

USE OF DIGITAL TECHNOLOGIES IN THE TRAINING OF DEAF STUDENTS IN
HIGHER EDUCATION: A LITERATURE REVIEW

*USO DE TECNOLOGIAS DIGITAIS NA FORMAÇÃO DE ESTUDANTES SURDOS NO
ENSINO SUPERIOR: UMA REVISÃO DE LITERATURA*

*USO DE TECNOLOGÍAS DIGITALES EN LA FORMACIÓN DE ESTUDIANTES
SORDOS EN LA EDUCACIÓN SUPERIOR: UNA REVISIÓN DE LA LITERATURA*



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ABSTRACT: This Narrative Literature Review aimed to investigate scientific productions on the use of digital technologies in the training of deaf people in higher education. The review analyzed 10 academic productions, seven dissertations, and three theses, published between 2011 and 2021, from the BDTD, SciELO, and CAPES Portal databases, based on the keywords: digital educational tools, deaf people, and initial training between March and June 2022. The information was grouped into thematic categories: i) Strategies and methodologies as mediators in the teaching and learning process for deaf students; ii) Teacher training; iii) Digital teaching materials and educational software for the deaf. From the results, we observed that production related to the area of teacher training for deaf people has been constant. However, the need to carry out research on this topic is evident, considering that it will bring valuable contributions to the scope of scientific knowledge.

KEYWORDS: Digital Technologies. Initial Teacher Training. Deaf Academics. University education.

RESUMO: *Esta Revisão Narrativa de literatura teve como objetivo investigar produções científicas sobre o uso de tecnologias digitais na formação de surdos no ensino superior. A revisão analisou 10 produções acadêmicas, sendo sete dissertações e três teses, publicadas entre os anos de 2011 e 2021, das bases de dados BDTD, SciELO e Portal da CAPES, a partir das palavras-chave: ferramentas educacionais digitais, surdos e formação inicial, no interm de março a junho de 2022. As informações foram agrupadas nas categorias temáticas: i) Estratégias e metodologias como mediadoras no processo de ensino e aprendizagem do estudante surdo; ii) Formação de professores; iii) Materiais didáticos digitais e softwares educativos para surdos. A partir dos resultados observamos que a produção relacionada à área de formação docente de surdos tem sido constante. Contudo, evidencia-se a necessidade de realização de pesquisas nesta temática, tendo em vista que trará valiosas contribuições para um escopo do conhecimento científico.*

PALAVRAS-CHAVE: *Tecnologias Digitais. Formação Inicial de Professores. Acadêmicos Surdos. Ensino Superior.*

RESUMEN: *Esta Revisión de Literatura Narrativa tuvo como objetivo investigar producciones científicas sobre el uso de tecnologías digitales en la formación de personas sordas en la educación superior. La revisión analizó 10 producciones académicas, siete disertaciones y tres tesis, publicadas entre 2011 y 2021, de las bases de datos BDTD, SciELO y Portal CAPES, a partir de las palabras clave: herramientas educativas digitales, personas sordas y formación inicial, entre marzo y junio de 2022. La información se agrupó en categorías temáticas: i) Estrategias y metodologías como mediadoras en el proceso de enseñanza y aprendizaje de estudiantes sordos; ii) Formación docente; iii) Materiales didáticos digitales y software educativo para personas sordas. De los resultados observamos que la producción relacionada con el área de formación docente para personas sordas ha sido constante. Sin embargo, es evidente la necesidad de realizar investigaciones sobre este tema, considerando que traerá valiosos aportes a un ámbito del conocimiento científico.*

PALABRAS CLAVE: *Tecnologías digitales. Formación Inicial del Profesorado. Académicos sordos. Enseñanza superior.*

Introduction

The history of deaf education is marked by numerous struggles and movements advocating for the political, linguistic, and educational rights of the deaf community. In Brazil, these advocacy efforts and movements for a more suitable educational approach for the deaf have led to the implementation of bilingual education for these individuals, representing a significant advancement beyond basic education and extending to higher education.

This approach advocates for access to two languages: Brazilian Sign Language (LIBRAS), considered the first language (L1) of the deaf, and Portuguese as the second language (L2) (Quadros, 1997). It is noteworthy that several authors recommend bilingual education as an approach that ensures satisfactory learning for deaf students (Quadros, 1997; Hencklein; Camargo, 2016; Crittelli, 2017).

