concepts (questions 1 to 6); 2. Prevention (questions 7 to 10); 3. Techniques for the identification and diagnosis of hearing loss (questions 11 to 16); 4. General aspects of hearing loss involved with the intervention (questions 17 to 20).

As soon as the questionnaire was completed, the responses were entered directly on the website of the São Paulo Telehealth Center. Only after completing and sending the initial questionnaire, nurses received the access password to be able to start their studies.

The program content that was developed in a previous project[13] is divided into five modules, which address the following themes:

1) Sound and auditory system: notions related to sound frequency and intensity, anatomy and physiology of the auditory system.
2) Hearing, language and hearing loss: normal and impaired hearing function, hearing loss and the importance of hearing for the development of speech and language.
3) Causes of hearing loss and health care: etiological factors of congenital and acquired hearing loss, perinatal and postnatal complications, genetic syndromes, guidance on the position of breastfeeding due to otitis media common in children.
4) Identification and diagnosis of hearing loss in the first year of life: the importance of the nursing staff in the process of prevention, identification and intervention in hearing loss. Theoretical basis for providing adequate guidance to families about newborn hearing screening. Conceptualization of newborn hearing screening, its stages (test and retest) and equipment used. Behavioral, electroacoustic and electrophysiological tests that allow the identification of hearing loss in the first months of life presented succinctly.
5) Hearing rehabilitation: guidelines to make the family aware of the importance of participation in the rehabilitation process. Theoretical basis on the rehabilitation process, including knowledge about electronic devices applied to hearing impairments: what are the personal sound amplification devices and cochlear implants; when they should be indicated; what are the benefits of their frequent use. Concepts on the care and handling of electronic devices, adjustments such as on/off and volume control. Care of the electronic device, the ear mold of the hearing aid and batteries, related to the correct way to preserve and sanitize them.

Thus, the nurses learned to use the device, at their own pace, and at the end of each module, they performed exercises for the evaluation of their learning. Each time a question is answered correctly, the system allows the participant to proceed to the next module. When a question is answered incorrectly, the system advises the nurse to go over the topic that has not been fully understood, and so on, until the end of the course. At the end of the study of all modules, the nurses answered the final questionnaire, which was the same questionnaire applied in the pre-training stage.

The questionnaire has three response options for each question: "true", "false" and "I don't know", with a value of 1 point assigned for each correct answer, in a total score of 20 points or 100% of correct answers. The participants' level of learning was assessed by comparing the initial and final scores.

A qualitative evaluation in which the nurses assessed the tool used for their training (Cybertutor) was also carried out. A complementary questionnaire was administered for this purpose. It was composed of questions that addressed the following topics: (1) difficulties encountered in accessing the material; (2) quality of the material presented; (3) opinions on the methodology used. Two open-ended questions were also included, so that the nurses could identify the positive and negative aspects of the Cybertutor.

The nurses were told to carry out the activities proposed in the Cybertutor, for a minimum period of one week for each module, totaling five weeks, and a maximum period for completion of all modules of eight weeks. The passwords for accessing the modules were only made available when the training was carried out within the proposed deadline. So, the nurses were able to control their own learning, as long as the pre-established deadline were met.

Data analysis

Comparison between the four domains and the moment of the evaluation (pre and post training) was done through repeated measures ANOVA followed by Tukey test, with a significance level of 5% ($p < 0.05$). Student's t test was performed to compare the performance obtained in the total score of the post-training questionnaire among nurses who answered "yes" or "no" to each question, also considered significant when the p value was <0. 05.

RESULTS

Table 1 shows mean and standard deviation values of nurses' performance (percentage of correct answers relative to the total score) in the pre and post-training stages by

Table 1 – Descriptive analysis, in percentage, of the total score and by domains of the questionnaire in the pre and post training stages

Domain	Moment	Mean (%)	SD (%)	p
1. Concept	Pre-training	58.13	22.09	0.000*
	Post-training	79.67	12.08	
2. Prevention	Pre-training	69.51	28.24	0.000*
	Post-training	95.73	11.04	
3. Identification	Pre-training	52.03	15.00	0.023*
	Post-training	65.04	13.85	
4. General aspects of the intervention	Pre-training	53.66	17.29	0.001*
	Post-training	67.07	11.78	
Global Score	Pre-training	57.69	10.19	0.001*
	Post-training	75.98	7.18	

Source: Research data.

domains. Values of p <0.05 indicate a difference in the pre and post comparison of each domain.

