education sciences

MDPI

Review

What Is Known about Assistive Technologies in Distance and Digital Education for Learners with Disabilities?

Jaime Sánchez [1], José Reyes-Rojas [2] and Jhon Alé-Silva [3,*]

[1] Center for Advanced Research in Education, University of Chile, Santiago 8330014, Chile; jsanchezi@uchile.cl
[2] Faculty of Education, Pontifical Catholic University of Chile, Santiago 8320165, Chile; jgreyes2@uc.cl
[3] Doctor of Education Program, Faculty of Social Sciences, University of Chile, Santiago 7800284, Chile
* Correspondence: jhon.ale@ug.uchile.cl

Abstract: Distance education and the development of assistive technologies represent a possibility of balancing the access and participation of people with special educational needs in learning experiences and participation in society. This study is aimed at finding out what is known about distance education mediated by assistive technology based on an analysis of the characteristics of scientific production. Through a review of the literature, the sample content is analyzed, culminating in trends that point towards the autonomy and independence of this people, the need for accommodation and accompaniment in a scenario of permanent technological change, initial training and continuing education of inclusive education teachers, as well as collegiate participation between professionals, community, and family in the design of training courses and technologies for people with special needs. The results reveal limited scientific productivity at all educational levels, with greater use of technologies to assist visual and hearing disabilities. The trends emphasize autonomy, Universal Design for Learning, and the challenges of technological adaptation. Findings are discussed and synthesized with the purpose of informing policy makers, researchers, and school communities.

Keywords: distance education; assistive technology; inclusive education

check for updates

Citation: Sánchez, J.; Reyes-Rojas, J.; Alé-Silva, J. What Is Known about Assistive Technologies in Distance and Digital Education for Learners with Disabilities? *Educ. Sci.* **2024**, *14*, 595. https://doi.org/10.3390/educsci14060595

Academic Editors: Vincenza Benigno, Stefano Di Tore and Michael Simonson

Received: 15 February 2024
Revised: 26 April 2024
Accepted: 1 May 2024
Published: 30 May 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Access to education is not a human right guaranteed for all people. Different types of populations are excluded from their right to learn and, therefore, to participate fully in society. There are many reasons: social, gender, racial, religious inequities, wars, diseases, and so forth [1]. However, disability is a reason that, regardless of social political and economic conditions, cuts across all societies and, therefore, requires answers not only from the point of view of accessibility to education, but also for the promotion of full participation capable of maximizing the possibilities of people in society, regardless of their disability [2]. Teachers have the task and responsibility to facilitate the achievement of this objective. Some frameworks propose that this occurs by incorporating perspectives that enable them to address the representation of disability during their preparation, including individuals with disabilities in teaching about disability, and by incorporating a perspective of the teacher as an agent of social justice [3].

Technology has become a crucial tool to enhance people's possibilities in the field of educational inclusion. For [4], assistive technologies are designed so that people can live better in their family life and in their community, improve their functionality, and strengthen their independence (p. 440), whereas for [5], the use of assistive technologies helps to narrow the gaps in access between students with and without disabilities within the same classroom (p. 165).

Studies in the field highlight that using assistive technologies in education can produce three immediate benefits, which involve changes in "attending behaviors, understanding and compliance with rules of appropriate behavior (understanding of and compliance with

rules of appropriate behavior), and abilities to communicate in the classroom settings" [6] (p. 316). Other studies indicate that integrating innovations with technology leads to changes with high acceptance in teachers' classroom management behaviors [7], perceived knowledge, confidence, and utility [8]. According to [9], after participating in an orientation study on assistive and instructional technologies, preservice teachers exhibited statistically significant changes in their preparedness and perspectives regarding assistive technologies.

These technologies are developed according to the science, technology, and economic conditions of their societies. Thus, we can analyze the evolution of different types of prostheses, from the peg foot of a pirate to the use of robotic humanoids deployed therapeutically with older adults [10].