In terms of public policy advancements concerning deaf education, we have Law No. 10,436/02 (Brasil, 2002), which recognizes Brazilian Sign Language as a language, a visual-motor linguistic system with its own grammatical structure, originating from Brazilian deaf communities, and Decree No. 5,626/05 that regulates it (Brasil, 2005). Farias (2021) emphasizes that this recognition was supported by linguistic research on the status of LIBRAS as a natural language, initiated nationally in the 1990s by Ferreira-Brito (1995), and later by Quadros & Karnopp (2004), Felipe (2006), among others.

Regarding Decree No. 5,626/05, dated December 22, 2005, we highlight the topic related to teacher training, which mandates the inclusion of the LIBRAS course in all teaching degree programs and Speech-Language Pathology courses. For other higher education courses, the LIBRAS course should be offered as an elective. The document also discusses the training of teachers through the higher education course in LIBRAS Letters; LIBRAS Letters/Portuguese as a second language, emphasizing the training of LIBRAS translators-interpreters as well as LIBRAS instructors, highlighting the differences between each role.

In this context, the creation of the Bachelor's Degree in LIBRAS was undeniably a milestone for the Brazilian deaf community (Farias, 2021). According to Quadros (2014), the first class of this course started in 2006 at the Federal University of Santa Catarina (UFSC), in the distance learning modality. In March 2007, according to Nembri (2011), the Bilingual Pedagogy course began at the National Institute of Deaf Education (INES), with 60 student slots.

The real dissemination of the LIBRAS Letters course nationwide occurred through the National Plan for the Rights of Persons with Disabilities, Living Without Limits, established

by Decree No. 7,612 in November 2011. This plan was created to fulfill the commitment to offer and ensure quality education for all. Aiming to offer and ensure bilingual education for deaf citizens, the plan led to the creation of the course in the 26 state capitals and the Federal District (Brasil, 2011).

With the significant increase of deaf students in higher education, predominantly in LIBRAS Letters courses, there was a change in the reality experienced by these individuals and, consequently, the community as a whole, as they gained access to scientific knowledge in various fields (Faria-Nascimento, 2009).

In recent years, in light of this significant access, research on the use of digital technologies in the initial training of teachers, especially deaf academics, has gained increasing prominence in the field of education. These studies focus on issues related to the profile of these future teachers, their identity, their linguistic specificities, and the theoretical-methodological contents necessary for teaching practice.

Nevertheless, there are numerous challenges in deaf education, which are sometimes marked by a series of ruptures and contradictions within an inclusive context, but which can be minimized through pedagogical practices that seek to strengthen the recognition of the learning specificities of these students (Viana; Barreto, 2014; Martins; Lins, 2015; Nogueira; Cabello, 2017; Brito, 2020).

With this overview, this article presents a study of the Narrative Review type of literature, characterized by bibliographic research using systematic criteria. The objective was to investigate academic and literary productions published between 2011 and 2021, involving the use of digital technologies in the training of deaf individuals in higher education.

The choice of this time frame was made because the production in the area over the last five years has shown a progressive and steady increase. The gathered information was grouped into three categories of analysis: i) Strategies and methodologies as mediators in the teaching and learning process of deaf students; ii) Teacher training; and iii) Digital didactic materials and educational software for deaf individuals.

Methodological Pathway

Using a qualitative, exploratory approach, this study employed a narrative literature review as its research methodology. "Narrative reviews are broad publications suitable for describing and discussing the development or 'state of the art' of a particular subject, from a theoretical or contextual point of view" (Sallum; Sanches, 2012, p. 151, our translation).

Such research can greatly aid in establishing a theoretical corpus of a certain area, as well as conducting mapping, pointing out significant theoretical contributions, highlighting gaps that may motivate further research, and reporting innovative experiences aimed at overcoming practice challenges (Romanowski; Ens, 2006). This type of study is a form of research with a bibliographic character aimed at investigating academic publications in various areas of knowledge, making connections with research and, discussing the main investigative trends in different periods and places, and, from data analysis, developing categories (Ferreira, 2002).

The data sources for narrative literature review research are mostly research repositories, libraries of different universities, associations, or research funding agencies (Ferreira, 2002). Thus, these studies are justified as they provide an overview of what has been produced in the field and an ordering that allows interested parties to perceive the evolution of research in a particular field to be investigated, as well as its characteristics and focus, in addition to identifying the remaining gaps (Romanowski; Ens, 2006).