Tukey test showed the difference in performance between the domains assessed by the questionnaire applied in the pre and post training stages (Table 2).

The answers obtained in the Cybertutor evaluation for the training of nurses in hearing health are described in Table 3.

The positive and negative aspects about the use of Cybertutor as a teaching methodology cited by the nurses are shown in Table 4.

Table 2 – Comparison of performance between the domains assessed by the questionnaire in the pre and post training stages

Domains	Pre (p)	Post (p)
Dom 1 x Dom 2	0.059471	0.000745*
Dom 1 x Dom 3	0.750166	0.003358*
Dom 1 x Dom 4	0.941223	0.022461*
Dom 2 x Dom 3	0.000161*	0.000032*
Dom 2 x Dom 4	0.000929*	0.000032*
Dom 3 x Dom 4	0.999888	0.999503

Source: Research data
Dom = Domains. *$p \leq 0.05$: significant difference
Domains: 1. Basic concepts; 2. Prevention; 3. Techiniques of identification and diagnosis of hearing loss; 4. General aspects of hearing loss related to the intervention.

Table 3 – Distribution of the objective responses obtained in the questionnaire for evaluation of training

Questions	Yes	(%)	No	(%)
1. Do you think the training program through the Cybertutor was a teaching resource that provided greater understanding?	41	100	0	0
2. Has the program made available through Cybertutor increased your interest in participating in it?	41	100	0	0
3. Do you think the information conveyed through the Cybertutor was easy to understand?	39	95.1	2	4.8
4. Did you think the Cybertutor allowed students to participate more actively in the learning process?	40	97.5	1	2.4
5. Did you have any problem with the Cybertutor while using it?	7	17.0	34	82.9
6. Were the sounds, images and videos in the Cybertutor adequate?	37	90.2	4	9.7
7. Was it possible for you to reconcile study periods and your professional activities?	40	97.5	1	2.4
8. Do you think the content inserted in the Cybertutor (children's hearing health) is important for your professional practice?	41	100	0	0
9. Have you ever participated in a training program using Cybertutor technology?	15	36.5	26	63.4
10. Would you take a distance-learning course again?	39	95.1	2	4.8

Source: Research data.

With the use of Student's t test, the performance obtained on the total score of the post-training questionnaire was compared between nurses who answered "yes" or "no" to each of the questions that evaluated the teaching methodology (Table 5). Questions 1 and 2 were not included in this analysis because 100% of the nurses gave only one answer. Questions 11 and 12 concerned the positive and negative aspects of using Cybertutor, respectively, and mentioning at least one aspect was considered as a "yes" answer.

Table 4 – Positive and negative aspects of the use of the teaching methodology according to the nurses' views

Positive Aspects	Negative Aspects
"Flexible schedule. Convenience. Enables learning. It is in the student's own interest." "Its ease of use and illustrations are the positive points that helped the students to memorize the guidelines."	"Going back to the beginning of all exercises after only one question was answered incorrectly."
"I really liked the content of the course, I enjoyed the opportunity to study a subject that has been little addressed in undergraduate nursing." "Each individual has their own time to read and understand. The program allows you to go back and review points that were not clear, audios and drawings facilitated understanding, making the subject clearer."	"I don't have many computer skills." "I still think we should have a teacher to help us with explanations." "There could be a lecture class on the subject."

Source: Research data.

Table 5 – Comparison of the performance obtained in the total score of the post-training questionnaire of nurses who answered "yes" or "no" in the questions of the teaching methodology evaluation questionnaire

Questions	Performance (%) Yes	Performance (%) No	p
3	85.86	80.00	0.267
4	85.50	85.50	0.946
5	85.96	83.00	0.403
6	88.75	85.00	0.333
7	85.17	95.00	0.178
8	85.34	87.50	0.686
9	87.14	85.00	0.492
10	86.55	70.00	0.001*
11	86.85	76.25	0.004*
12	86.50	85.00	0.592

Source: Research data.

DISCUSSION

In Brazil, health professionals work directly or indirectly in children's hearing health programs, as they are linked to various bodies that are part of the public health system. They play a key role in maternity wards, both in guiding families at the time of hospital discharge, contributing to the greater adherence of these families to the program, as well as in the procedures and care prior to hearing screening. In the care prior to hearing screening with oto-acoustic emission testing (OAE), or ear test, in particular, humidity of the external auditory canal caused by inadequate protection of ears from water when bathing the baby, and the short interval between the bath and the hearing screening, can be considered a possible factor that generates retest in newborn hearing screening programs[19]. As for the professionals who perform their functions in the basic health units or as members of the family health strategy team, they work directly with the families, reducing non-adherence to newborn hearing screening programs and assisting in the programs that monitor infants at risk of hearing loss and with confirmed hearing loss.

