TEXTO & CONTEXTO enfermagem
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HEALTH EDUCATION TECHNOLOGIES FOR PEOPLE WITH VISUAL IMPAIRMENT: INTEGRATIVE REVIEW

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ABSTRACT

Objective: to investigate scientific evidence about existing health education technologies for people with visual impairment.

Method: integrative review performed in MEDLINE/pubmed, CINAHL, LILACS databases, via Virtual Health Library, Web of Science, Scopus and Cochrane Library, in November 2021.

Results: 18 articles were identified, of which eight were published in nursing journals. Regarding the countries that were research sites, ten studies were published in Brazil and the others in countries such as the United States, Iran, India, Turkey and Portugal. The most addressed themes of the technologies were sexual and reproductive health and oral health. The others were about breastfeeding, occupational health, hypertension, diabetes and drugs. Regarding the types of accessibility resources used in the technologies, the use of audio, through text or CD, prevailed in ten studies, and resources that explored the tactile sense through anatomical didactic prototypes, educational manuals with embossed figures and different textures, in nine articles. Other accessibility features were audio description, technologies mediated by the use of the Internet and/or computer, and braille printed materials. Methodological studies predominated and, in fourteen studies, the application of technology with visual impaired people occurred.

Conclusion: the studies showed adequacy and feasibility regarding the health education technologies developed for people with visual impairment, because they offer knowledge about the proposed themes and equal access to educational materials for this group.

DESCRIPTORS: Health education. Teaching materials. Educational technology. Visually impaired people. Audiovisual resources.

TECNOLOGIAS PARA EDUCAÇÃO EM SAÚDE DE PESSOAS COM DEFICIÊNCIA VISUAL: REVISÃO INTEGRATIVA

RESUMO

Objetivo: investigar as evidências científicas acerca das tecnologias existentes e/ou que são utilizadas para educação em saúde de pessoas com deficiência visual.
Método: revisão integrativa realizada nas bases de dados MEDLINE/PubMed, CINAHL, LILACS, via Biblioteca Virtual em Saúde, Web of Science, Scopus e Cochrane Library, em novembro de 2021.
Resultados: identificaram-se 18 artigos, dos quais oito estudos foram publicados em periódicos de enfermagem. Acerca dos países que foram locais de pesquisa, dez estudos foram publicados no Brasil e os demais em países como Estados Unidos, Irã, Índia, Turquia e Portugal. Os temas mais abordados pelas tecnologias foram saúde sexual e reprodutiva e saúde bucal. Os demais versaram sobre amamentação, saúde ocupacional, hipertensão arterial, diabetes e drogas. Quanto aos tipos de recursos de acessibilidade empregados nas tecnologias, prevaleceu o uso do áudio, através de texto ou CD, em dez estudos, e de recursos que exploraram o sentido tátil do cego, por meio de protótipos didáticos anatômicos, manuais educativos com figuras em alto relevo e texturas diferentes, em nove artigos. Outros recursos de acessibilidade foram audiodescrição, tecnologias mediadas pelo uso da internet e/ou do computador e materiais impressos em *Braille.* Predominaram estudos metodológicos e, em quatorze estudos, ocorreu a aplicação da tecnologia com as pessoas com deficiência visual.
Conclusão: os estudos mostraram adequabilidade e viabilidade das tecnologias desenvolvidas para educação em saúde de pessoas com deficiência visual, por oferecerem conhecimento sobre os temas propostos e igualdade de cited a materiais educativos para este grupo.

DESCRITORES: Educação em saúde. Materiais de ensino. Tecnologia educacional. Pessoas com deficiência visual. Recursos audiovisuais.

TECNOLOGÍAS EN EDUCACIÓN EN SALUD PARA PERSONAS CON DISCAPACIDAD VISUAL: REVISIÓN INTEGRATIVA

RESUMEN

Objetivo: investigar la evidencia científica sobre tecnologías existentes y/o tecnologías que se utilizan para la educación en salud de personas con discapacidad visual.
Método: revisión integradora realizada en las bases de datos MEDLINE/PubMed, CINAHL, LILACS, vía Biblioteca Virtual en Salud, Web of Science, Scopus y Cochrane Library, en noviembre de 2021.
Resultados: se identificaron 18 artículos, de los cuales ocho estudios fueron publicados en revistas de enfermería. En cuanto a los países que fueron sitios de investigación, diez estudios fueron publicados en Brasil y los demás en países como Estados Unidos, Irán, India, Turquía y Portugal. Los temas más abordados por las tecnologías fueron la salud sexual y reproductiva y la salud bucal. Los otros eran sobre lactancia materna, salud ocupacional, presión arterial alta, diabetes y drogas. En cuanto a los tipos de recursos de accesibilidad utilizados en las tecnologías, predominó en diez estudios el uso de audio, a través de texto o CD, y recursos que exploraron el sentido táctil de los invidentes, a través de prototipos didácticos anatómicos, manuales didácticos con figuras en alto relieve y diferentes texturas, en nueve artículos. Otros recursos de accesibilidad fueron la audiodescripción, las tecnologías mediadas por el uso de internet y/o la computadora y los materiales impresos en braille. Predominaron los estudios metodológicos y, en catorce estudios, la tecnología se aplicó a personas con discapacidad visual.
Conclusión: los estudios demostraron la idoneidad y factibilidad de las tecnologías desarrolladas para la educación en salud de personas con discapacidad visual, ya que ofrecen conocimiento sobre los temas propuestos y acceso equitativo a los materiales educativos para este grupo.

DESCRIPTORES: Educación para la salud. Materiales de enseñanza. Tecnologia Educacional. Personas con discapacidad visual. Recursos audiovisuales.

INTRODUCTION

According to the 2010 census, visual disability has the highest occurrence in Brazil (18.6%)[1]. The term visual impairment is associated with complete or partial loss of vision, due to congenital or acquired factors, irreversibly, even after clinical, surgical treatment or use of optical resources[2].