Planning, Conduct, and Results

Initially, to ascertain the need for conducting a narrative literature review, an attempt was made to identify the existence of a secondary work on the use of digital technologies in the education of deaf students in higher education currently underway by another researcher or the publication of a protocol with the same theme on the Google Scholar platform. After this search, the Research Question (RQ) was defined, taking into account its exploratory characteristics: Is the use of digital technologies in the education of deaf students in higher education common?

Given the limited academic works found on this topic, the absence of any review or similar protocol publication, and the exploratory nature of the research question, a narrative literature review was chosen (Sallum; Sanches, 2012).

The structure of the main research question was organized according to the Population, Intervention, Context, Outcomes, Comparison (PICOC) framework, as recommended by Kitchenham and Charters (2007). However, only the Population, Intervention, and Outcomes (PIO) items were considered relevant for the research. The acronym PIO, translated into Portuguese as *População, Intervenção, e Resultados*, was used to assist both in this literature search and in the construction of the research question. Thus, this narrative literature review aims to analyze scientific productions involving the use of digital technologies in the education of deaf students in higher education.

In this regard, the following structure was defined for the objective, as proposed in Santos (2010):

- Analyze: experience reports and scientific publications through a study based on a narrative literature review;

- With the purpose of: analyzing scientific productions involving the use of digital technologies in the education of deaf students in higher education, whose importance is to obtain knowledge about the use of digital technologies with deaf undergraduates in higher education, as well as the approaches and methodological strategies for the use of these technologies and which ones offer a possible impact on the education of these individuals;

- Regarding the: definition and use of digital technologies for the teaching and learning process of deaf undergraduates;

- From the perspective: of the deaf;

- In the context: of higher education.

Therefore, according to Araújo (2020), the keywords for the PIO acronym were defined (Table 01):

- i) (P) What is the research problem, or who are the individuals/population? Deaf undergraduates.
- ii) (I) What will be done, what is the treatment, what is the intervention, or what is the exposure? Use of digital technologies.
- iii) (O) What is the expected outcome? Use of Digital Technologies in higher education with deaf undergraduates.

Table 01 - Use of the PIO acronym

Acronym	P	I	O
Extraction	Deaf	Digital Technologies	University education
<i>Conversion</i>	<i>Deaf</i>	<i>Digital Technologies</i>	<i>University education</i>
Combination	Deaf; Deafened; Hearing impaired	Digital Technologies; Digital Educational Tools.	University education; Teacher training; Graduation.
Construction	(deaf OR deafened OR "hearing impaired")	(Digital Technologies OR Digital Educational Tools)	(Higher education OR Teacher training OR Graduation)
Use	((deaf OR deafened OR "hearing impaired") AND (Digital Technologies OR Digital Educational Tools) AND (Higher education OR Teacher training OR Graduation))		

Source: Authors' elaboration with data from the research (2023).

The table above shows us that when belonging to the same group, words are grouped by a Boolean operator OR, and when in distinct groups, they are grouped with a Boolean operator AND. In this work, the search argument is: ((deaf OR hearing-impaired OR "hearing impaired") AND (Digital Technologies OR Digital Educational Tools) AND (Higher Education OR Teacher Training OR Undergraduate)).

Each database has buttons and filters that assist in the return of works with different sensitivity to Boolean operators, as well as limits on terms in the search string. Thus, in an effort to delimit and characterize the object of study, we conducted a detailed review of the following scientific databases: Institutional Repository of the Federal University of São Carlos (RI UFSCar/SP), which returned 234 studies, Digital Library of Theses and Dissertations (BDTD), which returned 34 studies, Google Scholar, 575 works, Scientific Electronic Library Online (SciELO), 4 research papers, and Periodicals Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), which returned 20 works. From this total, initially, we selected 40 articles and 25 theses/dissertations, using only the thematic approximation of the works as inclusion criteria for this research. After applying the inclusion and exclusion criteria (Table 02), 10 academic publications were selected, comprising 7 dissertations from federal and state universities in Brazilian territory and 3 doctoral theses.

Table 02 - Inclusion and Exclusion Criteria

Inclusion	Exclusion
Primary works with a theme related to this research	Secondary or tertiary jobs
Primary work carried out in the period between 2011-2021	Works with five pages or less
Primary works with open-access	Gray (gray) literature
Primary works whose empirical process does not exceed ten years	Duplicate jobs

Source: Authors' elaboration with data from the research (2023).