However, the results obtained before the training course demonstrated the need to train nurses in the area of children's hearing health, since the average of correct answers was around 50%, in three domains and in the total score. In the "prevention of hearing impairment" domain, the nurses' average prior knowledge was slightly higher (69.51%). It should be noted that the questions used to assess previous knowledge addressed content that nursing professionals should be familiar with in order to guide parents and caregivers of newborns or children, regarding the infant hearing health program, as well as to be able to identify suspected cases of hearing impairment and refer them to the appropriate hearing evaluation.

National curriculum guidelines for the undergraduate nursing course require the training of general practitioners, and include the ability of nurses to develop health prevention, promotion and rehabilitation actions, individually and collectively, as one of the skills in the health care area. According to these guidelines, health professionals must also carry out their practice in an integrated manner, in line with other spheres in the health system, as the responsibility for health care does not only imply the completion of a technical procedure, but also the resolution of the health care problem.

Therefore, these professionals can only meet the demands of the National Hearing Health Care Policy if there is investment in continuing education for those professionals who already work in primary care, as well as in the training of future professionals. This need was stressed by some nurses who perceived the approach to content that was not discussed in depth during the undergraduate nursing course as a positive aspect of the training, (Table 4). The importance of including the children's hearing health topic in the undergraduate nursing course, and in the continuing education of nurses, was also addressed by international researchers[8,10].

A comparison between the average performance at the two moments of the evaluation (Table 1) showed significantly better performance in all the domains evaluated and in the total score. The nurses reported that the learning process was facilitated by the quality of the content inserted because of the many illustrations and explainer videos related to the topic addressed (Table 3)

A comparison of performances between the domains evaluated (Table 2) showed that the prevention topic (domain 2) was the one that obtained the highest score. The fact that this topic is related to nurses' daily activities may have contributed to the high performance of the participants. Regarding the other domains, the nurses' performance in the pre-training stage was worse when the topic was more specific i.e. related to the area of hearing disorders (domains 3 and 4). The same results were observed in the analysis of performance after training.

It should be noted that none of the participants had received previous training in Hearing Health, and the best performance in the post-training stage shows that the educational instrument used was effective in improving knowledge on the topic addressed, even for those who already had some knowledge about one investigated domain (Table 1). However, the differences in performance between domains after training, and the fact that no group achieved 100% performance in the domains assessed, justified continuing education, as a single training program was not enough for the professional to assimilate all the concepts covered, corroborating previous studies that carried out a new evaluation after a few months of training[8,12].

Thus, distance learning allows the application of communication and information technologies to professionals who wish to have a more individualized continuing education. This is possible as long as the health professional is prepared to receive such education from both a technological and pedagogical point of view. Several studies have addressed the need to prepare health professionals and the work environment to ensure an effective use of information technologies. Such preparation includes actions that provide technological, organizational and professional innovation[15].

The results of this study showed the importance of the development and application of the Cybertutor in the interactive tele-education modality, as it can expand educational opportunities, promoting interaction and self-learning. The

methodology also allows for the exchange of experiences between people who may be distant from each other. This flexibility helps to solve one of the main problems faced by nurses in accessing Continuing Education, which is the difficulty of these professionals in attending face-to-face classes, as they cannot stay away from their professional activities for a long time.

Regarding the evaluation of the methodology, 100% of the participants perceived the Cybertutor as a teaching resource that provided knowledge of children's hearing health and was one of the factors that motivated the interest in training. The participants considered the content adequate and relevant for professional practice, and only two of them reported problems using the Cybertutor. According to the nurses, the presentation of the materials allowed the students to actively participate in the learning process, making it possible reconcile study and professional activities.

Such findings were evident in the analysis of the responses obtained in the training evaluation questionnaire and in the identification of the positive and negative aspects of the methodology used (Tables 3 and 4). Of the total number of nurses, 15 had previously participated in another training program using Cybertutor technology, though not focused on the hearing area, and 95% of nurses would be willing to participate again in a distance learning course. A comparison of the performance obtained by the participants in the total score in the post-training stage and the answers related to positive and negative aspects of the training (Table 5), showed that the participants who reported negative aspects in the use of the technology did not perform worse than the others, nor even those who reported lack of practice in handling the computer as a negative aspect.