In the field of education, distance learning, which had been an area of constant development during the years prior to the pandemic, with the emergence of COVID-19 pandemic, such growth skyrocketed, reaching a large part of world education, all educational levels and, for long periods of time, being the only means for education. For the United Nations International Children's Emergency Fund [11], distance learning was the preferred method used by the governments of the world to deliver education during the first half of 2020. Interaction platforms were massified, teacher capacities were improved, access from different realities to common virtual spaces that became virtual learning communities was possible, and at the same time, multiple difficulties emerged, such as an increase in pre-existing social gaps, overexposure to devices, differences in the pedagogical capacities of teachers, exclusion of communities without access to devices or the internet, and so on [12]. Distance education became the only means of teaching and learning during confinement, and later, with the experience accumulated around distance education modalities, it became an option for access to learning even in challenging times of post-pandemic normality [13–19].

In the case of the educational inclusion of people with special needs, distance education can become a real opportunity to actively participate in learning along with the rest of the population [20,21]. Such a process, according to the information provided, should be accompanied by educational designs and assistive technologies that balance the inequalities of social and family origins of people with special educational needs, the differences in pedagogical capacities for technology-mediated education, and skills in the use of emerging technologies designed for various types of disability [22–24]. However, the meeting between distance learning and assistive technologies has been a topic little addressed by the scientific literature until now [25]. Based on a literature review, authors such as [26] have provided important theoretical guidelines for sustaining educational practices in distance education with assisted technologies at the beginning of the century. Nevertheless, these contributions are not enough to understand educational and technological trends that are projected for the rest of the century. It is essential to explore the multiple findings of studies that address assistive technology mediated by distance education based on experiences, policy analysis, and prototype designs to understand the trends that can lead future research on assistive technology.

In this sense, the purpose of this study is to analyze the scientific production around distance education mediated by assistive technology, with the aim of extending the characteristics, trends, opportunities, and difficulties of the area under study and with the intention to offer perspectives of future work that allow guiding the inquiry in the face of the technological and educational challenges of this time.

This study is oriented based on the research question: What are the main characteristics, findings, and trends of scientific production around distance education mediated by assistive technology? Next, the proposed methodology to answer the question, the findings according to the review of the sample, and the discussion and conclusions of the study are developed.

2. Method

To carry out this study, a literature review was implemented to answer the research question posed. The literature review, broadly speaking, was carried out with a limited search in a certain database to later unfold a process of discrimination of the material according to the inclusion or exclusion criteria proposed by the researchers in coherence with the respective research question. We previously applied this review model both in research on the development of MOOCs in Latin America [27] and in a study on how prepared the world was to face the pandemic from distance education to school level [28]. In the present study, in contrast to those mentioned, we wanted to broadly trace the phenomenon of the application of assistive technologies through distance education, which led to the consideration of empirical scientific articles, as well as model proposals and analysis of local policies related with educational inclusion and the use of assistive technologies in distance education. Also, some studies on teaching subjects and even prototypes of emerging technologies for educational inclusion were considered as part of the sample. The criteria and description of the search process is developed in detail below.

2.1. Selection Criteria

Two types of criteria were established to carry out the search process. First, exploratory criteria that covered part of the phenomenon and that allowed knowing both the magnitude of the representation of specific educational levels in the scientific literature, as well as the emergence of search areas not foreseen from the research. Second, after carrying out a first search, definitive selection criteria were established, which broadened the sample to cover the phenomenon more fully. The criteria were established as follows.

2.1.1. Exploratory Criteria

(a) Publications of the last 10 years on assistive technologies through distance education developed at or for the primary and/or secondary school level (K-12), (b) Research based on the experiences of students and teachers.

2.1.2. Final Criteria

(a) Publications on assistive technologies through distance education developed at all educational levels; (b) Empirical articles, policy analysis, systematic literature reviews, and design prototypes; (c) Research based on the experiences of students and teachers; (d) Published publications without time restriction.

2.2. Search Procedure

To study the scientific production around assistive technology through distance education, we selected 5 world high-impact research databases, namely, Web of Science (WOS), Scopus, ERIC, IEEE, and PubMed.