People with disabilities, including the visual kind, are considered vulnerable to health risks[3]. Architectural barriers cause impair access to health services and the scarcity of professionals trained to establish adequate communication to the needs of this public poses a challenge for effective care, as well as for conducting educational orientations and interventions[4–5].

Despite the influence of information and communication technologies on health practices and on the production of health information, the knowledge provided through these technologies is not always accessible to all people.

The visually impaired public has restricted access to health information because they are predominantly on paper and ink, illustrations and/or television images. These materials made in a format that are inappropriate to blind people disfavor the possibility of receiving important health information[6.]

Access to information is perceived as a fundamental aspect for health promotion, in which the acquisition of knowledge allows individuals to intervene positively on the risk factors to their own health, making it possible to act actively in the self-care of physical, psychological and affective health. Therefore, health education actions are relevant and necessary, because they contribute to the development of competencies (knowledge, skills and attitudes) of the population to be co-responsible in prevention, treatment, recovery and rehabilitation[7].

It is noteworthy that the application of scientific knowledge to solve practical problems, from the creation and use of educational technologies, has been used by health professionals as a complementary resource of care and the process of teaching and learning in health with the population[8–9].

Educational technologies are systematic tools that aim to prepare, execute and analyze the learning process, so that it can be effective, and enable more dynamic and attractive education[10]. The use of these technologies allows health education strategies to become more diverse, and it is essential for the achievement of learning.

However, in the case of people with visual impairments, it is necessary that health professionals be attentive and know the particularities of this clientele, so that these technologies can be developed and applied, in order to enable access to knowledge about the health-disease process. It should be added that the educational technological resources adjusted to the specificities of this clientele can contribute significantly to the better effectiveness of health interventions[11].

In this context, these educational technologies can be considered assistive technologies, since they constitute products, resources, methodologies, strategies, practices and services that aim to promote learning, functional and participation skills of people with disabilities, aiming at autonomy, independence, quality of life and social inclusion[12].

In the literature, there is a scarcity of studies that scientifically disseminate assistive health education technologies for people with visual impairment and/or that support the use from scientific evidence[13].

Therefore, it is relevant that the results of existing studies on health education technologies for people with visual impairment to be summarized in order to know the types of technologies and themes most used and, thus, allow health professionals involved in the caring process of these individuals to be able to implement them or develop new technologies adapted to local needs.

Thus, the objective was to investigate the scientific evidence about existing technologies and/or that are used for health education of people with visual impairment.

METHOD

This is an integrative review that followed the following steps: establishment of the research question; definition of inclusion and exclusion criteria for studies; designation of the information to be extracted from the selected studies and characterization; data collection and interpretation and presentation of results[14].

The selection of studies was carried out in November 2021, by searching the following databases: *Cumulative Index to Nursing and Allied Health Literature* (CINAHL), *Scopus,* Latin American and Caribbean Literature on Health Sciences (LILACS), via Virtual Health Library (VHL), *Web of Science, Medline* via *Pubmed* and *Cochrane library.*

The PICO strategy (Population; Intervention; Comparison; Outcome/Expected Outcome)[15] was used to obtain the best formulation of the research question. In this study, P: People with visual impairment were delimited; I: Assistive technologies; C: not used; O: Health education. Comparison between intervention or group, was not used, due to the type of revision. The research question was: what are the existing technologies that are used for health education of people with visual impairment?

To perform the searches, controlled and uncontrolled descriptors present in the Descriptors in Health Sciences (DeCS) and in the Medical Subject Headings (MeSH) were used.

To perform the high sensitivity search in each database, the descriptors of each component of the PICO strategy were combined with the Boolean OR connector and, in sequence, each set was combined with the AND connector.

The search strategy that versed on the acronym PICO, as shown in Figure 1, was conducted for all databases. In the LILACS database, the same crossings were used, but with descriptors in the Portuguese language.

In order to select the articles that made up the sample of this review, the following inclusion criteria were adopted: research referring to technology developed and/or used for health education for people with visual impairments, being available electronically in full. No time and language restriction filters were added, in order to integrate and direct as many studies as possible on the topic.

Exclusion criteria were: dissertations, thesis, books or book chapters, events, editorials, literature review studies, studies unrelated to the theme, those that did not answer the guiding question, studies that did not address technologies and with divergent audiences (people who do not have visual impairment). Repeated articles repeated were considered for analysis only once.

The study screening process was based on the guidelines of the Updated Guideline for Reporting Systematic Reviews (PRISMAsr)[16]. The steps are shown in Figure 2.

The search for studies, screening and data extraction were performed by two researchers, who standardized the search strategy in each database and performed it independently, with a later comparison of the results found. Faced with divergences in the selection, a consensus strategy was adopted among the researchers for inclusion or exclusion from the study.

The variables of the review were related to the information available in the selected studies: year, country and journal of publication; objectives; method and level of evidence; technology and type of accessibility, health content addressed and main results/conclusions. To extract this information, an instrument was elaborated to record the variables presented.

To classify the studies regarding the Level of Evidence (LoE), the following levels were considered: I- the evidence stems from systematic review, meta-analysis or clinical guidelines from systematic reviews of randomized controlled trials; II- evidence of at least one randomized controlled trial; III- evidence derived from well-delineated clinical trials without randomization; IV - evidence from

a well-delineated cohort and case-control study; V- evidence presented of systematic review, descriptive and qualitative studies; VI - evidence from a single descriptive or qualitative study; VII- evidence derived from the opinion of authorities and/or expert committee opinion[17].

