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Why Are Other Teachers More Inclusive in Online Learning than Us? Exploring Challenges Faced by Teachers of Blind and Visually Impaired Students: A Literature Review

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Abstract: Distance learning has grown rapidly in recent years. E-learning can aid teachers of students with disabilities, particularly visually impaired students (VISs), by offering versatility, accessibility, enhanced communication, adaptability, and a wide range of multimedia and non-verbal teaching methods. However, the shift from traditional face-to-face instruction to online platforms, especially during the pandemic, introduced unique challenges for VISs, with respect to including instructional methodologies, accessibility, and the integration of suitable technology. Recent research has shown that the resources and facilities of educational institutions pose challenges for teachers of visually impaired students (TVISs). This study conducts a literature review of research studies from the years 2000 to 2024 to identify significant issues encountered by TVISs with online learning to show the effects of distance learning before, during, and after the pandemic. This systematic literature review examines 25 publications. The evaluation reveals technological problems affecting the educational experience of visually impaired educators through a methodical categorization and analysis of these papers. The results emphasize important problems and suggest solutions, providing valuable knowledge for experts in education and legislation. The study recommends technology solutions to support instructors in providing inclusive online learning environments for VISs.

Keywords: education; literature review; online learning; solutions; students; teachers; tools; visually impaired

1. Introduction

Distance education endeavors to offer instruction that learners may pursue at their convenience and from any location. The objective is for distance learning programs to provide students who are unable to attend formal education with the opportunity to obtain their degrees. Therefore, the concept of distance learning environments aims to offer attainable guidance to more informal students [1]. According to [2], many students struggle to comprehend and articulate the concept of distance learning when they first encounter it online. Given the current state of remote education, some practical projects aim to enhance it by facilitating remote learning for students. Adaptability is the key factor in online education [2]. Sudrajat et al. [3] stated that the COVID-19 pandemic led to a necessity for online learning to ensure student safety in education systems globally. With institutions shutting down, remote learning was the sole option for students to pursue their education. The transition from traditional in-person classes to online or digital learning has been taking place for years in many parts of the world. Universities vary significantly in structure and technological expertise [3].

Distance education has gained immense significance in recent years, especially as schools and institutions globally shifted to remote learning in response to the COVID-19

pandemic. Nevertheless, despite the expansion of online education, there is still considerable inconsistency in its implementation, especially for students with disabilities, such as those with visual impairments. This analysis specifically examines the experiences of educators who engage with visually impaired students in distance learning settings, where the lack of accessibility is very evident.

For the purpose of this review, distance education is defined as any formal educational method in which the teacher and student are geographically separated and instruction is provided using digital methods. A particular emphasis of this review is on online learning environments, encompassing systems and tools employed to enable virtual classrooms, typically distinguished by synchronous or asynchronous instruction.

The need for this systematic literature review (SLR) arises from the fact that although there is an increasing amount of research on the overall difficulties of online learning, there has been limited exploration of the particular difficulties encountered by visually impaired students and their instructors. The current research is dispersed among several fields, and an abbreviated synthesis was conducted to consolidate results from a diverse array of investigations. The present review addresses the existing gap by conducting a thorough analysis of the difficulties, solutions, and technical progress documented in the literature. The findings of this analysis have important implications for policy and practice by identifying areas for improvement in support for visually impaired students and how education institutions might change to better meet their needs.

The educational perspective on visual impairment highlights the connection between vision and learning. It focuses on the challenges and limitations observed in students with visual impairments that set them apart from their peers with normal vision, necessitating specialized educational support [4]. Teachers' evaluations of visually impaired students (VISs) influences the dynamism and approaches of a lesson, in addition to the students' assessments [5]. James O. Bickford [6] proposed that various synchronous and asynchronous methods, including live audio and video, sequential video, and technological devices that utilize the internet, be used by distance learning programs that prepare teachers of visually impaired students (TVISs) through remote education. Furthermore, Cooper and Keefe [7] highlighted that distance education is an effective approach for the training of TVISs and that such programs can enhance the educational experience compared to traditional methods by facilitating activities and projects that foster problem solving, critical thinking, interpersonal skills, and self-directed learning while also allowing time for communication with VISs.

Despite the fact that the existing literature has emphasized strengthening e-learning teaching experiences for teachers of visually impaired students, there are numerous challenges that VISs and their instructors confront that might demand consideration, and pinpointing these obstacles is an important strategy to improve their online educational expertise. The most crucial concern is that TVISs have to cope with their insufficient training on the digital tools and technological platforms that are required to teach VISs remotely [8–10]. Additionally, lacking web accessibility materials has been a critical barrier faced by TVISs, so it is important to address the learning resources needed for this specific student group to understand the material that they are learning [9,11,12]. This research aims to examine and emphasize the primary challenges that TVISs have with online learning. We systematically review all research papers confronting these aforementioned concerns to identify, analyze, and categorize the encountered difficulties. This study analyzes 25 publications to highlight shortcomings and the essential techniques available to solve them, in addition to addressing the developed technological tools used to overcome these challenges.

Reviewing the literature on the limitations faced by teachers of visually impaired students and their students in e-learning, as well as exploring emerging tools that may be utilized, could provide remedies for these issues. Prior research emphasized distance learning in general, as explored by Mastan et al. [13], whereas other studies examined the challenges of online learning encountered by deaf students during the pandemic [14],

in addition to research on the development of information communication technology for people with visual impairment [15]. To the best of our knowledge, this study is the first to review the literature on the issues addressed by TVISs, along with the solutions to overcome them.

The contributions of this paper are outlined as follows:

- A literature review of 25 peer-reviewed research papers from the year 2000 until the present about TVISs and their students during remote education to create a reference for future research;
- An analysis of the obstacles encountered by educators teaching visually impaired students through e-learning;
- Determination of solutions for the challenges faced by TVISs during online learning;
- Definition of various developing technological tools that could assist TVISs;
- Key findings from the analyzed study aimed at enhancing the educational experience of VISs for reference by researchers and educators.

The remainder of this paper is organized as follows. Section 2 examines previous research on obstacles that TVISs encounter and the use of various digital tools and platforms in education. Section 3 delineates our research questions. Section 4 outlines the methodology employed in this study to examine the challenges faced by teachers of visually impaired students and their students during online learning. Section 5 presents the results of our research, and Section 6 discusses our research results. Lastly, Section 7 identifies the research's shortcomings, and Section 8 provides a summary of our conclusions and outlines further directions for our work.

2. Related Work

In this section, we discuss a variety of challenges encountered by teachers of visually impaired students (TVISs) and the different techniques utilized in previous studies to show how researchers have defined and explained these challenges.

2.1. Visually Impaired Society

Several social and institutional barriers are encountered by students with vision impairments and their teachers when attending colleges and universities [16–19]. For example, Wagner et al. [20] associated academic failures with insufficient institutional and instructional assistance, as well as students leaving universities due to inadequate guidance in learning. Additionally, Archie Roy [21] examined the challenges faced by VISs due to inadequate instructive, social, and scholastic support. A qualitative study conducted by Wolffe et al. [22] also revealed that teachers do not always provide VISs with the necessary degree of disability-specific assistance. Researchers observed instructors' interactions with students in the classroom, noting the various forms of support and training offered, including the teaching of skills specific to disabilities. To address these challenges, Koutsoklenis [23] highlighted that teachers undergo professional development to improve their understanding of VISs and to effectively teach both these students and other students with disabilities. Moreover, Lionarakis and Likourgiotis [24] suggested that remote learning is a beneficial method for students with disabilities, especially those with visual impairments, since it helps them integrate more easily into society, promoting the development of alternative educational choices and facilitate the ability of all individuals to pursue the goal of inclusive education.