To address the exploratory criteria, a search string was established that related the areas of interest of assistive technology and distance education, but in the specific context of school education (K-12). The following string was set: (“assistive technolog*” OR “learners with disabilities”) AND (“K-12” OR “primary education” OR “secondary education” OR “elementary school” OR “high school”) AND (“ distance education” OR “digital education”) and was ran on WOS, Scopus, ERIC, IEEE, and Google Scholar. Of the 131 results obtained, 105 belonged to Google Scholar whose results did not allow the search to be carried out precisely, which is why we chose a new database, PubMed, for the next phase. From the remaining documents, it was possible to verify the low scientific productivity of the main constructs in school education (K-12), in addition to reporting high productivity of other types of publications capable of more comprehensive description of the phenomenon under study, such as analysis of public policies, technology prototyping and analysis, and literature reviews. It also highlighted the presence of articles focused on teacher experiences or usability evaluation, which were considered for the next phase.

To address the definitive criteria, a search string was configured that could unite the concepts related to assistive technologies and concepts that broadly encompass the phenomenon of distance education. Thus, the search string was established as follows: ("assistive technolog*" OR "learners with disabilities") AND ("distance education" OR "digital education"). The search yielded a total of 122 documents, which were submitted to the definitive criteria that resulted in a total sample of 23 documents, which are presented in Table 1. The texts were processed through content analysis and organized by categories according to the type of publication and type of study objects, which are presented in the results section.

Table 1. Sample: documents, database, and type of publication.

Document	Database	Type of Publication
[29]	IEEE, Scopus	Empirical articles
[30]	PubMed	
[31]	Eric	
[32]	WOS	
[33]	Scopus, WOS	
[34]	PubMed, Scopus, WOS	
[35]	Scopus	
[36]	Scopus, WOS	
[37]	IEEE, Scopus	
[38]	Scopus	Teacher centered
[39]	Eric	
[40]	Scopus	
[41]	Scopus	Prototypes and design
[42]	IEEE	
[43]	IEEE	
[44]	PubMed, WOS	
[2]	PubMed	Systematic and policy reviews
[26]	Scopus, Eric	
[45]	Scopus	
[46]	Scopus	
[47]	WOS	
[48]	PubMed	
[49]	IEEE	

3. Results

3.1. Empirical Articles

The content analysis of the sample reveals important distinctions in the type of scientific production, the research focus, and the emerging trends in each focus. Diverse findings are informed in scientific articles, depending on the level of schooling (K-12, higher education, or adult training) and type of object of study, that, in some cases, may include teachers or students, while, in other cases, may involve software or communication platforms designed for students with disabilities. The results obtained from the content analysis of the empirical articles according to different categories are presented below.

3.1.1. Student-Centered Studies

It was possible to identify in the sample one article on primary education [29], two articles on secondary education [30] and two on vocational or pre-university education [31,32], two of higher education [33,34], and finally, a case study that retrospectively addressed all educational levels [35]. Initially and independently of the results obtained, these magnitudes reveal a low scientific productivity in each of the educational levels addressed from empirical research. At the same time, a lack of continuity in the progression of studies is also reflected because, while there was a limited period where the first documents were concentrated (between 2000 and 2006), this type of study reappears more than 10 years

later. Low and little continuous productivity are characteristics that a priori stand out in a general characterization of scientific production in the areas addressed.

Primary Education

It is reported that the use of pedagogical resources that facilitate to supply visual disabilities through the stimulation of other senses such as hearing or touch, allow students to have experiences capable of making knowledge about everyday space more complex, strengthening both academic skills and aspects such as autonomy and understanding of the environment [29].

For the primary education level, the study by [29] is advanced insofar as it explores the possibility of improving the learning experience of geography and other concepts related to space, through haptic interfaces combined with sounds from the environment. For the author, the positive findings in the improvement of the educational experience from interaction through interface design put to the test made it a promising option to strengthen the curriculum in inclusive education.

Secondary and Vocational Education

Autonomy is a relevant aspect to the extent that it contributes to the gradual integration of the users to increasingly complex aspects of social life, from daily functions to future possibilities of labor insertion. Thus, the investigations address both the present of high school students and the functional projections of life through vocational education.