However, the participants who mentioned positive aspects of the training showed better performance than the others did. Moreover, the nurses who performed significantly better on the overall score were those who said they would be willing to participate in a distance learning course again. In the other questions (3 to 9 and 12) the "yes" or "no" answer was not related to the general performance in the post-training stage. This data indicates that the participants who mentioned that the content inserted in the Cybertutor was not easily understood (4.8%), or that the Cybertutor did not allow a more active participation of the students in the learning process (2.4%), or who had a problem with the Cybertutor during its use (17%), or else those who mentioned that the sounds, images and videos included in the Cybertutor were not adequate (9.7%), did not show a worse average performance than those participants who did not report such problems in the teaching tool.

Distance learning using the Cybertutor showed numerous advantages, such as flexibility in study hours, making it possible for the individuals to have their own time to learn the content and go back and review points that were not clear, as many times as necessary. These aspects are valuable, since distance learning can eliminate distances, providing high quality education, improving the quality of the services offered and generating a positive impact on prevention, diagnosis and intervention[18], not only in the area of hearing health, but in health, in general.

It should be stressed that nursing professionals are also educators, and this role should also be played in the area of children's hearing health, in the education of the population regarding the necessary preventive measures, and in the diagnosis and treatment of hearing disorders. This is particularly important since early detection of hearing loss reflects on the future of children, impacting their development and learning.

Such measures allow for referral to early intervention services and due care for children and their families. On the other hand, non-identification of hearing loss or identification when there is already a delay in the development of the children, reduces the benefits provided by early intervention to language development.

CONCLUSION

The Cybertutor proved to be effective as an interactive tele-education tool, as there was an improvement in the participants' performance in all the domains evaluated, and it was well accepted as a training instrument for nurses in Children's Hearing Health. Thus, this teaching methodology can be used to update or train other classes.

Due to the continental dimensions of the country and the difficulty accessing information in some regions, tele-education is an important strategy in the democratization of knowledge.

However, although the Cybertutor includes modules with elements that facilitate learning, the presence of a monitor to answer individual questions could have contributed to a better performance of the participants in the course.

Despite the promising results regarding the efficacy of this model, further studies with larger samples are needed to determine whether these results apply or not to larger and more diverse populations.