2.2. Visually Impaired Education

The teaching experience is a crucial component of learning activities, particularly for students with visual impairments. It involves a comprehensive approach that considers the teacher's location, environment, and content selection, ensuring an effective educational experience [10]. For instance, according to David Jaffee [25], teachers play a crucial role in ensuring the effectiveness of distance learning. TVISs must be adequately qualified to effectively moderate online learning, thereby maximizing its impact through educational

programs. This study aimed to enhance various online and information technology learning initiatives, along with the training requirements and assessments discussed by Lorraine Sherry [26]. Alternatively, Gill et al. [27] examined the lack of necessary training and understanding among TVISs in effectively utilizing e-learning technologies and related information. As a consequence, they lack confidence in using computers, smartphones, or e-book readers, and they acknowledge their faults as a reflection of the limitations of the institutional structure. These challenges arise from the absence of training facilities for the visually impaired and the lack of early technological education in schools. However, Fichten et al. [28] suggested that TVISs should receive training and implement accessible e-learning policies. Furthermore, was proposed that educational institutions, including universities and colleges, as well as rehabilitative specialists and teachers, be required to determine and assess the computer technology training that they currently provide to students in order to facilitate their academic advancement. Additionally, Lucia Solcova [29] explored how teachers might employ novel tactics, such as the use of comprehensive audiobooks, to help students acquire extra skills and enjoy their educational experience.

2.3. Digital Learning Platforms

The majority of education is transitioning to digital platforms. Onukotun's research, as referenced in [17,18,30], demonstrated that Information Technologies (ITs) not only improve access to knowledge but also encourage learning and perpetual education. Pacheco [31] also proposed that information technologies can assist these students in a number of ways, such as by supporting communication, allowing access to information, enabling disability compensation, promoting learning support, arranging and maintaining support, enhancing collaboration, and facilitating interpersonal relationships and involvement. However, Ro Teles and Ganesan et al. [32,33] asserted that when it comes to special education needs and information technologies, vision impairment is arguably the most disregarded field for several reasons. For example, Ramos and de Andrea along with AlSaeed et al. [19,34], found that the majority of the tools and software designed for VISs can be intimidating for many teachers, who feel unprepared. This situation leads to these students using information technology (IT) less frequently.

Nevertheless, a study conducted in the Sultanate of Oman [12] found that using the Moodle course management system for virtual professional development and training provides teachers with features, space, and resources for professional growth and individualized, customized instruction. A study conducted in Tanzania [35] suggested that TVISs could be motivated to use smartphones for learning and be equipped with knowledge and abilities in mobile-based assistive learning technologies to utilize them effectively. The authors also highlighted that the importance of mobile computing technologies and applications in higher education needs to be emphasized, in addition to proper processes and training to provide VISs with the most effective means of using these technologies. Additionally, a study conducted in Brazil [36] examined variations in the functionalities and suitability of assistive technology, specifically, information technology for blind and low-vision students, and found that certain computer programs are crucial for these students.Key requirements for the integration of information technology in schools include having a sufficient number of computers for all students, experts to support teachers, and educational assistants. .

3. Research Questions

The objective of this study is to examine the challenges encountered by TVISs and blind students in the realm of online education and to propose remedies for these issues. Additionally, this study aims to create innovative online resources that can assist these students in their learning process. This study aims to identify and critically examine the various concerns and challenges that visually impaired students face when using e-learning methods. The outcomes of our literature study can serve as an extensive guide for improving visually impaired education.

Section 2 presents a summary of prior research that has investigated the obstacles encountered by visually impaired students and their instructors in both conventional and online learning settings. Notwithstanding these contributions, several studies have mostly concentrated on either the technology itself or the wider issues of inclusive education, without sufficiently addressing the particular convergence of visual impairment and online learning.

The study questions outlined in Section 3 are specifically formulated to fill the existing gaps in the literature. In particular, the first research question (RQ1) addresses the insufficient attention given to the particular challenges and concerns encountered by teachers of visually impaired students in virtual learning settings. Likewise, RQ2 is designed to explicitly address the tactics and solutions proposed to overcome these obstacles. These questions are derived from relevant but insufficiently explored perspectives in the literature, namely the practical implementation of assistive technologies and the actual experiences of educators. By explicitly addressing these deficiencies, this review seeks to offer a more sophisticated comprehension of the investigated difficulties and suggest practical remedies that can be implemented in different educational settings.

To be more exact, we investigate the following research questions (RQs).

RQ1: Which obstacles and apprehensions do teachers of visually impaired and blind students encounter in the realm of web-based education?

RQ1 examines the various difficulties and issues faced by TVISs and blind students during remote learning from 2000 to the present. We conduct a comprehensive analysis of the findings related to the published research in this field and examine their effects over the course of several years.

RQ2: What are the latest strategies being developed to effectively address the difficulties encountered in educating individuals with visual impairments via e-learning?

RQ2 analyzes whether developing prevalent solutions may overcome some of RQ1's primary barriers. These methods can help distant learners interact by providing knowledge that goes beyond the minimum requirements. It highlights alternative methods and recommendations for TVISs in in online learning for visually impaired students, as well as strategies for universities worldwide to enhance the use of distance education.

RQ3: What are the digital learning resources and tools that educators have specifically developed for students with visual impairments?

RQ3 elucidates the various sophisticated online tools that can be implemented to assist instructors of VISs in navigating distance learning and facilitate their use of these tools.

4. Methodology

The present research constitutes a comprehensive literature review aimed at synthesizing and analyzing existing academic articles in the field in order to address the research inquiries at hand. The main purpose is to delve into the fundamental obstacles encountered by educators responsible for instructing visually impaired students within the realm of online learning. The present section is structured in accordance with the three distinct phases that were undertaken in the process of selecting pertinent publications. The three fundamental components under consideration in this discourse are planning, execution, and synthesis. The subsequent sections provide a comprehensive elucidation of each of the aforementioned steps.

4.1. Planning

We elaborated our literature search technique during this process. Following the process of the literature review, we developed a collection of specific terms relevant to

our analysis. These terms were then used to conduct searches across many web-based databases.