For secondary education, the study by [30] addressed the importance of the autonomy and independence of students who are deaf, at the same time as the concern is generated in their respective families about the process by which they acquire such autonomy as they integrate more actively into social life. To strengthen such a process, they proposed an old text messaging technology that allowed a quick written response to their family or peers, which proved to be effective and easy to implement in the pre-smartphone era.

Likewise, vocational studies address both high school seniors and others who have already graduated and want to enter higher education or jobs. The study by [31] found that a Virtual Advanced Placement program aimed at balancing the presence of underrepresented populations in distance education programs failed to make a difference for people with special educational needs, and they remained underrepresented compared to other populations. In a different area, the study by [32] addresses vocational assistance focused on the world of work from a tutoring program delivered via videoconference for people with hearing disabilities in rural areas. In a post-secondary education environment, the videoconferencing model was positively evaluated by the participants due to the possibility of executing communication through sign language and the reduction in the barriers that distance imposes on the rural population in general. For the rural and population with disabilities, distance education allows continuous access to therapeutic and vocational activities, balancing their possibilities of participation in society. In this way, vocational studies reflect the difficulties that the population with disabilities has not only when it comes to being able to access higher education but also when participating in the world of work once they end secondary education. In addition, possible solutions were explored that, with less technology than today, were able to solve problems felt by their protagonists.

Higher Education and Adult Training

As the academic trajectory of people with special educational needs becomes more complex, assistive technologies in distance education also play a role in balancing opportunities to participate in courses based on the creative and functional use of the means of communication available at the time [33]. Similarly, the translation of academic content whose broad level of abstraction but limited level of representation requires compensatory mechanisms allows students with disabilities to access alternative representations of knowledge [34].

In this sense, the study by [33] addresses distance education in master's students with visual disabilities. The study proposes that the participants preferred the classes in real time via telephone instead of videoconferences, which allowed the content of the class to be more oriented to auditory receptivity since "everyone is blind to the telephone" (p. 574). Subsequently, the study by [34] developed a virtual platform that allowed complex mathematical formulas to be translated into descriptive sound systems for students with visual disabilities. This technology, implemented in contexts of e-learning and distance education, improved the levels of understanding of essential mathematical formulas for undergraduate training in many university careers. Both studies addressed difficulties faced by people with visual disabilities and found effective solutions based on sound responses to give higher education fairer and more equitable conditions for all its members.

A case study by [35] investigates the reality of a student with visual disabilities through the different stages of academic life, a trajectory that revealed the importance of assistive technologies in distance education, both for the advantages it can provide, and for the shortcomings mainly lodged in aspects such as accessibility to graphic content (p. 10).

Finally, the study by [36] addresses the topic of adult education or adult training by exploring readiness of participants with visual impairment in distance education. The findings of the study allow correlation of the educational level and the frequency of computer use with better attitudes towards participation in distance education.

3.1.2. Teacher-Centered Studies

The articles focused on aspects such as teacher training and preparation to face challenges from the point of view of inclusive education [38,39], as well as their experiences concerning pedagogical accompaniment to students with some type of disability [40]. Within the teacher's preparation, the fact that the programs were taught remotely allows us to understand non-face-to-face modalities beyond providing education with an inclusive approach to students, but also as a training space and construction of pedagogical tools to meet the special needs of students.

The study by [39] showed that, in addition to teachers' positive assessment of inclusive education approaches, they increased their willingness to modify their pedagogical practices based on what was learned in online courses. A study by [38] evaluated virtual learning environments in the accompaniment of teachers who teach students with cerebral palsy. Similarly, ref. [40] addressed the difficulties of distance learning with special education students through the perceptions and reports of teachers, who describe serious difficulties in motivating learning in this type of students, in addition to reporting of the restrictions of the didactic materials created for their classes, which were designed only for face-to-face educational modalities.