REFERENCES

1. Comitê Brasileiro sobre Perdas Auditivas na Infância (CBPAI). Recomendação 01/99 [draft – 2nd. verion]. J Cons Fed Fonoaudiol. 2000;5:3-7.
2. Bevilacqua MC, Alvarenga KF, Costa AO, Moret AL The universal newborn hearing screening in Brazil: from identification to intervention. Int J Pediatr Otorhinolaryngol. 2010;74(5):510-5. doi: https://doi.org/10.1016/j.ijporl.2010.02.009
3. Centers for Disease Control and Prevention (US). Summary of 2016 national CDC EHDI data. Washington: CDC; 2018 [cited 2019 May 26]. Available from: https://www.cdc.gov/ncbddd/hearingloss/2016-data/01-2016-HSFS-Data-Summary-h.pdf
4. Yoshinaga-Itano C, Apuzzo ML. Identification of hearing loss after age 18 months is not early enough. Am Ann Deaf. 1998;143(5):380-7. doi: https://doi.org/10.1353/aad.2012.0151
5. American Academy of Pediatrics. Joint Committee of Infant Hearing. Year 2007 position statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. Pediatrics. 2007;120(4):898-921. doi: https://doi.org/10.1542/peds.2007-2333
6. World Health Organization (CH). Newborn and infant hearing screening: current issues and guiding principles for action: outcome of a WHO informal consultation, 09-10 November 2009. Geneva: WHO; 2010 [cited 2019 Sep 19]. Available from: http://www.who.int/blindness/publications/Newborn_and_Infant_Hearing_Screening_Report.pdf
7. Presidência da República (BR). Lei Nº 12.303, de 02 de agosto de 2010. Dispõe sobre a obrigatoriedade de realização do exame denominado Emissões Otoacústicas Evocadas. Brasília, DF; 2010 [cited 2019 Oct 04]. Available from: http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Lei/L12303.htm#:~:text=LEI%20N%C2%BA%2012.303%2C%20DE%202,eu%20sanciono%20a%20seguinte%20Lei%3A&text=2o%20Esta%20Lei%20entra%20em%20vigor%20na%20data%20de%20sua%20publica%C3%A7%C3%A3o
8. Jones AL, Lambert AW, Barnett M. Nursing students: training and maintaining universal newborn hearing screening knowledge. Nurse Educ Pract. 2018;Sep:32:72-7. doi: https://doi.org/10.1016/j.nepr.2018.07.011
9. Libardi AL, Carvalho JLB, Neves TAP, Pesse RSA, Amorin R, Alvarenga KF. The importance of the nursing team in the newborn hearing screening program [Abstract]. 2009. J Appl Oral Sci.17(sp issue):201. Abstract A019. doi: https://doi.org/10.1590/S1678-77572009000700023
10. Roberts C, Jones AL. Measuring nurses'knowledge and understanding of universal newborn hearing screenings. Journal of Early Hearing Detection and Intervention [Internet]. 2017 [cited 2019 Nov 25]; 2(2):38-47. Available from https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1045&context=jehdi
11. Ministério da Saúde (BR). Portaria nº 1.886 de 18 de dezembro de 1997. Aprova as normas e diretrizes do Programa de Agentes Comunitários de Saúde e do Programa de Saúde da Família. Diário Oficial da União. 1997 dez 18;135(247-E Seção 1):11-3.
12. Araujo ES, Jacob-Corteletti LCB, Abramides DVM, Alvarenga, KF. Community health workers training on infant hearing health: information retention. Rev CEFAC. 2015;17(2):445-53. doi: https://doi.org/10.1590/1982-0216201511913
13. Araújo ES, Alvarenga KF, Urnau DL, Pagnossin DF, Wen CL. Community health worker training for infant hearing health: effectiveness of distance learning. Int J Audiol 2013;52(9),636-41. doi: https://doi.org/10.3109/14992027.2013.791029
14. O'Donovan J, Verkerk M, Winters N, Chadha S, Bhutta MF. The role of community health workers in addressing the global burden of ear disease and hearingloss: a systematic scoping review of the literature. BMJ Glob Health. 2019;4(2):e001141. doi: https://doi.org/10.1136/bmjgh-2018-001141
15. bvsalud.org [Internet]. São Paulo: BIREME/OPAS/OMS; c1998 [cited 2019 Oct 12]. Available from: https://bvsalud.org/
16. Guimarães E, Godoy S, Assis D. Capacitação profissional: a opção pela telenfermagem. Rev Docênc Ens Sup. 2013;3:62-9. doi https://doi.org/10.35699/2237-5864.2013.1998
17. Leitão GGS, Silva TPS, Lima MLLP, Rodrigues M, Nascimento CBM. Educational actions in human communication health: telehealth contributions in primary care. Rev CEFAC. 2018;20(2):182-90. doi: https://doi.org/10.1590/1982-0216201820210417
18. Prado C, Silva IA, Soares AVN, Aragaki IMM, Shimoda GT, Zaniboni VF, et al . Nursing contributions to the development of the Brazilian Telehealth Lactation Support Program. Rev Esc Enferm. 2013;47(4):990-6. doi: https://doi.org/10.1590/S0080-623420130000400031
19. Marques TR, Mendes PC, Bochnia CFP, Jacob LCB, Roggia SM, Marques JM. Newborn Hearing Screening: the relation between bathing and the retesting rate. Braz J Otorhinolaryngol. 2008;74(3):375-81. doi: https://doi.org/10.1590/S0034-72992008000300011

Acknowledgments:

We thank the National Council for Scientific and Technological Development - CNPq, protocol no 485508/2007-9; the Research Support Foundation of the State of São Paulo (FAPESP) for the aid granted to the regular project, under protocol no 2010/20037-8), the Discipline of Telemedicine of the Medical School of the University of São Paulo (FMUSP) for the partnership in this study, the Municipal Department of Health of the city of Bauru/SP and the hospital Maternidade Santa Isabel for the participation and effective support of their managers and nurses in the development of the study.

Corresponding author:
Lilian Cassia Bornia Jacob Corteletti
E-mail: lilianjacob@fob.usp.br

Received: 12.01.2019
Approved: 02.12.2020

Associate editor:
Rosana Maffacciolli

Editor-in-chief:
Maria da Graça Oliveira Crossetti