4.1.1. QueryTerms

A preliminary study [37] was conducted to inform the development of appropriate search terms within two prominent databases, namely ACM and IEEE. The objective of our study was to ascertain the lexical equivalents and terminologies employed in characterizing the obstacles encountered in the realm of teaching visually impaired students using distance learning. Consequently, the scope of our study was limited to merely examining the abstracts and titles. The implementation of such a strategic approach proved to be significant in effectively mitigating the occurrence of false positives. The following search query was employed in this study:

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Title:("teachers*" AND "visual* impair*" OR "blind*" OR "loss of
vision" OR "low vision") AND Abstract:("education*" OR "teach*" OR
"e-learning" OR "elearning" OR "Distance Learning" OR "online" OR
"remote" OR "online-learning")
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4.1.2. Web-Based Library

A comprehensive literature search was conducted across various reputable digital libraries, including Scopus, IEEE Xplore, ACM Digital Library, Web of Science, Springer Link, Virtual Health Library, Wiley, ERIC, and Science Direct. The selection of the nine libraries was performed for the purpose of achieving comprehensive coverage of our chosen topic. This approach was adopted to ensure that no significant studies were disregarded, thereby optimizing the incorporation of relevant insights of other scholarly studies (e.g., [38]). The libraries that were queried were compiled and are presented in Table 1. The libraries in question house a collection of scholarly works pertaining to our research topic, as well as encompassing the broader domain of education for individuals with visual impairments.

Table 1. Overview of targeted digital libraries used to collect published work.

Digital Library	Digital Library URL	Accessed Date
ACM Digital Library	https://dl.acm.org/	13 February 2024
IEEE Xplore	https://ieeexplore.ieee.org/	3 February 2024
Science Direct	https://www.sciencedirect.com/	3 February 2024
Scopus	https://www.scopus.com/	3 February 2024
Springer Link	https://link.springer.com/	3 February 2024
Web of Science	https://webofknowledge.com/	3 February 2024
Wiley	https://onlinelibrary.wiley.com/	3 February 2024
Virtual Health Library	https://pesquisa.bvsalud.org/	3 February 2024
Eric	https://eric.ed.gov/	3 February 2024

4.1.3. Inclusion/Exclusion Standards

The implementation of these standards proved to be instrumental in effectively sorting and refining our search results, thereby ensuring that only publications that were congruent with the objectives of our study remained. In order to maintain the integrity and relevance of our research, it was imperative to carefully select studies conducted within the context of education and documented in the English language. Furthermore, it was necessary to exclude studies that focused on in-person classes and lacked the rigorous scrutiny of the peer-review process. In addition, we incorporated scholarly articles accessible in digital form and published subsequent to the year 2000. The standards for inclusion and exclusion

are provided in Table 2. In pursuit of a comprehensive compilation of pertinent scholarly articles, the preliminary outcomes of our search facilitated a meticulous process of manual sorting. This enabled us to assess the suitability of the studies in question for our research endeavor. In order to gain a comprehensive understanding of the subject matter, it was of utmost importance to ascertain the specific nature of the challenges that were observed.

Table 2. Inclusion and exclusion criteria.

Inclusion Factors	Exclusion Factors
Papers in the education area	Websites, leaflets, and gray literature
Papers written in English	Full text not available online
Papers available in digital format	Papers published before 2000
Papers related to teachers	Papers related to students only
Papers related to online learning	Papers related to in-person classes

4.1.4. Backward/Forward Snowballing

The present study employed a widely recognized snowball sampling technique in order to augment the existing corpus of articles acquired through automated search methods. As elucidated by Wohlin [39], the snowballing technique encompasses a meticulous examination of scholarly articles that have surfaced during the course of a literature search, with the objective of discerning the following two distinct categories: articles that reference the focal paper (forward snowballing) and articles that are referenced within the focal paper (backward snowballing). The snowballing technique was employed in an iterative and bounded approach in order to enhance its competence. Consequently, the snowballing technique yielded a corpus of 13 articles, from which a subset of 8 articles was chosen based on adherence to our predetermined selection criteria. In conclusion, the present study successfully incorporated the articles obtained through the snowballing technique, thereby augmenting the total number of articles to a final count of 25.

4.1.5. Exclusion During Data Extraction

During the step of data extraction, scholars retain the ability to discard certain articles from the selection process. This issue arises when a researcher identifies an article as an exact copy of another publication or as not meeting the predetermined exclusion criteria. One instance pertained to a scholarly article [40], which presented a comprehensive overview of communication barriers encountered by teachers of visually impaired students but through in-person classes, not via e-learning. Another study focused only on visually impaired students and how they use online learning, without mentioning the crucial role of teachers [41].

4.2. Execution

The outcomes of the analysis conducted in the various web-based libraries are displayed in this step. There were 1789 articles returned from the initial search across each of the six sources. Then, we followed a four-step process to determine which papers were most pertinent to the present research. Subsequently, following the elimination of duplicate and retracted publications in the first stage, 1441 publications proceeded to the next stage, while 384 articles were discarded. Our inclusion and exclusion standards were used at the subsequent step of the sorting process, which involved titles and abstracts. A total of 1129 publications were eliminated overall, while 312 were accepted to continue to the subsequent step. The implementation of our established inclusion and exclusion standards yielded the omission of articles published before 2000, non-peer-reviewed materials, and gray literature. The third phase, full-text filtering, resulted in the elimination of 295 articles and the progression of 17 to the following stage. In the last phase, we conducted both forward and backward snowball sampling [39], resulting in the inclusion of 8 additional

publications. A total of 25 articles were chosen for additional examination. Figure 1 represents the procedure of executing a search. Finally, Figure 2 displays a visual representation as a word cloud that highlights the key themes derived from the titles of the 25 publications included in the analysis .

Figure 1. Overview of publication filtering process.

Figure 2. Word cloud of the titles of the selected papers.

4.3. Synthesis

In order to determine whether the data we collected might assist us in accomplishing our research purposes, we analyzed them throughout the synthesis phase. For educators to have a better understanding of the geographical and temporal context of the obstacles faced by visually impaired students, we sorted these research papers by year and their geographic base. Each and every paper was thoroughly investigated for proof, and all pertinent information was guaranteed to be conveyed. A meticulous analysis was conducted to gather all data pertaining to the challenges encountered by teachers in providing education to visually impaired students through online learning. We collected the following information for each study: disability type (e.g., vision impairment or blindness), year of publication, research design, data source, data collection method, participant type (e.g., teachers or students), participant count, and research location.

We implemented a peer-review methodology in which all researchers critically assessed the data and engaged in discussions to address any disagreements to mitigate bias in our data. To guarantee the synchronization of all the authors' involvement throughout the study, the data were exported to a Google spreadsheet.

The synthesis strategy employed in this analysis is highly congruent with the research inquiries stated in Section 3. During the data synthesis process, the review initially

classified studies based on the difficulties they documented, using a thematic analysis methodology. The present analysis was motivated by the necessity of addressing RQ1, which centers on comprehending the various barriers and concerns encountered by educators. This classification facilitated the recognition of prominent patterns in the research, including technological obstacles, challenges with accessibility, and limitations imposed by educational policies.

RQ2 was addressed by synthesizing the techniques and solutions suggested in the literature. In this analysis, the strategies were examined in relation to the problems outlined in RQ1, with a focus on the feasibility of the solutions and their suitability in various situations. The interventions recommended in each study were analyzed and classified into theme areas, including technological advancements, policy modifications, and teacher training programs. A systematic synthesis of the information enables a thorough understanding of how difficulties might be resolved, offering specific approaches for enhancing the online learning experiences of visually impaired students.

5. Results

In light of the three research questions presented in this study, an extensive evaluation of the pertinent literature was conducted, and the resulting findings are discussed in this section. A comprehensive analysis was conducted on a total of 25 articles. The features of this group of research are detailed in Table 3. Data were collected for this research from 2000 until the present (02/2024).