3.1.3. Prototypes and Educational Technology Designs

Within the review, documents that proposed technologies designed to address the special needs of students in distance education were identified, as well as online course designs capable of sustaining an adequate educational flow with people with special needs. The innovations in development propose solutions to specific accessibility problems that in turn require empirical studies capable of knowing the real impact of such assistive technologies on the academic trajectories of learners who require them.

Thus, studies such as that of [41] raise the problem of access for students with mobility problems to videoconferences as educational channels for distance learning and propose a personalized human–computer interaction system through cameras and sensors that would allow the student to interact with the learning environment. Additionally, ref. [42] develops software for the recognition of a sign language capable of improving the accessibility of students in distance education environments.

The study of [43] addresses BDC-API (Blind/Deaf Communications API), a modular toolkit capable of facilitating accessibility to educational digital content by people who are

blind and deaf. Their proposal stands on the assumption that students who are blind and deaf can play along and communicate through serious games environments.

Finally, the study by [44] analyzes and redesigns an online master's program in Rehabilitation Counseling from the conceptual framework of Bloom's taxonomy and with the final perspective of having technologies and online learning environments as a support in the development of higher order cognitive skills in future counselors of people with special needs. Analogous to the empirical works focused on teachers, ref. [44] approaches inclusive education from the point of view of trainers or advisors who have the responsibility of guiding educational processes in people with special needs.

3.1.4. External Validity of Some Empirical Studies

The empirical studies analyzed present variations in their methodological approaches, which should be considered by the scientific community when considering their possible impact. In empirical studies of primary and secondary education, Table 1 shows small samples [29] and medium samples [30–32], where in all cases there was non-probabilistic sampling. The case of [31] stands out, who in addition to specifically studying the use of a technology applied to a specific disability, extend the focus to the implementation of a respective financing program applied in schools. This aspect allows us to deepen our knowledge about communities with diverse needs in the use of distance education, but it does not allow establishing specific findings about any disability. In addition, studies on higher education entirely address visual deficiencies [33–35], with small samples and non-probabilistic sampling, while [36] uses a sample of 41 participants and random sampling, which provides validity to the correlations proposed. Likewise, an in-depth case study stands out [35] where, although the sample is small, it is consistent with the stated research design. Other studies, although they declare findings from empirically collected data, do not declare a sample [37], which limits the critical evaluation of their results, as can be seen in Table 2:

Table 2. Sample: disability addressed and method details.

Document	Disability	Design	Participants	Instruments
[29]	Visual impairment	Exploratory	8	Observation
[30]	Deafness	Pre-experimental	48	Survey
[31]	All	Mixed methods	19	Survey/Focus group
[32]	Deafness	Exploratory	53	Survey
[33]	Visual impairment	Descriptive	7	Survey
[34]	Visual impairment	Experimental	20	Observation/Assessment outcomes
[35]	Blindness	Exploratory	1	Interview
[36]	Visual impairment	Correlational	41	Survey
[37]	Blindness	Exploratory	--	Survey

3.2. Literature Reviews

The various literature reviews found are all located in the present century, but still with differences regarding the technologies available and the evolution of regulatory frameworks and educational approaches to promote inclusive education for students with disabilities. Next, we review the results of reviews focused on educational experiences or perspectives and others studies that focus on public policies for the inclusion of assistive technologies in inclusive distance education contexts.

3.2.1. Educational Reviews

The conceptual framework of Universal Design for Learning (UDL) is situated as a pillar capable of sustaining educational practices that mediate between assistive technologies and special educational needs from inclusive pedagogical principles and applicable to distance education [26]. Additionally, modern distance education technologies and trends break into the field of inclusive education, which makes it possible to diversify the

repertoire of virtual learning spaces that can be used in educational designs for people with special educational needs.