The presentation of the results occurred descriptively and the theoretical support for the analysis of the results was based on complementary scientific literature on the subject.
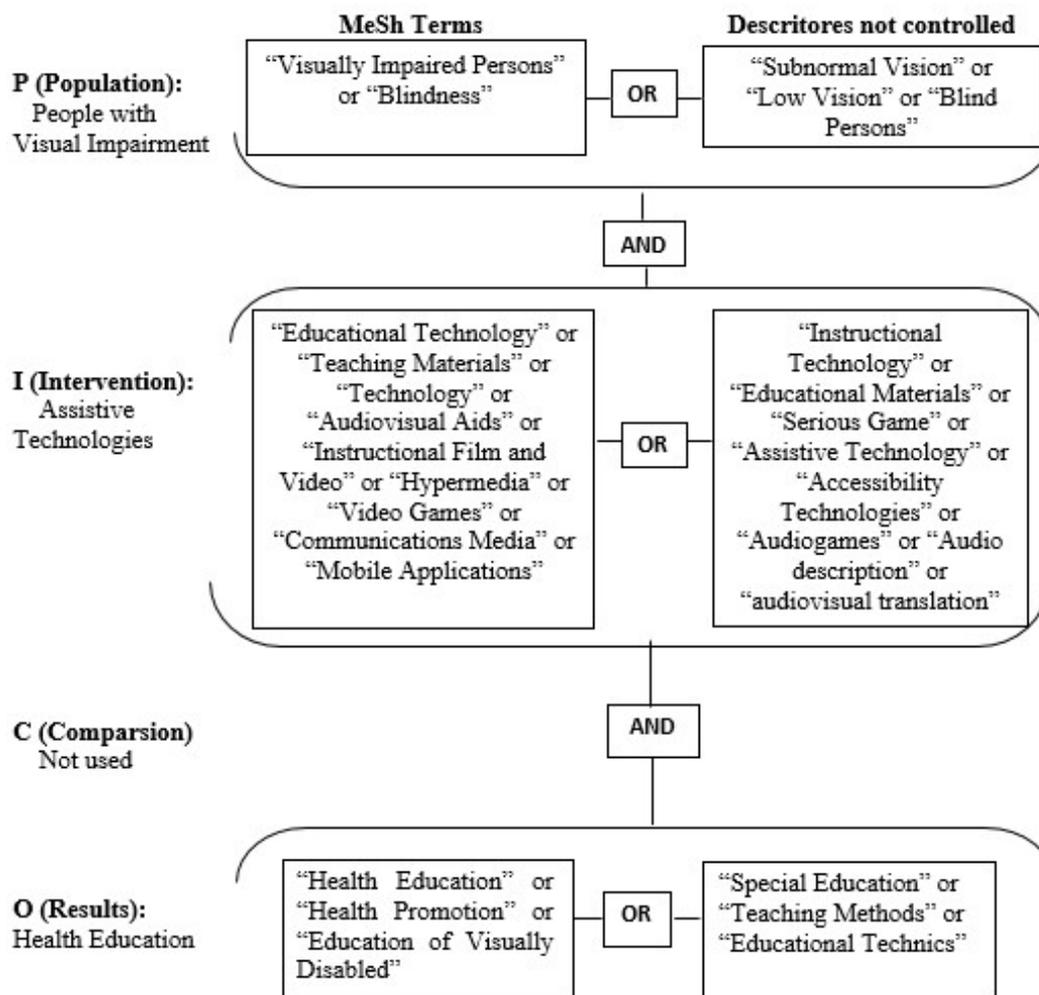

Figure 1 - Search strategy used in integrative review. Fortaleza, CE, Brazil, 2021.

RESULTS

A total of 954 studies were identified and, after *excluding* the 23 duplicates, 931 remained for analysis: five in CINAHL, 55 in LILACS, 242 in *the Web* of *Science*, 162 in Scopus, 63 in Medline and 404 in *Cochrane*. After applying the inclusion and exclusion criteria, 18 articles were included in the sample. Among these, four were from LILACS, six from Medline, two from Scopus, two from *the Web of Science,* four in *Cochrane*.