Table 3. Comprehensive data of the 25 highlighted articles. These papers reflect the primary challenges faced by teachers of blind or visually impaired students during remote learning. These research papers are classified based on the year, user, methodology, data collection method, data source, participants, sample size, and location.

| Study	Year	Category	Methodology	Data Collection Method	Data Source	Participants	Sample Size	Location
[42]	2006	Visually impaired	Case scenario phase 1 Feedback	Online questionnaire	University of Birmingham	Teachers	10	United Kingdom
[43]	2007	Visually impaired	Case scenario phase 2 Feedback	Online questionnaire	University of Birmingham	Teachers	34	United Kingdom
[44]	2023	Visually impaired	Semi-structured Interview	Research questions	International University in Hanoi	Teachers Students	3	Vietnam
[45]	2015	Blind Visually impaired	Preservice Inclusion Survey (PSIS)	SurveyMonkey website	Two southwestern universities and one midwestern university	Teachers	91	United States
[11]	2019	Visually impaired	Research study	ICT tools	View point	Teachers Students	UNK	United States
[9]	2022	Visually impaired	Survey	Facebook, Messenger, and organizational pages	American Foundation and American Printing House for the Blind	Teachers	710	USA and Canada
[46]	2019	Visually impaired	Scenario study program Feedback	Feedback from anonymous mail questionnaire	School of Education at University of Birmingham	Teachers	53	United Kingdom
[47]	2012	Visually impaired	Research	Mathematics technology	View point	Teachers Students	4 Teachers 11 Students	United States
[48]	2006	Visually impaired	Case scenario Phase 2 Feedback	Online questionnaire	University of Birmingham	Teachers	34	United Kingdom
[10]	2023	Visually impaired	Interview Survey	Google Meet	Zamboanga city	Teachers	3	Philippines
[49]	2007	Visually impaired	Program for prescribed TVI and OM courses	Self-perception of competency survey	College of Education at Missouri State University	Teachers	9	United States

Table 3. *Cont.*

Studies	Year	Category	Methodology	Data Collection Method	Data Source	Participant	Sample Size	Location
[8]	2022	Visually impaired Blind	Evocative autoethnography	Self-observation, self-reflection, and field notes	Language Department at the University of the North	Teachers	1 (author)	Barranquilla, Colombia
[6]	2006	Visually impaired Blind	Survey	Anonymous emailed questionnaire	Portland State University	Teachers Students	21 Teachers 17 Students	Oregon, USA
[50]	2012	Visually impaired	Online survey	Questionnaire	Texas Tech University	Teachers	840	United States
[51]	2020	Visually impaired	Pretest/post-test comparison group, quasi experimental design	Modified Delphi method to collect feedback	Universities in Lowa, South Carolina, and California	Students	84	United States
[12]	2021	Visually impaired Hard of hearing	Interview	Moodle	Sultan Qaboos University	Teachers	3	Muscat, Oman
[52]	2011	Visually impaired	Survey	Online questionnaire sent via email	Texas	Teachers	165	Texas, USA
[53]	2004	Visually impaired	Scenario study program Feedback	Online questionnaire	University of Birmingham	Teachers	UNK	United Kingdom
[54]	2001	Visually impaired	Scenario study program Feedback	Online questionnaire	University of Birmingham	Students	120	United Kingdom
[7]	2001	Visually impaired	Unstructured and open-ended	Telephone conferencing	Texas	Teachers	12	United States
[55]	2001	Visually impaired deaf-blindness orientation & mobility	Web-based program	Feedback	Michigan State University (MSU)	Teachers	UNK	United States
[56]	2001	Visually impaired rehabilitation orientation and mobility	Survey	Questionnaire	Universities	Teachers Students	37 Universities	USA and Canada
[57]	2001	Visually impaired	Evaluation	Telephone interviews	Texas Tech University (TTU)	Students	25	Texas, USA
[58]	2001	Visually impaired	Courses evaluation	Questionnaire	University of Arizona	Teachers Students	20 Teachers 10 Students	Arizona, USA
[59]	2002	Visually impaired	Survey	Mailed surveys	Public Schools and Kentucky School for the Blind	Teachers	145	Kentucky, USA

The different approaches employed in these studies are grouped according to a taxonomic classification as illustrated in the following Figure 3. The figure provides a grouping of all the studies according to the methodology and methods used in the studies and the focus of the studies. Based on the presented data, it is evident that surveys, interviews, and feedback were the predominant methods employed in the various studies. The primary tools utilized to conduct these types of studies encompassed online questionnaires, social media platforms, phone interviews, Google Meet, Moodle, and other ICT tools and mathematics technologies. In terms of the subject of investigation, the surveys, interviews, and other studies primarily centered around individuals with visual impairments and blindness, as they constituted the most prevalent target groups. By employing the literature taxonomy, we conducted a comprehensive examination of the selected studies. In addition, Figure 3 provides a comprehensive summary of the dataset types utilized in all 20 research studies. The picture clearly indicates that the use of an online questionnaire was the predominant technique for data collection employed in the studies. Most researchers likely utilized online questionnaire platforms due to their increased accessibility for those with visual impairments. Furthermore, this approach offers greater convenience and cost-efficiency than conventional approaches. The integration of technology in education since 2000 has facilitated the education of students with learning disabilities through the implementation of diverse online learning techniques. Also, this integration has fostered the development of novel tools and technologies aimed at enhancing support for these students. It is crucial to situate our discoveries within the framework of the three research inquiries that we formulated in this investigation.
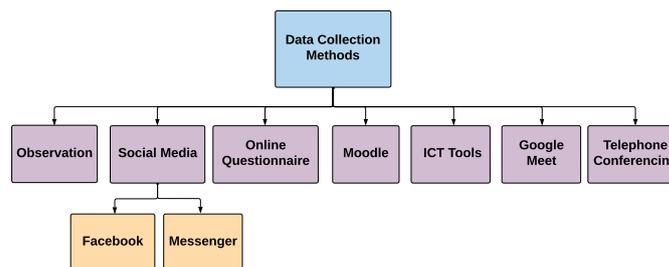
Figure 3. Summary of dataset types utilized in 25 publications.

Figure 4 focuses on identifying the country of origin where the studies were conducted. Based on the gathered data, it is evident that the majority of the studies were carried out in the United States. The United Kingdom had the second-highest number of studies, followed by Canada. Other nations, such as Vietnam, the Philippines, Colombia, and the Sultanate of Oman, each had one study. These findings can serve as a catalyst for scholars in nations with limited or nonexistent research to investigate the issues faced by visually impaired individuals in their own areas.
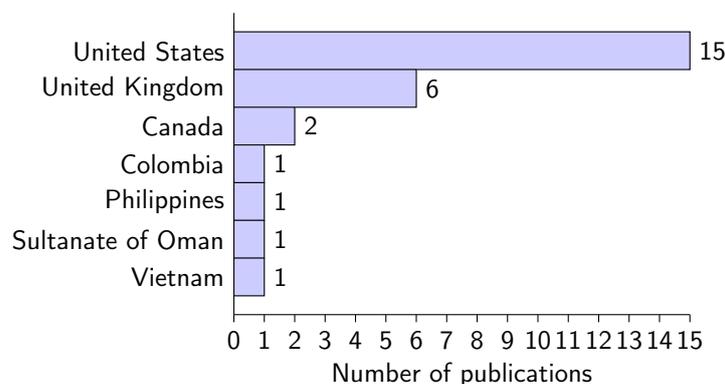
Figure 4. Geographical distribution of publications.