Thus, a general perspective is given by [45] in whose review he positions the problem of accessibility to educational goods from the approaches used, surpassing an exclusively material vision. After the document review, a framework based on the universal design learning (UDL) is proposed for technology integration into curriculum in distance education courses for students with disabilities. Additionally, the state of the art by [46] and the systematic review by [47] focus on a particular technology. Thus, the first review carries out a state of the art of the use of drones as artifacts that can be approached from assistive technology, which results in a joint proposal for the use of drones and virtual reality to allow people with reduced mobility to access sites through those who could not attend as a result of their disability, while the second author deals with the accessibility to MOOCs by students with hearing disabilities. This last study, not only propose to gamify the distance-assisted educational experiences for students who are deaf stands out, but also recommend the enhancement of the digital literacy process, which for the authors can take place in a MOOC environment at the same time as teaches about certain content [47] (p. 116).

In this way, educational reviews address assistive technologies in distance education from the general to the specific, in both cases with proposals for educational models [45] or educational integration systems for technologies [46,47] to improve the pedagogical experience of people with special needs. In addition, the Universal Design of Learning (UDL) is positioned as a theoretical framework capable of supporting both the design and the implementation of educational environments that consider disability in distance education [26,45].

3.2.2. Policy Reviews and Trends in Distance Education Mediated by Assistive Technology

From the point of view of educational public policies, a strong rights-based approach stands out, which considers equal access to education not only from the point of view of course promotion, but also from the accessibility of means that allow students with disabilities to better develop their potential at school and in the future world of work [2]. However, there is evidence of discrepancies when implementing regulations that protect the right of access to distance education for people with special needs. In this sense, the review of the disability policy by [48] exposes tensions in terms of a district court that ruled that the school was responsible for providing a sign language interpreter for a student who is deaf (p. 87). This case reveals deep inequities for those people with disabilities, but also a worrying difference in criteria between entities in charge of asserting the right to education for all.

If inclusion policies are translated into pedagogical guidelines that impact the design of courses and didactic materials from their origin, it is more effective than adaptation on the fly. The review by [26] points out that developing courses that from the beginning consider accessibility for the different types of disabilities faced by the school is even cheaper and easier to design than trying to transform materials whose design did not consider inclusive aspects (p. 28). To this way of understanding the design of assistive technologies, the authors add the approach of universal learning design as a framework for the development of technologies based on fundamental principles such as multiple forms of representation, multiple forms of expression, and multiple forms of engagement in distance educational experiences mediated by technology (p. 28).

Another aspect that stands out from the reviews on assistive technology and that address distance education as a modality for delivery of conditions for learning, is what [48] called the "permanent need for accommodation" (p. 89) and that refers to the problem that the rapid technological change produces in people with special needs, who constantly have to adapt to new technological prostheses, which in turn conspires with a real possibility of taking full advantage of the opportunities of some current technology for distance education. In this sense, the authors point out that technology developers are more concerned with the new properties or characteristics of assistive technologies than with ensuring the

capabilities to interact with them (ibid.). Similarly, do ref. [49] state that understanding and recognizing the demands of people with severe visual disabilities in web-based learning environments, can help make the leap between learning educational content and trying to understand how web sites work (p. 7).

Likewise, it is worrying that in almost two decades of research, the challenges and development of material conditions for inclusion through assistive technology in distance modality are not reflected in scientific production. Many of the difficulties reported not only in the reviews by [48] and in [2], cannot be fully corrected in more current experiences or in fully valid reviews such as that of do [49]. The low magnitude of scientific production prevents generating findings that contribute decisively to the development of technologies, educational designs, and public inclusion policies to make the educational experience of students with disabilities using distance education modality fairer and more dignified.

3.3. Characteristics and Trends of Scientific Production in the Area

The literature review yielded multiple data that allow a descriptive overview of how scientific knowledge is produced around distance education mediated by assistive technology. In the next section, we review some of this data and systematize trends based on content analysis. In the first place, the relationship between the type of research and the database in which they are hosted stands out. As indicated in Table 1, the database that contains the most texts regarding distance education mediated by assistive technology is Scopus (12), followed by Web of Science, PubMed, and IEEE (5), and finally by ERIC (3) considering the repetitions of the documents in the different catalogues. From one point of view, if we analyze the production of empirical articles, in the same table we can see that of 10 articles, 6 are published in Scopus, 3 in WOS and IEEE, 2 in PubMed and 1 in ERIC. From another point of view, it is possible to conclude that the most generic documents regarding distance education mediated by assistive technology [26,45], or reviews of public inclusion policies [48] do not appear in databases such as WOS or IEEE, but do appear in Scopus, PubMed, and ERIC. The scientific production, although it addresses multiple types of disabilities, focuses mainly on visual and hearing disabilities. Table 3 shows that those texts that reported addressing a particular disability five times did so in hearing disabilities and seven times in visual disabilities. However, disabilities such as cerebral palsy [38] or cognitive disability [40], were only addressed once.