Regarding the means of scientific dissemination, eight studies were published in nursing journals and two in interdisciplinary journals focused on occupational health, communication and health education. Three articles were published in specific journals covering people with disabilities, regarding rehabilitation, accessibility, digital inclusion and assistive technologies. In addition to these, journals of dentistry and medicine had five publications. The years 2017 and 2018 had the most publications, with four studies in each year.
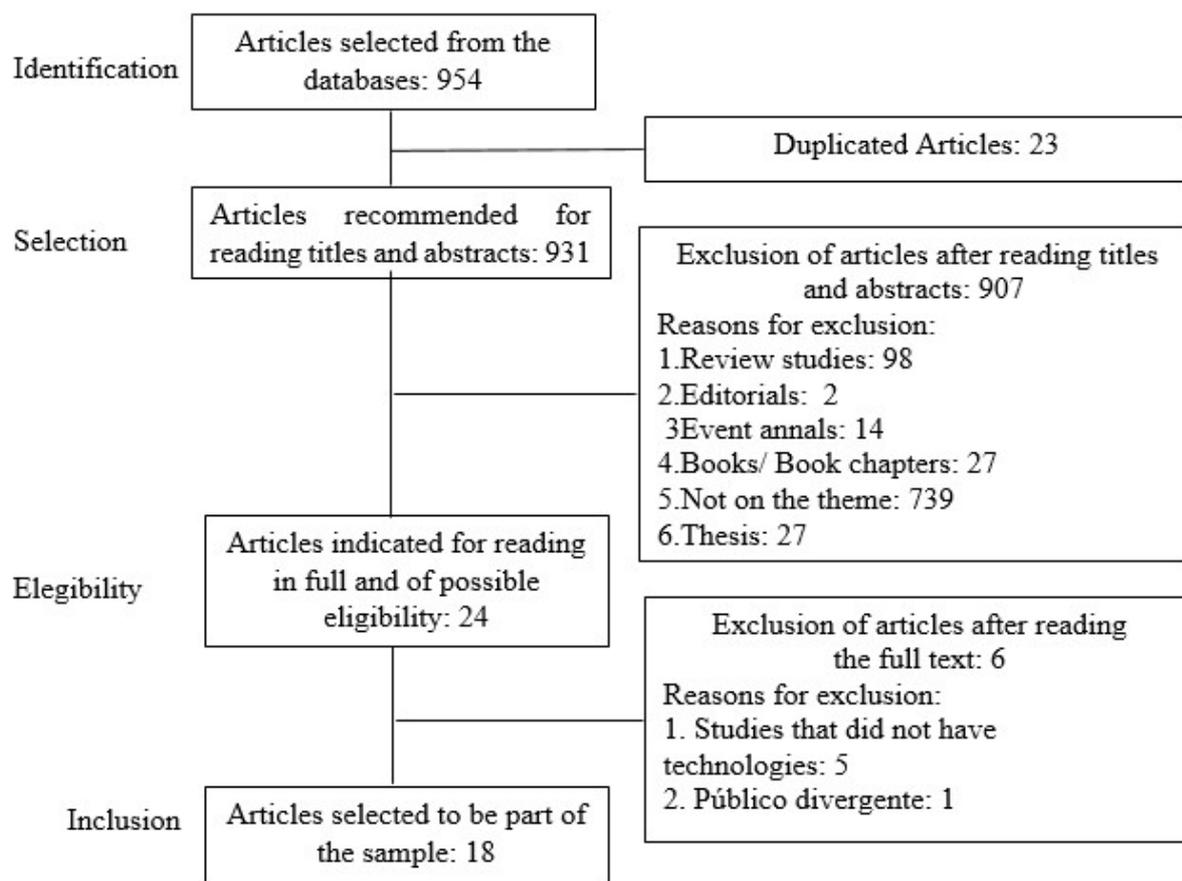
Figure 2 - Flowchart of the selection process of the articles of the integrative review. Fortaleza, CE, Brazil, 2021.

Regarding the countries that were research sites, ten studies were published in Brazil. The other articles were published in countries such as the United States, Iran, India, Turkey and Portugal.

Regarding the study design, eight studies were methodological, as they consisted of the construction and/or validation of technologies. Moreover, three were descriptive and exploratory, five non-randomized (quasi-experimental) studies and two were randomized clinical trials. In 14 studies, the application of technology was observed with the visually impaired public.

Regarding the themes of which technologies for health education were treated, it was observed that the most contemplated were about sexual and reproductive health, and oral health. The following included topics such as breastfeeding, hypertension, diabetes, oral health, breast cancer, occupational health and psychoactive substances.

Regarding the types of accessibility resources used in the technologies which made them accessible to people with visual impairment, the use of audio, through text or CD, prevailed in ten studies and resources that explored the tactile sense of the blind, through anatomical didactic prototypes, educational manuals, with high-relief figures and different textures, in nine articles. Technologies mediated by the use of the Internet and/or computer with screen reading software were found in four articles. Materials printed in Braille or in enlarged text were found in four studies. Some studies on the development of technology have combined these different accessibility features.

Another accessibility resource used in educational technologies was audio description, in two articles, which consisted of the development of a course and an interactive booklet, both online, with audio and images with audio description.

Among the selected articles, two that presented technologies in the modality of educational games, adapted to people with visual impairment, are highlighted. One dealt with tactile play in different textures, at the beginning of a board game, complemented by cards and instructions printed in Braille; and the other an exergame, which captures and virtualizes the user's real movements, providing personalized auditory feedback. The summary of the articles can be found in Table 1.

Table 1 - Summary of the articles that were part of the integrative review sample. Fortaleza, CE, Brazil, 2021**.**

Year/ Country	Technology/ Content	Results/Conclusions	LoE*
2021 Turkey[18]	Site Web Sexual Health	Site evaluated by experts and people with visual impairment. Accessibility, quality and content considered appropriate, and can be used as an education method for people with visual impairment.	Does not apply
2020 Portugal[19]	Interactive primer online/ Occupational Safety and Health	Online digital resource development that used web accessibility guidelines and audio and audio description features. Online digital resources can become inclusive when adjusted with accessibility features.	Does not apply
2020 Iran[20]	Game, Music, audio features and touch models Oral Health	The effect of different resources was evaluated. The technique mediated by audio and tactile features is an effective method to improve the oral health status of visually impaired students.	II
2018 India[21]	Audio features, and touch models Oral Health	A new health education technique (audio and tactile resources) was shown to be in equality with the traditional method of combining audio and text in Braille in the maintenance of oral health.	II
2018 India[22]	Audio features, *Braille* and touch models Oral Health	The combination of audio, *Braille* and tactile models is an effective way to provide oral health education and improve the oral health status of visually impaired children.	III
2018 Brazil[23]	Online course/ Hypertension	Completed course construction stage. The course was structured through accessibility criteria, offering knowledge and contributing to the inclusion of digital educational materials.	Does not apply
2018 Brazil[24]	Manual in *Braille* and ink with embossed figures/ Female reproductive system	Blind learning was evaluated through the use of an educational manual. There was an increase in correct answers in the post-test. Manual allowed learning of participants after use.	Does not apply
2017 United States[25]	*Exergame* with auditory feedback Yoga	Participants practiced yoga more consistently; frequency and time of physical activity.	VI
2017 Brazil[26]	Online audio string literature Breastfeeding	Technology validated by the target audience that considered it appropriate, with good general organization, structure, presentation strategy and coherence, appropriate understanding.	Does not apply
2017 Brazil[27]	Audio text/ Psychoactive Substances	After validation process, the technology was considered valid and reliable to inform people with visual impairment about psychoactive substances.	Does not apply

Table 1 - Cont.