RQ1: Which obstacles and apprehensions do teachers of visually impaired and blind students encounter in the realm of web-based education?

The purpose of this research question was to determine the challenges faced by TVISs when using online learning. We divided the difficulties into the following four groups based on our research: accessibility-related, technological, educational, and physiological difficulties.

To effectively address RQ1, it is crucial to establish a clear interpretation of the concepts of obstacles, apprehensions, and challenges. Within the context of this review, obstacles are defined as concrete hurdles that hinder the successful implementation of instruction, such as limited availability of assistive technology or insufficient training for teachers. Apprehensions, on the other hand, encompass the subjective concerns of educators, such as anxieties about their capacity to provide high-quality education in an online setting or worries about student involvement. Finally, "challenges" is employed as a comprehensive term that includes both barriers and concerns, enabling the review to tackle both the external and internal burdens encountered by instructors.

1. **Accessibility-related challenges.** Visual impairment educators lacked the necessary resources to guarantee their students' access to instructional materials, including braille production equipment, braille writers, braille paper, tactile graphic materials, and diagrams. Additionally, teachers observed a deficiency in the availability of communication devices, assistive technology gadgets, tactile materials, light boxes, and tools for manipulation [9]. Wild et al. [9] showed that not only did teachers report

that they did not have low-vision devices at home, but they, additionally, claimed that they lacked the high-visibility pens and bold-lined paper that they required for their students in order to run the class. They also did not have access to a copy machine, which would have been useful for making smaller prints larger. There is a growing recognition of the necessity of ensuring that websites are accessible to all individuals, regardless of their abilities or disabilities. This obligation is reinforced by the Disability Discrimination Acts in the United Kingdom and Australia, as well as the Disabilities Act in the United States [60].

In addition, while most TVISs now have access to remote learning tools and technologies, including video conferencing, a variety of digital programs, and information systems, developing countries have had difficulty utilizing these tools [61]. Therefore, teachers face obstacles in terms of the accessibility and usability of some digital technologies present at the researched educational facilities. Furthermore, some colleges have dedicated sections to provide support for special needs students in general. However, their efforts to accommodate VISs in online environments have proven to be challenging at times [41].

2. **Technologically related challenges.** The utilization of Assistive Technology (AT) encompasses the processes of evaluating, choosing, adapting, instructing, and providing ongoing assistance [62]. Integrating technology into teaching enhances the efficiency of the educational process for educators and facilitates learning for VISs. The presence of technology in the classroom alone does not hold much significance; instead, the manner in which instructors utilize the technology is of utmost importance [63]. There are clear signs of substantial disparities and a lack of linkage in the knowledge and proficiency of teachers working with visually impaired students in the field of assistive technology despite the fact that assistive technology serves as a tool for obtaining information and enhancing the quality of life for VISs [64].

The challenges pertaining to literacy with braille and assistive technology mirror the ongoing concerns among educators who work with VISs. The literature strongly advocates for the preservation and continuous promotion of braille literacy [65–67], despite the emergence of speech output and printing amplification technology as alternative techniques [68–70]. In the 21st century, as technology plays a significant role in our lives, there is an ongoing discussion about the similarities between teaching early literacy to VISs and the contemporary cultural literacies that are influenced by particular innovations [71]. Educators also reported dedicating a significant amount of time to assisting students and parents with technology-related challenges, such as accessing Google Classroom or finding assignments [72].

3. **Educationally related challenges.** There are several educational challenges that can emerge from the use of e-learning and that have the ability to affect TVISs. For example, the modifications of the policies of school districts that came into effect during the COVID-19 pandemic greatly affected the potential of TVISs to perform their tasks, even if federal laws pertaining to the education of students with disabilities remained in effect [9]. Their work was adversely influenced by the policies they encountered, which presented various challenges that encompassed restrictions in terms of using only district-approved resources, a lack of consistency in district policies, insufficient district resources, a lack of adequate planning, and frequent policy changes [9]. VISs who were assigned to their caseloads did not receive the educational services that were outlined in their Individualized Education Program (IEP) as a result of these modifications, which had a significant impact [9].

The transition to remote learning, especially during the COVID-19 pandemic, posed significant challenges for educators, necessitating their acquisition of new digital tools and online teaching strategies in order to effectively adapt to this mode of education. Remote instruction delivery methods exhibited considerable variation, with a prevalent utilization of digital applications and tools [72]. In addition, as a result of the pandemic, VISs were no longer able to avail themselves of the educational models that provided them with

free appropriate public education (FAPE) as mandated by U.S. law (Section 504 of the Rehabilitation Act of 1973 (34C.F.R. Part 104) and Individuals with Disabilities Education Act (2004)) [9].

4. **Health-related challenges.** VISs may experience anxiety during online classes due to outdated assistive technology that may not be compatible with contemporary online learning settings, resulting in their inability to comprehend pertinent material [73]. Several studies have indicated that students with disabilities are more likely to experience academic anxiety than students without disabilities [74,75]. This is attributed to the challenges they face in academics, cognitive interference, negative academic self-perception [75], attention, and concentration issues, as well as difficulties with motivation and organization [76]. Anxiety has a significant impact on the academic performance and ability of visually impaired students to stay engaged in web-based distance education [75,77]. Elevated levels of anxiety might hinder their cognitive functioning, impeding their ability to achieve optimal performance, and can have a considerable impact on their psychological health [77]. Consequently, it is believed that VISs who experience higher levels of anxiety associated with learning are less likely to continue with web-based distance education [73].

RQ2: What are the latest strategies being developed to effectively address the difficulties encountered in educating individuals with visual impairments via e-learning?

After identifying the most significant challenges faced by TVISs, we will explore some potential solutions in relation to this research question. In an endeavor to confront the obstacles of accessibility, a few educators have discovered interim solutions. Their acquaintances have been imprinting braille documents for them. They successfully addressed the shortage of materials by employing innovative approaches, with numerous teachers utilizing online resources and other materials available to students in their homes. Several teachers engaged their community. They solicited contributions from acquaintances, relatives, and nearby residents for children's literature and accompanying supplies to assemble literacy book bags for their students to use [9]. Several teachers attempted to employ online resources, items from home, and their ingenuity to address challenges. Teachers suggested creating videos for families as an illustration. Due to the prevalence of students with different disabilities, teachers have initiated the practice of sharing instructional films with parents. These movies showcase teachers engaging in activities such as sorting forks and spoons while also providing guidance to parents on how to effectively carry out these activities with their children. Furthermore, they created PowerPoints for the purpose of visual presentation for parents, produced YouTube videos, and conducted read-aloud sessions to engage VISs [9].