Below, the initial data of the productions that compose this narrative literature review are presented (Table 03).

Table 03 - Selected dissertations and theses for the narrative literature review

Author and year	Title	Publication Type	Origin
BRITO, Everton da Silva (2020)	The use of active methodologies in the teaching training of resident students on the Literature course - Portuguese language and Libras at UFRN	Dissertation	<i>Universidade Federal do Rio Grande do Norte</i>
GONÇALVES, Tainá (2019)	The mind maps course in initial teacher training in history - degree: the use of online digital technologies as a differentiated teaching practice at Unicentro/PR	Dissertation	<i>Universidade Estadual do Centro-Oeste - Unicentro/PR</i>
CARMO, Kácia Araújo do. (2018)	Inclusive education with deaf people: mediating strategies and methodologies for learning chemical concepts	Dissertation	<i>Universidade Federal do Amazonas – AM</i>
ROCHA, Fabiano Guimarães da. (2017)	The pedagogical conceptions of deaf teachers in the production of digital teaching materials using images	Dissertation	<i>Universidade Estácio de Sá/ RJ</i>
RIOS, Lucas Tadeu Rosente (2016)	Gamification in the Libras learning process	Dissertation	<i>Pontifícia Universidade Católica de São Paulo – PUC</i>
CAMPOS, Mariana (2015)	The Libras teaching-learning process through Moodle at UAB-UFSCar	Thesis	<i>Universidade Federal de São Carlos – UFSCar</i>
GOETTERT, Nelson (2014)	Digital technologies and communication strategies for deaf people: from the vitality of sign language to the need for written language	Dissertation	<i>Universidade UNISINOS -São Leopoldo – RS</i>
PRIETCH, Soraia Silva (2014)	Acceptance of technologies by deaf students from the perspective of inclusive education	Thesis	<i>Escola Politécnica, Universidade de São Paulo</i>

SILVA, Marta de Fátima (2013)	Bilingual intercultural education for the deaf: teacher training for culturally sensitive/relevant teaching	Dissertation	<i>Universidade Estadual do Oeste do Paraná</i>
CARVALHO, Daniel de. (2011)	Software in Portuguese/Libras with augmented reality technology: teaching words to deaf students	Thesis	<i>Faculdade de Filosofia e Ciências - Universidade Estadual Paulista -UNESP</i>

Source: Authors' elaboration with data from the research (2023).

Discussion

Access to scientific portals occurred between March and July 2021. To analyze the found corpus, we divided the results into three categories of analysis: 1. Strategies and methodologies as mediators in the teaching and learning process of deaf students; 2. Teacher training; and 3. Digital teaching materials and educational software for the deaf.

Strategies and methodologies as mediators in the teaching and learning process of deaf students

In category 1, which refers to "*Strategies and methodologies as mediators in the teaching and learning process of deaf students*," four selected works fit the established criteria. Of these, three are dissertations, and one is a thesis, all published between 2014 and 2020. Almost all productions are from federal universities, except one, which was developed in a private institution located in a city in southern Brazil.

Studies reveal that the theme concerning deaf education has been consolidating as an area of interest for research in various universities, encompassing different thematic areas. However, it is important to emphasize the scarcity of work that gives visibility to this social group, which has specific expectations, difficulties, and perceptions about their academic formation process in the university.

Brito (2020), in research conducted on a professional master's degree, found the need for the incorporation of active methodologies and tools that position the student as an active subject and protagonist of their learning process. In response to this need, he created and implemented a formative workshop using active methodologies, aimed at resident students (deaf and hearing undergraduates) of the Pedagogical Residency Program (RP) of the Portuguese Language and Libras course at the Federal University of Rio Grande do Norte (UFRN).

Analyzing the impacts of the formative workshop on the use of Active Methodologies, the results of the study highlighted important aspects of teaching practice that enable a better understanding of the use of these methodologies as teaching and learning resources for deaf students in basic education, based on the teacher training provided by the Pedagogical Residency Program of the Portuguese Language and Libras course at UFRN.

The author emphasizes, however, the need for a change in teaching posture regarding the teaching and learning process of these students. Furthermore, he emphasizes that the use of active methodologies, without effective planning, with appropriate and context-directed strategies in deaf education, does not result in the disruption of traditional paradigms present in pedagogical practices. Such change requires effort, time, and study to become effective.