Year/ Country	Technology/ Content	Results/Conclusions	LoE*
2017 India[28]	Brushing technique with music, dental plaster model and Braille booklet Oral Health	Results of the Knowledge, Attitude and Practices index was higher in the post-intervention period, as well as a significant decrease in oral plaque.	III
2016 Brazil[29]	Audio-rhymed text/ Sexually Transmitted Diseases	Technology validated by experts in relation to content, showing adequate objectives, structure, presentation and relevance.	Does not apply
2015 Brazil[30]	Tactile prototype simulates vaginal canal with audio instructions/ Female condom	Technology evaluated by experts who considered it appropriate. Low cost instrument and valid for health promotion.	Does not apply
2013 Brazil[31]	Tactile educational game/ Psychoactive substances	According to the evaluation of experts and blind people, the game proved to be adequate to the target audience, as it provides information on psychoactive substances in a playful and accessible way.	Does not apply
2009 United States[32]	Materials with enlarged printed letters, *braille* and audio/ Diabetes	Changes made to educational materials and programs about diabetes, leaving them in a format accessible to people with visual impairment.	VI
2005 Brazil[33]	Anatomical prototype of the breast and audio CD Breast cancer	The use of hearing and touch facilitated the learning and assimilation of informative content by the participants.	Does not apply
2003 Brazil[34]	Anatomical heart cut Hypertension	Blind people considered the tactile model very didactic, easy to handle and helped in understanding hypertension.	Does not apply
1999 Brazil[35]	Recording text on K7 tape and materials for tactile exploration Contraceptive methods	Self-instructional material evaluated by blind people who considered it with adequate content and language contributed to knowledge and communication.	VI

*LoE: level of evidence[17]

DISCUSSION

The technologies presented in the selected articles are inserted in the context of assistive technologies that, among the various functionalities, contribute to knowledge and health promotion, while respecting diversities.

The analysis of the articles demonstrates the low number of studies that provide scientific evidence on the subject. Research in this area is still incipient, however health care directed to people with disabilities must meet the requirements imposed by public policies. Expanding the access of this population in health promotion actions requires training professionals and sensitizing them about the relevance of producing accessible educational materials[13].

It is noteworthy that the studies were predominantly published by nurses and in nursing journals. This finding corroborates other different studies, in which it was sought to identify technologies used in health education for chronic renal patients and found that the majority (56.25%) of the studies were published in nursing journals[36]. As well as in a study that investigated for health education technologies on airway obstruction by a foreign body, the majority (62.5%) published in journals in this area[37]. These findings emphasize the relevance of nurses as health educators and in the construction of health education technologies.

Regarding the theme, the most mentioned in the studies was sexual and reproductive health. The approach to this theme has relevance in view of the stigmas regarding sexuality of the population with disabilities, because it is believed that men and women with this condition cannot have children or practice the sexual acts[38]. However, research shows that this public experiences sexuality, and is interested in affective and sexual issues. The perceptions of these and the discourses do not differ from the other young people without disabilities, who are also influenced, mainly, by gender, culture and family dynamics, in which parents often presented protective postures[29–30].

In addition, the studies highlighted that there are gaps in knowledge about risk factors and safe sex in this population. A similar result was observed in a study that aimed to evaluate the knowledge about the sexual health of blind people, among men and women. The use of condoms in sexual relations was investigated, in which 86% did not use or only sometimes used. Among the participants, 36.2% reported Sexually Transmitted Infections (STIs) and ignorance in relation to signs and symptoms and their clinical complications[39]. These results reinforce the importance of health professionals addressing this them through strategies and educational materials which accessible to these people.

It was found that in 78% of the analyzed studies, the technology was used with people with visual impairment, so that they could evaluate the quality, usability, or so that the researcher could evaluate its effectiveness. The realization of this stage is of paramount importance to understand the accessible and inclusive dimension of the developed technology.

The publications predominantly evaluated the effect of these educational resources on users' knowledge. The results presented in the studies showed the efficacy and/or viability of health education technologies, because they help to increase the information of these people after the intervention[24,27,33].

Effects regarding the use of technology on attitudes and practices were also explored. A study conducted in the city of Bhubaneswar, India, aimed to evaluate the efficacy of an health educational method for maintaining oral hygiene for visually impaired children. The method combined audio instructions, Braille and tactile models to aid the brushing technique. In the interval of 30 and 90 days, the oral hygiene was recorded and compared. There was a significant reduction in plaque and improvement in oral hygiene when comparing the pre- and post-intervention periods[21].

In relation to technological options, the use of accessibility resources is necessary. Therefore, teaching materials should explore the sensory means that are appropriate to this audience. In this context, the audio material aids that are used to transmit information from health contents are highlighted. Tactile models that help visually impaired people assimilate things they cannot visualize and are therefore important learning tools[40]. Combining audio, Braille and tactile models is an effective way to provide health education.

In the analyzed studies, technologies were identified that explored the tactile sense of the blind, such as the construction of an anatomical model of the heart in different textures to understand arterial hypertension;[34] the development of a three-dimensional breast prototype and an explanatory CD addressing breast cancer and how to do self-examination;[33] use of a model that simulates the vaginal canal and audio instructions on how to use the female condom;[30] a manual printed in Braille with embossed figures to learn the anatomy and physiology of the female reproductive system[24].

Another accessibility resource used in educational technologies was audio description, which aims to make audiovisual materials accessible to blind people.[19,23]. This resource can be incorporated into the teaching-learning process in health of this public, providing access to visual contents and, thus, better understanding of the reality and assimilation of information[41].

In the review, technologies mediated by the use of the Internet and the computer with screen *reading software* were also evidenced. With regard to educational technology in the online course format, a study conducted in Fortaleza, Ceará, developed a course on the prevention of hypertension, following the guidelines of accessibility on the Web, so that it could become accessible to the blind[23,42]. Another similar finding was from a study conducted in Turkey, which developed a web site accessible to the blind to promote sexual health education[18].