Therefore, in RQ2, it is necessary to provide further explanation for the terms "strategies" and "solutions". "Strategies", in this light, refer to comprehensive methods that educators and institutions can use to enhance the online learning experience for visually impaired students. These methods include the incorporating inclusive design principles or improving teacher training programs. Meanwhile, "solutions" refer to the precise remedies or tools that can directly tackle the identified problems. Potential examples of assistive technologies include screen readers, braille-enabled devices, and plugins designed for virtual learning environments (VLEs). The analysis differentiates between these two concepts, enabling the proposal of both enduring methodologies (strategies) and practical, instant remedies (solutions) for educators.

One of the most significant goals of the social justice theory proposed by Rawls [78] for educational institutions is to guarantee that benefits are distributed fairly and without any kind of discrimination among students, including those in developing countries. The primary issue in e-accessibility is the financial barrier that hinders the broader accessibility of e-accessibility for TVISs in such developing countries, where an unequal allocation of resources is typically prevalent [15]. Ashraf et al. [15] proposed that examining the ways

in which the government might actively contribute to guaranteeing the affordability of accessibility of online resources and tools in developed countries is crucial.

On the other hand, when attempting to solve issues related to technology, students with visual impairments cannot be excluded from the advancement of technology, and their teachers should also be able to access such technology. However, there are likely to be restrictions on technological usability due to visual impairment. As a result, it is essential for VISs to benefit from technology to support their participation in education, digital inclusion, communication, and autonomy [11]. By reducing their deficiency of ability to see colors, motions, and images, Ramos and de Andrade [11] stated that students who are blind or partially sighted can become more independent thanks to information technologies (ITs). They also recommended that display magnifiers, voice synthesizers, and computers as tools to facilitate access to and the creation of digital information. Technology is, therefore, a tool for overcoming blindness and increasing communication and personal independence options; additionally, it promotes cognitive development and facilitates the acquisition of expertise, abilities, and knowledge [79]. Furthermore, Jackson and Presley [80] revealed that the utilization of a screen reader with audio accompaniment enhances and facilitates the speed of information processing in VISs. In addition, it facilitates comprehension of texts and reduces the time needed to perform the activities [31,80]. Research conducted by Corn et al. [81] also indicated that the use of optical devices enhances students' reading fluency and comprehension skills..

Moreover, education-related challenges can be overcome in several ways. According to a study conducted by Ramos and de Andrade [34], educators are aware that information and communication technology (ICT) tools help spread knowledge and enhance the teaching and learning process, promoting academic achievement, students' independence, and the incorporation of blind or partially sighted students. The extent to which VISs utilize information technology (IT) depends on the level of support provided by their teachers and is constrained by the teachers' training at both initial and ongoing stages [82]. To enhance their confidence in the effectiveness of IT as a facilitator of inclusive education [34,36] and to ensure a positive impact on the curriculum [34,83], teachers need sufficient time to plan, gain knowledge on integrating technology, and apply it effectively [83]. While governments and educational systems prioritize the use of IT in schools, it is evident that there are additional significant steps and essential elements required for the effective integration of ICT into the educational field [83]. For instance, Bhatt and Kumari [84] highlighted that cognitive computing services, which are a kind of data-driven artificial intelligence (AI), offer intelligent activities, planning, and content tailored to each student's needs in the education field, which allows for effective individualized promotion of knowledge and also may also help students succeed academically while providing instructors with significant support. Moreover, education systems have adopted approaches to make learning more effective, engaging, and innovative, particularly considering the potential rise of digital voice assistants in education [11].

Furthermore, when discussing remedies for health-related difficulties, Vamosi et al. [85] investigated students' happiness and perceptions of the effectiveness of distance learning in an accounting concepts course. Students expressed a diminished level of satisfaction with the distance learning delivery method, perceiving that the components were less engaging and less effective for learning. They believed that this method hindered their ability to effectively comprehend the course material, in contrast to the traditional delivery system. Koenig and Robinson [57], on the other hand, determined that an online course provided a high-quality and rigorous approach to the delivery of training when they evaluated a web-based course in braille code skills for preservice television instructors. They were of the opinion that the feedback and experiences of the participants provided evidence that the online course was both beneficial and helpful. Cooper and Keefe [7] reported that many students thought that they would not have been able to acquire certification if they had not participated in the program. The program was designed to teach VISs through the use of distance education training. Additionally, they expressed a general sense of contentment with the initiative. In

the majority of instances, the location-based availability of the instructional programs offered by remote education compensated for any potential drawbacks, including anxiety, depression, and all other health-related problems.

RQ3: What are the digital learning resources and tools that educators have specifically developed for students with visual impairments?

The objective of this research question is to determine the different resources and tools that teachers can utilize while working with VISs in order to enhance the quality of online learning. It is essential for qualified TVISs to have a strong understanding of the various technological accessibility tools. that are currently available in order to be able to provide high-quality services and education to their students [59]. In order to provide support, the Texas Education Agency provided funding for the development of an online course in braille code skills. This course was developed through a collaborative effort between Texas Tech University (TTU), Stephen F. Austin State University (SFASU), thw Texas School for the Blind and Visually Impaired, and regional educational programs in the state of Texas [57]. Zhou et al. [52] conducted a study in Texas that sought the perspectives of teachers who interact with VISs. The study focused on their opinions regarding a specific set of skills related to assistive technology that were established by Smith and Kelley [82] for the training of teachers who work with VISs. The study's findings represent their perspectives. These insights provide valuable guidance for teacher preparation programs in terms of instructing and evaluating the use of assistive technology, offering significant promise to aid VISs.

Additionally, McLinden [48] pointed out that WebCT™ (Web Course Tools), which is a well-known virtual learning environment (VLE) in the field of higher education, is utilized for the delivery of online courses. WebCT™ includes a wide variety of tools and features, such as bulletin boards and chat room facilities, that have great potential to assist in online activities, serving as a fundamental component of the platform at the University of Birmingham in the United Kingdom. According to McLean and Murrell [86], one of the most valuable features of this tool is that it can be accessed on the university's computer system. This means that even if students who have Internet access are not physically present on campus, they possess the ability to gain access to and view all the materials. Libraries of audiobooks, speech synthesizers, and assistive devices for improving mobility for mobile phones are among the technical instruments that can aid VISs. Additional illustrations encompass computer screen readers, scanners, braille embossers, optical character recognition software, compact discs, sophisticated closed-circuit televisions (CCTV) systems, and an extensive range of additional advancements.

The National Eye Institute, a branch of the USA National Institutes of Health, showcased novel tools and technology in 2017 as part of Low Vision Awareness Month to aid the 4.1 million Americans who suffer from blindness or visual impairment. The aforementioned innovations include a smartphone application for navigating crosswalks; a cane enhanced with co-robotic capabilities; a glove equipped with sensors to detect door handles and small items; and the CamIO device, which provides immediate aural feedback to the user while exploring an object [87]. Technological advancements such as three-dimensional printed tactile models, integrated e-book delivery on touchscreen devices, haptic feedback, and sonification [88] can also assist students who have visual impairments and face difficulties in accessing graphic materials [89]. Pacheco et al. [31] reported that these students exhibit a preference for utilizing social networking platforms and portable electronic devices as means of accessing information and engaging in communication. They utilize technology to augment informal and individualized learning, as well as facilitating digital data exchange and scholarly partnerships. They make use of social media platforms and apps. Computing devices enable blind or partially sighted learners to participate in class activities and communicate with classmates, both synchronously and asynchronously [90]. The expanding mobile app market has made it possible for VISs who use smartphones to have accessible

experiences. In July 2017, Microsoft introduced Seeing AI, previously known as Deep Vision, as a cost-free artificial intelligence application for iPhone users. The purpose of this software is to cater to the needs of these students. This app captures and displays images, text, currencies, individuals, and colors through the phone camera and also facilitates the overcoming of obstacles they face by transforming the surrounding environment into an auditory one [91]. It is recommended that TVISs utilize voice-activated virtual assistants offered by companies such as Apple, Microsoft, Google, and Amazon, namely Siri, Cortana, Google Assistant, and Alexa, respectively. For example, this can facilitate expedited retrieval of library materials for their students [11]. The various technological tools are illustrated in details in Table 4.