Faced with the difficulties encountered by teachers in working with more complex content in the chemistry discipline, Carmo (2018) analyzed how different methodologies and didactic strategies used in mediating the learning of chemical concepts contribute to the inclusion of deaf students.

Based on the survey of these methodologies, strategies, and differentiated resources, a didactic sequence was created to verify which ones contribute to the learning of chemical concepts. In order to address the proposed research problem, a 40-hour course was prepared and taught in the presence of a LIBRAS interpreter.

The researcher concluded, based on the results obtained, that didactic activities developed with visual resources, using contextualization, enable student interaction and provide better inclusion for learning chemical concepts. Among the findings of the study, it was also found that the main difficulty of deaf students in learning chemical concepts is related to linguistic issues, while ease is associated with the logical understanding of the phenomenological and representational level, involving examples and numbers, respectively.

In her dissertation entitled "*Tecnologias Digitais e Estratégias Comunicacionais de Surdos: da vitalidade da língua de sinais à necessidade da língua escrita*"³, Goettert (2014) investigated the influence of technologies on the development of Portuguese writing strategies by deaf individuals and their relationship with the use of sign language.

The study was developed based on ethnomethodology, guided by the assumptions of culture, deaf identity, and bilingualism, using questionnaires, interviews, and systematic monitoring of deaf communities in some Brazilian regions. Overall, the study found strategies

³ "Digital Technologies and Communicative Strategies of the Deaf: from the Vitality of Sign Language to the Necessity of Written Language".

for deaf individuals using digital technologies to acquire new knowledge, communicate, and develop a second language in their daily lives. The research findings pointed to the identification of different communicative strategies in the use of Portuguese and observed the constant use of images to understand new information, functioning as a tool in the acquisition of this knowledge.

Such observations suggest that learning a second language is more receptive and successful when considering the visual references of deaf individuals. Furthermore, communication mediated by digital technologies, due to its hybrid characteristic, allows deaf individuals to operate better in the realm of signifiers, facilitating their sensory expression.

Finally, Campos's (2015) thesis, "*O Processo de Ensino-Aprendizagem de Libras por meio do Moodle da UAB-UFSCar*"⁴ analyzed aspects of teaching and learning Libras as a second language through Moodle, considering the adequacy of this environment and the process of communication and interaction among students, tutors, and teachers.

The evaluations and perceptions regarding the different items generally received a good rating from the agents of the Virtual Learning Environment (VLE), and the discipline, overall, seems to have achieved its objectives. The propositions presented by the agents and analyzed by the researcher point to the need to continuously improve the offering of Libras, making it more accessible to hearing students.

Based on the findings of this first discussion topic, it can be considered that these investigations highlight the use of digital technologies as essential for innovating teaching practices, as they aim to place students as active subjects and protagonists of their learning process.

All of this reinforces the idea that incorporating digital practices mediated by educational digital tools can provide deaf students with greater autonomy and quality for their own knowledge acquisition process, as clarified by Behrens (2000, p. 36, our translation) when he states that "technology needs to be included in the teacher's pedagogical practice in order to equip them to act and interact in the world with criteria, ethics, and transformative vision."

Thus, the formative experience lived in educational spaces, with reflections directed towards pedagogical practices involving students in learning processes, allows for an expansion in perspective on issues that imply a greater protagonism of teachers in initial training, which, according to authors such as Moran (2007), Kenski (2015), and Gatti (2016), emphasize the need for this training to go beyond the instrumental action of teaching how to use technologies.

⁴ "The Teaching-Learning Process of Libras through UAB-UFSCar's Moodle".

Teacher Training

In the analysis category 2, referring to Teacher Training, we found 02 studies that fit into this category, both dissertations published in 2013 and 2019, both from state universities in the state of Paraná, respectively. Based on the low quantity of studies present here, even taking into account the time frame and the inclusion and exclusion criteria of this research, it is noteworthy that few studies have addressed this theme.

The master's research titled "*Educação intercultural bilíngue para surdos: formação do professor para um ensino culturalmente sensível/relevante*"⁵, authored by Silva (2013), aimed to verify and analyze the results of a proposal for bilingual and culturally relevant education for the continuing education of teachers working in the education of deaf students.