With the growth of the Internet, the expansion of information and communication technologies and the increasing presence of people with disabilities, health education, mediated by this resource, provides the blind with access to information in digital content[43].

This finding corroborates a study carried out in Portugal, which developed an interactive online booklet with video, image and game content on occupational health accessible to people with visual impairments. It was concluded that, following the principles of universal design, online digital educational content can become inclusive, when adjusted with accessibility features, making access and navigation suitable for both visually impaired people and the general public[19].

The concept of universal design applied to technologies for people with disabilities refers to the design of products, services and environments, so that they are usable by as many people as possible. Effective inclusion occurs when people with or without special educational needs interact and learn together, in the midst of performing the same set of activities[44].

Another finding was the development of health technologies in the modality of educational games. Educational games in the form of play is considered positive for the teaching and learning process and arouses interest about the content in a pleasurable way. These advantages are corroborated by study results that built and validated a tactile educational game in different textures in the board format, complemented by letters and braille instructions. The game was considered appropriate by the evaluators, because it allowed people with visual impairment to access to information about drugs in a playful way[31].

A study conducted in the United States developed an exercise game with personalized auditory feedback, according to the user's movements, accessible to visually impaired people so that they could engage with physical recreation and exercise independently. Yoga was chosen for physical benefits and mental health. The participants were motivated, practiced physical activity consistently, increasing frequency and time[25].

In view of the above, it is observed that, for people with visual impairment, learning based on resources that explore sensory means helps in the construction of meaning. Thus, the use of various appropriate technologies can create situations that enable meaningful learning[6].

Regarding the development of technologies for health education technologies, it is important to highlight that they are validated as a scientifically reliable product, and are also tested for effectiveness and suitability for application in different contexts. Educational material, when well-produced and validated, can contribute to health care practices and favor the participation of subjects in the educational process[45].

Methodological articles predominated in the review, which consisted of the development and evaluation of technologies. The findings showed the adequacy and feasibility of health education technologies developed for people with visual impairment, because they offer knowledge about the proposed themes and equal access to educational materials[26–27,29,31].

In the search for the development of materials that promote inclusion through access to health information for people with visual impairment, specialist validation is recommended, by means of specific methodologies, through which the accessibility and effectiveness of the resource can be used is verified.

CONCLUSION

The findings of this review showed scientific evidence about assistive technologies used for the health education of people with visual impairments.

The use of audio as an accessibility resource prevailed, followed by computer-mediated technologies and/or the Internet, and Braille printed materials and technologies that explored the tactile sense of blind people. The most addressed topics were sexual and reproductive health, followed by oral health.

It was noticed that the studies showed concern with the development of reliable technologies, through the validation of these both by experts and by the target audience.

The studies showed that the content and information of the applied technologies were understood by people with visual impairment, since the level of information of these people showed significant improvement after educational intervention.

In view of the differences in the modes of knowledge acquisition and differentiated needs of interaction, in order to effect learning between subjects, it is necessary to reflect on the development of educational materials that address the specificities of the target audience, including people with visual impairment.

The publications predominantly evaluated knowledge, few evaluated the verification of the change in behavior, attitude or practice. Evaluation of these other secondary effects to the knowledge of these educational resources is recommended. In addition, it is recommended to verify the development of health education technologies for people with visual impairments on various topics in the health area and their long-term effects.

REFERENCES

1.   Instituto Brasileiro de Geografia e Estatística (IBGE). Demographic census 2010 [Internet]. Rio de Janeiro, RJ(BR): Instituto Brasileiro de Geografia e Estatística; 2010 [cited 2021 Mar 20]. Available from: https://www.ibge.gov.br/home/estatistica/população/censo2010

2.   World Health Organization (WHO). International Statistical Classification of Diseases and Related Health Problems: ICD10. 5th ed. Genebra (CH): World Health Organization; 2016.

3.   Zander M. Public health and disability studies. Public Health Forum [Internet]. 2017 [cited 2021 Mar 20];25(4):259-61. Available from: http://doi.org/10.1515/pubhef-2017-0041

4.   Marques JF, Áfio ACE, Carvalho LV, Leite SS, Almeida PC, Pagliuca LMF. Physical accessibility in primary health care: a step towards the embracement. Rev Gaúcha Enferm [Internet]. 2018 [cited 2021 Mar 20];39:e2017-0009. Available from: https://doi.org/10.1590/1983-1447.2018.2017-0009

5.   Alves MJH, Maia ER, Pagliuca LMF. Evaluation of nurse's verbal communication skills in the blind patient consultation after training. Nurs Health Sci [Internet]. 2020 [cited 2021 Mar 20];9:31-6. Available from: http://doi.org/10.9790/1959-0901053135

6.   Carvalho LV, Melo GM, Aquino PS, Castro RCMB, Cardoso MVLML, Pagliuca LMF. Assistive technologies for the blind: Key competences for health promotion under the Galway Consensus. Rev Rene [Internet]. 2017 [cited 2021 Mar 20];18(3):412-9. Available from: http://doi.org/10.15253/2175-6783.2017000300018

7. Blake KD, Thai C, Falisi A, Chou W-YS, Oh A, Jackson D, et al. Video-based interventions for cancer control: a systematic review. Health Educ Behav [Internet]. 2020 [cited 2021 Mar 20];47(2):249-57. Available from: http://doi.org/10.1177/1090198119887210

8. Santos JLG, Souza CSBN, Tourinho FSV, Sebold LF, Kempfer SS, Linch GFC. Didactic strategies in the teaching-learning process of nursing management. Texto Contexto Enferm [Internet]. 2018 [cited 2021 Mar 20];27(2):e1980016. Available from: https://doi.org/10.1590/0104-070720180001980016