Table 3. Disabilities addressed.

Document	Disability
[2]	Limited Mobility
[29]	Visual disabilities
[30]	Deafness
[32]	Deafness
[33]	Visual disabilities
[34]	Visual disabilities
[35]	Blindness
[36]	Visual disabilities
[39]	Brain Palsy
[42]	Deafness
[44]	Cognitive disability
[37]	Blindness
[46]	Visual disabilities
[48]	Blindness and Deafness
[49]	Deafness

Note. Documents with no specific disability were excluded from the table.

Additionally, the sample showed a great variety of technologies designed, that are evaluated in distance education environments assisted by technology, as can be seen in Table 4.

Table 4. Main technologies addressed in the sample.

Document	Technology Addressed
[2]	Drones; Virtual Reality
[26]	Augmentative and alternative communication
[29]	Haptic Virtual Maps
[30]	Text Messaging
[31]	Virtual Advance Placement (program)
[32]	Complemented videoconference
[33]	Alternative videoconference
[34]	Interactive Tutoring Platform
[39]	Collaborative distance consulting service
[42]	Sign language recognition and translation system
[43]	Complemented videoconference
[37]	Distant Learning Management Systems, TelEduc, WebCT
[46]	Web-based Learning Environments
[48]	Blind/Deaf Communications API
[49]	MOOC

Note. Documents without a specific technology addressed were excluded.

Each technology responds to the challenges of its time. This is why, in studies such as [30] we see how the use of a text messaging system with rapid response could contribute to the tranquility of families and students who are deaf in their progressive entry into activities that involved higher levels of socialization. There exist also the cases of [32,33] whose studies provide important complements to educational videoconferences, helping to turn them into more interactive spaces and generating advanced experiences at the beginning of this century. On the contrary, the review provided by [46] addresses the educational use of drones in a creative combination with virtual reality and augmented reality, research that projects a different way of using drones in a global context of searching for different uses for these devices (transport, war, communications, etc.). Some systematic literature reviews mention that other technological trends of recent years addressed by the scientific production under study are Massive Open Online Courses (MOOCs) [47]. Additionally, some pilot studies mention the use of interactive videoconferences [41], and advancements in sign language recognition and translation systems [42].

Consequently, the characterization of technologies allows us to establish a path along which the scientific community has traveled in its search to provide solutions to real problems of people with special educational needs, and with a horizon of social justice that allows their full participation in society.

4. Discussion

Many of the scopes of the reviewed studies are limited both by the magnitude of the sample and by the replacement and technological renewal, mainly those elaborated at the beginning of the century. Regarding this last aspect, it is possible to assert that one of the main tasks within a retrospective investigation is to evaluate its relevance according to its respective conditions of study and implementation. Thus, for example, the study by [30] who proposes an instant messaging system for students who are deaf, is possibly surpassed by the enormous possibilities of instant communication made possible both by the development of smartphones and by widely used applications. Likewise, the studies conducted by [32,33], exploring ways to enhance the educational experience through videoconferencing, have contributed to our understanding of these platforms as interactive spaces facilitating two-way communication between instructors and students.