To achieve the proposed objective, the author employed a qualitative/interpretative approach, guided by collaborative ethnography. Anchored in the perspective of culturally sensitive/relevant education for bilingual deaf students, an extension/research project titled "*Formação em Educação Bilíngue para Surdos*"⁶, was developed, which allowed for recordings in videos and field diaries, used as a source of data, discussion, and analysis for the study at hand.

The project's methodological process involved forming study groups and discussions so that participants could clarify their theoretical-methodological doubts, as they would later put into practice all the learning acquired in the group discussions. The extension course began in April 2011 and ended in December 2011, comprising 12 meetings.

The research results indicated demands, suggestions, and proposals for the theoretical and practical training of teachers of the deaf, avoiding the tendency to seek from already consolidated models the correct approach to the education of deaf students.

In her study titled "*O curso de mapas mentais na formação docente inicial em história, licenciatura: o uso de tecnologias digitais on-line como prática de ensino diferenciada na Unicentro/PR*"⁷, Gonçalves (2019) investigated the contributions of mind mapping software in the History licensure course. To address the research objectives, the author embarked on a theoretical-practical investigation, developing a course on creating mind maps considering the

⁵ "Bilingual Intercultural Education for the Deaf: Teacher Training for Culturally Sensitive/Relevant Teaching".

⁶ "Training in Bilingual Education for the Deaf".

⁷ "The course on mind maps in initial teacher training in history, licensure: the use of online digital technologies as a differentiated teaching practice at Unicentro/PR".

applicability of these tools as a possibility for knowledge construction and as an instrument in differentiated teaching practice.

The research concluded that the use of mind maps provided diverse experiences and outcomes, with the effective participation of the students, resulting in the production of 16 mind maps. In this regard, the course proved to be a practice of constructing meaningful knowledge through the conscious use of available online tools and content. However, the author emphasizes the need for digital and online technologies to be recognized as an enhancing possibility in education, including in the discipline of History, rather than being seen as a problem or adversary in educational contexts.

In light of the above, both studies problematize the conditions of access, retention, and graduation of students in initial teacher training courses, as well as presenting contributions from mind mapping software that can assist in the construction of meaningful knowledge through the conscious and effective use of content and tools, thereby providing more effective teacher training. They also discuss the importance of culturally sensitive and relevant education for the bilingual education of deaf students.

However, it is important to note that, perhaps due to the low number of examples of research on the initial training of deaf students, despite the existence of a considerable amount of studies on the importance and necessity of adequate training for deaf students, considering their linguistic and cultural specificities, there is a noticeable decline in research production in this area.

Digital Didactic Materials and Educational Software for Deaf Individuals

In the analysis category 3, Digital Didactic Materials and Educational Software for Deaf Individuals, 04 productions were selected, comprising 03 dissertations and 01 thesis, indicating an increase in research volume in this area of knowledge. Of these, three works are linked to postgraduate programs at universities in the State of São Paulo, while one originates from Rio de Janeiro.

To address the guiding question and achieve the proposed objectives of her master's research, Rios (2016) studied and systematized the development of gamified interfaces in the school context for bilingual literacy of deaf children, with Brazilian Sign Language (Libras) as their first language and Portuguese as their second language.

As a result of the research, a catalog/guide was provided with an analysis of 27 educational game applications aimed at teaching Libras and found in mobile virtual stores. The guide was divided into 4 lines of analysis: *Objective; Interface; Feedback; and Content*. According to the author, there is an effort to conduct research and develop resources for the accessibility of deaf individuals, especially in terms of communication. However, the education sector, through educational technologies, still lacks attention in the development of research projects.

In his dissertation, Rocha (2017) discussed the pedagogical conceptions of deaf teachers regarding the use of images in digital technologies. The focus of his research was to understand how discourses on visuality and the use of images are perceived by deaf students in relation to theories and methodologies that effectively contribute to the teaching-learning process. In this sense, the research moves between teachers as learners and critics of hearing teachers, their conceptions, and pedagogical practices, as well as being themselves licensed teachers to teach the LIBRAS discipline. Thus, the author sought to identify which methodologies and theories are anchored in the teaching-learning process of deaf individuals.

The findings obtained in the research reveal the need for a review of the statements that deaf individuals are naturally visual and that the extension of subjective visual experience is inherent to the condition of being deaf, towards a refined visual experience through learning about the inner workings of images, composing images, and using them with conscious mastery. The education of deaf individuals using images in digital media, virtual networks, contributes to the development of the visual language of the deaf.