9. LeCroy CW, Cosgrove JMC, Cotter K, Fordney M. Go grrrls: a randomized controlled trial of a gender-specific intervention to reduce sexual risk factors in middle school females. Health Educ Behav [Internet]. 2018 [cited 2021 Mar 20];45(2):286-94. Available from: https://doi.org/10.1177/1090198117715667

10. Lira GS, Freitas MRD, Chaves BFB, Brito ACM, Freitas FFQ. The use of educational technologies for the elderly: an integrative review of the literature. Rev Enferm Atual In Derme [Internet]. 2021 [cited 2021 Nov 24];95(34):e-21054. Available from: https://revistaenfermagematual.com.br/index.php/revista/article/view/966

11. Mariano MR, Pagliuca LMF, Oliveira PMP, Almeida PC, Aguiar ASAC, Abreu WC. Educational game about drugs for visually impaired people: a comparison between Brazil and Portugal. Open J Nurs [Internet]. 2017 [cited 2021 Mar 20];7:399-408. Available from: http://doi.org/10.4236/ojn.2017.73031

12. Bersch R. Introduction to assistive technology [Internet]. Porto Alegre, RS(BR): Specialized Center for Child Development; 2017 [cited 2021 Feb 15]. 20 p. Available from: https://www.assistiva.com.br/Introducao_Tecnologia_Assistiva.pdf

13. Carvalho AT, Áfio ACE, Marques JF, Pagliuca LMF, Carvalho LV, Leite SS. Instructional design in nursing: assistive technologies for the blind and deaf. Rev Cogitare Enferm [Internet]. 2019 [cited 2021 Mar 20];24:e62767. Available from: https://doi.org/10.5380/ce.v24i0.62767

14. Soares CB, Hoga LAK, Peduzzi M, Sangaleti C, Yonekura T, Silva DRAD. Integrative review: concepts and methods used in nursing. Rev Esc Enferm USP [Internet]. 2014 [cited 2021 Mar 20];48(2):329-45. Available from: https://doi.org/10.1590/S0080-623420140002000020

15. Polit DF. Nursing research foundation: evaluation of evidence for nursing practice. 9th ed. Porto Alegre, RS(BR): Artmed; 2019. 431 p.

16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ [Internet]. 2021 [cited 2022 Jan 21];372:n71. Available from: https://doi.org/10.1136/bmj.n71

17. Melnyk BM, Fineout-Overholt E. Evidence-based practice in nursing and healthcare: a guide to best practice. 3rd ed. Philadelphia, PA(US): Lippincott Williams & Wilkins; 2014. 599 p.

18. Öz HG, Yangin HB. Evaluation of a web-based sexual health education program for individuals with visual impairments. Sex Disabil [Internet]. 2021 [cited 2021 Nov 20];39(3):1-16. Available from: https://doi.org/10.1007/s11195-021-09692-1

19. Almeida AMP, Beja J, Pedro L, Rodrigues F, Clemente M, Vieira R, et al. Development of an online digital resource accessible for students with visual impairment or blindness: challenges and strategies. Work [Internet]. 2020 [cited 2021 Mar 20];65(2):333-42. Available from: https://doi.org/10.3233/WOR-203085

20. Sharififard N, Sargeran K, Gholami M, Zayeri F. A music- and game-based oral health education for visually impaired school children; multilevel analysis of a cluster randomized controlled trial. BMC Oral Health [Internet]. 2020 [cited 2021 Nov 20];20(1):144. Available from: https://doi.org/10.1186/s12903-020-01131-5

21. Das D, Suresan V, Jnaneswar A, Pathi J, Subramaniam GB. Effectiveness of a novel oral health education technique in maintenance of gingival health and plaque removal efficacy among institutionalized visually impaired children of Bhubaneswar city: a randomized controlled trial. Spec Care Dentist [Internet]. 2019 [cited 2021 Nov 20];39(2):125-34. Available from: https://doi.org/10.1111/scd.12350

22. Gautam A, Bhambal A, Moghe S. Impact of oral health education by audio aids, braille and tactile models on the oral health status of visually impairedchildren of Bhopal City. J Indian Soc Pedod Prev Dent [Internet]. 2018 [cited 2021 Nov 20];36(1):82-5. Available from: https://doi.org/10.4103/JISPPD.JISPPD_307_16

23. Carvalho LV, Carvalho AT, Áfio ACE, Silva ASR, Silva MG, Pagliuca LMF. Construction of assistive technology as online course for the blind about hypertension. Rev Bras Enferm [Internet]. 2018 [cited 2021 Mar 20];71(4):1970-6. Available from: https://doi.org/10.1590/0034-7167-2017-0056

24. Oliveira MG, Áfio ACE, Almeida PC, Machado MMT, Lindsay AC, Pagliuca LMF. Teaching blind women about the anatomy and physiology of the female reproductive system through educational manual. Rev Bras Saúde Mater Infant [Internet]. 2018 [cited 2021 Mar 20];18(4):763-9. Available from: https://doi.org/10.1590/1806-93042018000400005

25. Rector K, Vilardaga R, Lansky L, Lu K, Bennett CL, Ladner RE, et al. Design and real-world evaluation of eyes-free yoga: an exergame for blind and low-vision exercise. ACM Trans Access Comput [Internet]. 2017 [cited 2021 Mar 20];9(4):12. Available from: https://doi.org/10.1145/3022729

26. Oliveira PMP, Pagliuca LMF, Cezario KG, Almeida PC, Beserra GL. Breastfeeding: validation of assistive audio technology for the visually impaired individual. Acta Paul Enferm [Internet]. 2017 [cited 2021 Mar 20];30(2):122-8. Available from: https://doi.org/10.1590/1982-0194201700020

27. Guimarães FJ, Pagliuca LMF. Validation of assistive technology on psychoactive substances for visually impaired people. Disabil Rehabil Assist Technol [Internet]. 2017 [cited 2021 Mar 20];14(3):236-40. Available from: https://doi.org/10.1080/17483107.2017.1421270