Table 4. Characteristics and applications of technological tools.

Technological Tool	Characteristics and Usage
WebCT (Web Course Tools)	A Virtual learning environment (VLE) used for delivery of online courses, providing tools like bulletin boards and chat rooms.
Computer Screen Readers	Assistive technology to audibly read text displayed on a computer screen, aiding visually impaired users in accessing digital content.
Scanners	Devices that convert printed text or images into digital format, facilitating the conversion of physical documents into accessible digital versions.
Braille Embossers	Devices that emboss braille characters onto paper, creating tactile representations of text for visually impaired individuals.
Optical Character Recognition Software	Technology that converts scanned text into editable and readable text, enhancing accessibility for visually impaired users.
Libraries of Audio Books	Collections of audio books providing an auditory alternative for visually impaired individuals to access written content.
Speech Synthesizers	Tools that convert text into spoken words, aiding visually impaired users in listening to written content or instructions.
Assistive Devices for Mobility	Technological instruments designed to enhance the mobility of visually impaired individuals, potentially including devices for use with mobile phones.
Closed-Circuit Television (CCTV) Systems	Advanced visual aids that magnify and display text or images on a screen, aiding visually impaired users in reading or viewing materials.
Three-Dimensional Printed Tactile Models	Technological advancements producing tactile models to represent objects or concepts for visually impaired students, improving understanding of spatial relationships.
Integrated E-Book Delivery on Touchscreen Devices	Accessibility features in touchscreen devices for the delivery of electronic books, offering visually impaired students an alternative way to access written content.
Haptic Feedback	Technology that provides tactile sensations or feedback, enhancing the interactive experience for visually impaired users in accessing digital content.
Sonification	The use of sound to represent data or information, assisting visually impaired students in interpreting graphical materials through auditory cues.
Smartphone Applications	Various applications, including Microsoft's Seeing AI, providing auditory and tactile feedback through the smartphone's camera to aid visually impaired users.
Voice-Activated Virtual Assistants	Virtual assistants like Siri, Cortana, Google Assistant, and Alexa, facilitating voice-activated commands and information retrieval for visually impaired individuals.

6. Discussion

Our analysis of the literature provides a comprehensive overview of the challenges confronting TVISs while conducting online instruction. We also examined potential remedies that different authors may adopt and enforce, as well as various technological tools. In this section, we highlight the significant key findings of our research.

Key finding 1: Applying new approaches to address the issue of material inaccessibility. Hanzálková [92], Coşkun [93] investigated the various tools, resources, and approaches available for teaching of visually impaired and blind students. Coşkun conducted a study on the implementation of T3, also known as the talking tactile technology, using a custom-made tactile diagram that does not rely on braille and is sensitive to pressure. By utilizing tactile diagrams that incorporate several layers of information, such as vocal, melodic, or other audio sounds, this approach combines touch, sound, and learning approaches referred to as audio-haptic pedagogy [93]. Khan et al. [94] stated that various accessibility services, such as auditory responses, tactile feedback, screen enlargement, increased font size, color differentiation, and shortcuts, can assist individuals who are blind or visually impaired in carrying out multiple tasks. These services facilitate users in completing tasks such as note taking

and location finding, in addition to enhancing text or graphs for VISs, mitigating confusion caused by color blindness, and providing easy access to icons [94].

Key finding 2: Technological tools should be utilized as needed. Several faculty members expressed their concerns about the ongoing impact of insufficient technology resources on their online teaching [95]. The requirement to use readily available assistive equipment and software as launching pads to successfully accommodate the VISs in online learning was identified in the data analyzed by Amponsah and Bekele [41]. A few teachers supported the idea of providing all content in braille and audio formats for students with visual impairments. In contrast, other teachers provided the solution and relied on increasing the availability of assistive devices required to support VISs in their virtual education. Amponsah and Bekele [41] also reported that teachers reached a consensus on how to utilize social media as a technique to incorporate VISs in online learning environments. Universities should integrate popular social media platforms such as Zoom, WhatsApp, and Instagram into the Learning Management System (LMSs) such as WebCT and Blackboard to enhance usability for both teachers and students [41]. Pham [44] suggested that additional factors to consider when selecting learning applications or incorporating gamification into a lecture should also include the appropriate utilization of visual aids. He also proposed that Additional programs catering to VISs, such as the Student Aid Program (SAP) or Equitable Learning Service (ELS), be implemented, in addition to peer support [44]. Potentially, the needs of VISs in online learning could be met through the further enhancement and refinement of existing technology [41].

Key finding 3: Cooperation and partnerships should be strengthened to achieve optimal quality in education. From an educational perspective, distance learning can facilitate the seamless integration of VISs into society [24]. This integration can promote alternative educational opportunities and ensure equal access to inclusive education for all individuals. Ngubane-Mokiwa and Khoza [96] suggested that the Community of Inquiry should be considered a suitable framework for fostering an inclusive e-learning environment that enhances educational experiences and can assist designers in developing a comprehensive e-learning experience for VISs, as it is central to teaching and learning activities. For instance, it revolves around the teacher's physical setting, the surrounding atmosphere, and the process of choosing educational material in isolation. However, all of these components collaborate to form a comprehensive educational encounter. Furthermore, Amponsah and Bekele [41] recommended that colleges engage in partnerships with government organizations and enterprises in order to provide support to these students. Online education is crucial for individuals who lack the financial means to purchase a basic Android smartphone, so the government should allocate computers and tablets as discretionary measures. Companies can also provide complimentary assistive devices and software to VISs as a component of their corporate social responsibility to guarantee they are not disadvantaged [41].