Carvalho (2011), in his dissertation, developed an Augmented Reality Software to facilitate word learning for deaf students. To achieve the proposed objectives of the study, the researcher selected three teachers from an educational institution located in a city in the interior of São Paulo. Then, the teachers were presented with a list of 267 words, which later resulted in only 15. For these words, sign language videos were produced and transformed into animations presented to 8 deaf students.

As a result, the research led to the development of the Libras/Portuguese Software with augmented reality feature, titled Libras AR Software, which was presented and tested with the students to identify its potential in the practical learning of the participating deaf students.

In his doctoral thesis titled "*Aceitação de tecnologias por estudantes surdos na perspectiva da educação inclusiva*"⁸, Prietch (2014), from the Polytechnic School of the

⁸ "Acceptance of technologies by deaf students from the perspective of inclusive education".

University of São Paulo, proposed a model of technology acceptance that takes into account aspects related to the context of inclusive education. Additionally, he conducted an experiment on the interaction of deaf and hard-of-hearing individuals with technology to evaluate the suggested model.

Regarding the research methodology, the study was developed in cycles (literature review, construction, experiment, and analysis), characterized in a spiral form. The first cycle aimed to address questions related to potential barriers that could be minimized through the use of technology. After a review of specialized literature and documents, field observations were conducted by the researcher, as well as interviews with deaf or hard-of-hearing students (with the presence of a professional interpreter of Libras) to validate the acquired knowledge.

In the second cycle, efforts were made to identify the types of assistive technologies, educational technologies, and information and communication technologies available to support D/HH students in the classroom. The third cycle investigated the instruments for assessing hedonic quality, technology acceptance factors, and the definition of the type of technology capable of minimizing potential educational barriers. In the fourth and final cycle, the factors involving important aspects motivating deaf or hard-of-hearing students to accept technology for use in the context of inclusive education were analyzed.

The results obtained revealed that the proposed model yielded positive outcomes, as it was able to address the factors that can influence the acceptance of technologies in the context of inclusive education. This includes both investigating users' personal motivational issues and analyzing aspects of the usage context. It was concluded that the model could be used for the purpose for which it was intended, namely, evaluating the acceptance of technologies in inclusive education environments.

Therefore, in this set of studies from the third category, the increased presence of technological resources as tools for knowledge production with deaf students is initially highlighted. This means that all selected works propose the integration of digital technologies with the aim of facilitating the teaching and learning process for deaf students and empowering them as protagonists of their own development.

In this context, it is understood that digital technologies can contribute both to the development of skills, attitudes, and intelligences of deaf students and the exploration of new forms of learning, enabling an increasingly meaningful and effective education. From this perspective, the need to adopt methodologies that align higher education courses with technological challenges and contemporary demands becomes evident.

Final considerations

This research allowed us to gather data for the composition of the narrative literature review, with a total of 10 selected academic works, comprising 7 dissertations and 3 doctoral theses, published between 2011 and 2021. These investigations highlighted several studies that explored the topic related to the use of digital tools in the education of deaf individuals. However, we observed a limited number of studies that specifically address the focus of this research.

The analyzed works demonstrate that bilingual education, with Libras as the language of instruction and Portuguese used in its written form, yields greater benefits in the teaching and learning process of deaf students. Nevertheless, in the context of higher education, we observed a certain scarcity of research focused on the use of digital technologies in the initial training of deaf students.

When focusing on the object of study, namely, the use of digital technologies in the initial education of deaf individuals, few studies have effectively addressed the academic training of these subjects through technologies, which is of utmost importance. This is because including digital tools enables the development of skills and attitudes that facilitate the understanding of content in a more dynamic, autonomous, and collaborative manner, promoting more meaningful learning during the formative process. Additionally, it enhances inclusive capabilities in the academic environment (Martins, 2005; Nogueira; Cabello, 2017; Brito, 2020).

The discussions presented by the analyzed works emphasize the necessity of promoting a genuinely meaningful education for deaf students, with a greater focus on the knowledge of initial training mediated by digital educational tools. Therefore, it can be concluded that this study confirms the originality and necessity of conducting research on this topic. This is because it will provide valuable contributions to a scope of scientific knowledge that has been partially explored up to this point, aiming to improve and ensure not only access but also the quality of stay for these individuals in higher education.

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