28. Debnath A, Srivastava BK, Shetty P, Eshwar S. New vision for improving the oral health education of visually impaired children- a non randomized control trial. J Clin Diagn Res [Internet]. 2017 [cited 2021 Nov 20];11(7):ZC29-32. Available from: https://doi.org/10.7860/JCDR/2017/26515.10170

29. Oliveira GOB, Cavalcante LDW, Pagliuca LMF, Almeida PC, Rebouças CBA. Prevention of sexually transmitted diseases among visually impaired people: educational text validation. Rev Lat Am Enfermagem [Internet]. 2016 [cited 2021 Mar 20];24:e2775. Available from: https://doi.org/10.1590/1518-8345.0906.2775

30. Cavalcante LDW, Oliveira GOB, Almeida PC, Rebouças CBA, Pagliuca LMF. Assistive technology for visually impaired women for use of the female condom: a validation study. Rev Esc Enferm USP [Internet]. 2015 [cited 2021 Mar 20];49(1):14-21. Available from: https://doi.org/10.1590/S0080-623420150000100002

31. Mariano MR, Rebouças CBA, Pagliuca LMF. Educative game on drugs for blind individuals: development and assessment. Rev Esc Enferm USP [Internet]. 2013 [cited 2021 Mar 20];47(4):930-6. Available from: https://doi.org/10.1590/S0080-623420130000400022

32. Wilian AS. Making diabetes education accessible for people with visual impairment. Diabetes Educ [Internet]. 2009 [cited 2021 Mar 20];35(4):612-21. Available from: https://doi.org/10.1177/0145721709335005

33. Pagliuca LMF, Costa EM. Educational technology for breast self-examination in blind women. Rev Rene [Internet]. 2005 [cited 2021 Mar 20];6(1):77-85. Available from: http://periodicos.ufc.br/rene/article/view/5473

34. Pagliuca LMF, Macedo KNF, Silva GRF. Tactile material for the prevention of blood hypertension in blind people. Rev Rene [Internet]. 2003 [cited 2021 Nov 20];4(2):75-81. Available from: http://periodicos.ufc.br/rene/article/view/5704/4088

35. Pagliuca LMF, Rodrigues JO. Barrier contraceptive methods and IUDs: educational technology for the visually impaired. Rev Bras Enferm [Internet]. 1999 [cited 2021 Nov 20];52(3):413-22. Available from: https://doi.org/10.1590/s0034-71671999000300011

36. Pessoa NR, Lira MN, Frazão CMFQ, Ramos VP, Albuquerque CP. Educational technologies aimed at chronic kidney patients in promoting self-care. Rev Cuid Fund [Internet]. 2019 [cited 2021 Nov 20];11(3):756-62. Available from: https://doi.org/10.9789/2175-5361.2019.v11i3.756-762

37. Silva FL, Galindo Neto NM, Sá GGM, França MS, Oliveira PMP, Grimaildi MRM. Technologies for health education about foreign-body airway obstruction: an integrative review. Rev Esc Enferm USP [Internet]. 2021 [cited 2021 Nov 20];55:e03778. Available from: https://doi.org/10.1590/S1980-220X2020035103778

38. Carvalho ANL, Silva JP. Sexuality of people with disabilities: a systematic review. Arq Bras Psicol [Internet]. 2018 [cited 2021 Mar 20];70(3):289-304. Available from: http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1809-52672018000300020&lng=pt&nrm=iso&tlng=pt

39. França ISX, Coura AS, Sousa FS, Aragão JS, Silva AFR, Santos SR. Acquiring of knowledge about sexual health by blind people: an action research. Rev Lat Am Enfermagem [Internet]. 2019 [cited 2021 Mar 20];27:e3163. Available from: https://doi.org/10.1590/1518-8345.3006.3163

40. Torres JP, Costa CSL, Lourenço GF. Visuo-tactile and visual-auditory sensory substitution in people with visual impairment: a systematic review. Rev Bras Ed Esp [Internet]. 2016 [cited 2021 Nov 20];22(4):605-18. Available from: https://doi.org/10.1590/s1413-65382216000400010

41. Cozendey SG, Costa MPR. Using audiodescription as a teaching resource. Rev Ibero-Am Estud Educ [Internet]. 2018 [cited 2021 Mar 20];13(3):1164-86. Available from: https://doi.org/10.21723/riaee.v13.n3.2018.9626

42. W3C. Web Content Accessibility Guidelines-WCAG-2.0 [Internet]. 2014 [cited 2016 Nov 15]. Available from: http://www.w3.org/Translations/WCAG20-pt-PT/WCAG20-pt-PT-20141024/

43. Bonilla MHS, Silva MCCC, Machado TA. Digital technologies and visual impairment: the contribution of ICT to pedagogical practice in the context of the Brazilian law of inclusion. Rev Pesqui Qual [Internet]. 2018 [cited 2021 Mar 20];6(12):412-25. Available from: https://doi.org/10.33361/RPQ.2018.v.6.n.12.236

44. Oliveira ARP, Munster MA, Goncalves AG. Universal design for learning and inclusive education: a systematic review in the international literature. Rev Bras Educ Espec [Internet]. 2019 [cited 2021 Mar 20];25(4):675-90. Available from: https://doi.org/10.1590/s1413-65382519000400009

45. Rosa BVC, Girardon-Perlini NMO, Gamboa NSG, Nietsche EA, Beuter M, Dalmolin A. Development and validation of audiovisual educational technology for families and people with colostomy by cancer. Texto Contexto Enferm [Internet]. 2019 [cited 2021 Mar 20];28:e20180053. Available from: https://doi.org/10.1590/1980-265X-TCE-2018-0053

NOTES

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CONFLICT OF INTEREST

There is no conflict of interest.

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