Key finding 4: Managing psychological health concerns is crucial. Villalba [8] identified five emotional obstacles experienced by TVISs and their students, including helplessness, reduced distress, decreased frustration, fear of failure, and subconscious discrimination, the most predominant of which were efforts to alleviate distress and powerlessness. The presence of sensory disabilities has significant social ramifications, which may have contributed to increased levels of distress and powerlessness. These negative consequences arise from societal barriers rooted in unfavorable perceptions and the prevailing biological perspective, ultimately leading to marginalization, as reported by Oviedo-Cáceres et al. [97]. These obstacles can potentially affect instructors who are unable to assist students in need. The findings with respect to apprehension towards failure and subconscious bias against individuals with visual impairments are particularly relevant, as these are prevalent misunderstandings that any educator may come across [97]. These fallacies encompass what Monbeck [98] refers to as ideal-

ized perceptions and erroneous notions of those who are powerless, maladjusted, or rejected. Students might mitigate these emotions by posing insightful inquiries to gain perspective and by engaging in self-examination [98]. According to Pham [44], VISs were anxious about connecting online, navigating platforms and applications, and identifying visual aids during lectures and experienced discomfort when it came to addressing their condition with their peers and, in addition to feeling overwhelmed by their academic responsibilities. This could be attributed to the instructor's cognizance of the difficulties faced by VISs, such as technical complications, inaccessible learning resources, exam stress, and limited opportunities for engagement. In response, the teacher took proactive measures to assist these students, such as offering accessible materials, adapting teaching techniques, and ensuring their well-being. Furthermore, apart from the assistance provided by teachers, peers played a crucial role in creating a sense of ease and ensuring that VISs were well-informed. The institution introduced initiatives and regulations to support them. Students indicated tangible economic advantages, such as reduced travel expenses, as well as intangible emotional benefits, such as a sense of support and increased self-assurance. Their successful online classes motivated them to empower other VISs and improve the community's perception of visually impaired individuals [44].

Key finding 5: A variety of technological tools should be developed. Our study revealed that the emerging devices and tools in technology have a significant impact on assisting VISs and effectively promoting their educational experience. Koenig and Robinson [57] highlighted that techniques utilized for instructing braille reading skills are highly compatible with online education and conveyed the outcome of an evaluation of an online course designed for future instructors who specialize in educating VISs, specifically focusing on their proficiency in braille coding, and indicated that students who were self-reliant, tenacious learners with the requisite technical aptitude and resources experienced the online course as a demanding and excellent approach for acquiring braille code proficiency [57]. In addition, Bruce and Hwang [55] asserted that videos such as *Magic of Reading* and *Understanding Braille Literacy* were indispensable for visual impairment courses, which were acquired and disseminated to online distance education VISs. In addition, the multimedia approach incorporated various elements, such as guided exercises, clip art, learner clips of video, simulations, cartoons, website links, and auditory stories, including experiences involving blindfolds and blindfolds with earplugs. University institutions that provide online programs must ensure that students have access to necessary technological tools, including JAWS, styluses, slates, Braille and Speak, and Perkins Braillewriters. Additionally, the study conducted by Villalba [8] emphasizes the pivotal role of teachers in facilitating access to learning using assistive technology for VISs. The effectiveness of this position relies on the clarity, comprehensiveness, and efficacy of teacher training both before and during their employment in the field of AT. Hence, AT must not be disregarded as a means of enhancing oneself, as training teachers on this technology is also important.

Recommendations for Future Research

- To effectively meet the distinct technological needs of VISs, it is crucial to conduct future research on the crucial uses and prerequisites of assistive technology. Additional research on the integration of technology in the workplace will provide teachers with advantages, as it will streamline the curriculum for students. This research will not only encourage teacher preparation programs to expand their curricula to incorporate technology relevant to visual impairment but also assist in identifying the specific skills and knowledge that educators require [59].
- One of the strategies that has been used to provide optimal therapy for students' mental health is the implementation of psychological counseling. Based on the per-

spectives revealed by the research, educational institutions have to endeavor to adapt to the students' circumstances [44].

- Due to the widespread availability of online resources, the field of special education has the potential to harness the opportunities it offers to VISs. To ensure the successful adaptation of scaffolding in the digital domain, it is crucial for platform designers and teachers to interact in a balanced and efficient manner. Teachers should also have a thorough understanding of the concept of web accessibility evaluation and how they can ensure that their instructional materials are designed to address it [8].

- It is important for teachers and parents to prioritize the meaningful and successful integration of learning for VISs. Teachers should strive to engage students in enjoyable and imaginative learning experiences, while parents should establish a supportive atmosphere that enables their children to reach their maximum learning potential. Further investigation should examine educators' viewpoints regarding remote education for individuals with visual impairment [10]. In addition, it is important to evaluate the variations in the level of knowledge and skills in assistive technology that are required for TVISs across different geographic regions within the country [50].

- VISs typically require comprehensive support after transitioning from their online environments. It is recognized that this is the initial stage in developing a virtual course with a humanistic approach [8]. Enhancements must be implemented for online chat rooms, email, online conferences, and discussion groups to cater to the needs of VISs to communicate with their peers and decrease their anxiety. The lack of accessibility of current communication technology hinders the process of community building. To enhance accessibility, it is imperative to advocate for the promotion of voice messaging and larger fonts, as well as the reinforcement of legislation pertaining to web-accessible communication [73].

7. Limitations

This study, like any other, has significant limitations. We conducted our investigation through a comprehensive literature review procedure. The literature review identified the primary challenges faced by teachers of students with visual impairment amid online learning. Although our study was restricted to VISs, it is important to acknowledge numerous limitations, which we now elucidate.

Comprehensive data: Choosing appropriate digital libraries and defining the scope are the initial restrictions in conducting a systematic literature review. Therefore, we chose nine distinct electronic data sources, ensuring that appropriate research papers were selected and incorporated in the following step. Nevertheless, we believed that there could be more pertinent assets in our field of study, so we endeavored to alleviate these restrictions by utilizing a series of search queries to initiate a domain search, in addition to utilizing a snowballing technique [39,99], which involves starting with a few initial search terms to gather results. Common domain-specific phrases are then recognized and employed to generate additional search queries, assuming there is enough domain expertise. In addition, we applied an iterative approach in developing our phrase lists. Different research communities may use different terminology or concepts to refer to the same idea. Because of this iterative approach, appropriate search phrases were carefully selected.

Objectivity: The third restriction concerns the study's objectivity. This usually indicates any biases or errors in the data. We investigated the bias of each reviewer by cross-referencing the publications in order to lessen this limitation. Therefore, no paper was reviewed by a single person, as the process engaged several reviewers. Additionally, to mitigate bias rather than relying solely on the perceptions or opinions of individual reviewers, we also summarized the results based on the collection of categorized papers.

Therefore, our study can help future researchers, since it reveals the obstacles faces by TVISs in remote learning and offers potential solutions.

8. Conclusions

This literature review examined key concerns that have emerged in education from 2000 to the present with respect to teaching students who are visually impaired through e-learning. Compelling evidence demonstrates a pressing need to investigate the obstacles mentioned in the previous section. Moreover, the contributions of early efforts enable researchers and the educational sector to address these concerns comprehensively and globally, with an appropriate level of care and attention. Additionally, by providing a comprehensive analysis of the challenges related to online learning for TVISs, our work directly contributes to the literature. Above all, it highlights how important it is for educational systems to be easier to access for learners who reside at a distance and to employ easily implemented pedagogical strategies, even in the event of a global ecological crisis. To further enhance systemic literature review (SLR) research, we published our data and made it accessible as an extra electronic file so that researchers can work on related topics more extensively and enhance our findings.

Future research will attempt to address issues by expanding our investigation by employing interviews with students with visual impairments and their teachers. We will try to provide solutions to the challenges mentioned in this paper, as well as any newly identified problems that we learn about during the interviews. Advancing this research may strengthen and enhance present distance learning teaching methods and facilitate the involvement of people with visual disabilities globally, addressing current educational limitations in the accessibility field.

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