Something similar would occur with the findings of [37], which shed light on the analysis of accessibility features for people who are blind across different Distance Learning Management Systems. However, it is imperative to acknowledge the evolving landscape of technology and accessibility standards, given the rapid advancement in technologies and the refinement of emerging technologies such as Artificial Intelligence (AI), Machine

Learning (ML), Deep Learning [50,51], or Extended Realities (XR) [52,53]. Regarding Artificial Intelligence, ref. [54] underscores the transformative potential of AI in Education, particularly in tailoring curricula to individual needs and democratizing access to education. Nonetheless, their analysis also highlights a critical concern: the exacerbation of educational inequalities if the current techno-solutionist narrative persists unchecked. The authors argue that without deliberate efforts to address the digital divide and pre-existing social disparities, the widespread deployment of AI in education could deepen existing inequalities rather than mitigate them. They call for a paradigm shift towards a more inclusive and equitable approach to integrating AI into education, emphasizing the importance of designing human-centered, transparent, and collaborative AI systems that empower all stakeholders. Furthermore, they advocate for the utilization of free and participatory resources alongside AI technologies to ensure that educational opportunities are accessible to all learners, regardless the background or ability. Considering their insights, it becomes clear that the successful integration of AI into education requires not only technological advancement but also a commitment to addressing socio-technical challenges and fostering inclusivity at every level.

While ref. [37] work paved the way for understanding accessibility features within Distance Learning Management Systems, ref. [36] study adds depth by examining the readiness of people with visual impairments to engage in distance education. By correlating readiness with personal characteristics such as educational level and frequency of computer usage, ref. [36] sheds light on the complex interplay between individual readiness factors and accessibility challenges. This understanding is essential for designing future inclusive distance education programs tailored to diverse needs of learners with visual impairments in an increasingly digital landscape. Ref. [34] studies complements previous research by offering a practical solution to the accessibility challenges faced by students will visual impairments in technical subjects like mathematics. While works such as [36,37] focused on understanding accessibility features within distance learning systems and the readiness of people with visually disabilities for distance education, ref. [34] research introduces an interactive tutoring platform designed specifically to make mathematics teaching and assessment accessible to the blind.

Currently, hybrid modalities are being implemented and explored in educational experiences in different places around the world, both at the level of higher education [55] and in school education [56]. They were even already being explored in synchronous mode employing face-to-face and non-face-to-face participants in school education before the COVID-19 pandemic [57–63].

Nevertheless, when bringing together distance education and assistive technology, the evolution of technological trends fails to be clearly reflected in real experiences in educational institutions around the world [15,64], as well as in scientific production within the field of special education [65]. Therefore, the value of knowing the trajectories established by the authors at the beginning of the century allowed the establishing of meeting points between technological novelty and new forms of delivering education and educational inclusion of people with special (educational) needs, even though the analyzed technologies have been surpassed by current technologies. Among the significant ideas that emerge from the review, the problem of technological renewal proposes challenges for developers and users, therapists, and teachers. Thus, the review of disability education policy by [48] warned at the beginning of the century about the permanent need for accommodation that both teachers and students suffer when faced with a new technology (p. 89). Years before this statement, the study by [4] stated that "the introduction of a new device can also make the use of an existing one more complicated or cumbersome" (p. 445), an aspect that amplifies the need to carefully observe the implications of the rapid transition from one technology to another, even in times when it was not counted, for example, with the development of smartphones that we have in the world today. From the point of view of [66], any launch of assistive technology products must be accompanied by a plan that considers the needs and goals of the users (p. 477). The authors warn that the entry of

new assistive technologies requires complex evaluation processes that have to be conducted by the people who work in the insertion and rehabilitation of users with special needs. For example, ref. [67] developed a website consisting of the module and a system allowing teachers to upload their videos and receive feedback. These ideas dialogue with other types of digital platform implementations, as seen in the study by [68]. Their investigation into the challenges faced during the rapid transition to distance education, particularly for students with disabilities, highlights the complexities of ensuring inclusive education in digital environments. The shift to platforms underscores the need for tailored approaches to meet diverse learning needs. Similarly, ref. [69] emphasized the importance of open education platforms in addressing similar challenges, providing insights into promoting inclusive digital.

To address the need for teachers' professional development in mathematics for students with disabilities and other struggling mathematics learners, they designed and studied an online program [70]. Similarly, ref. [71] confirmed that electronic coaching in a co-teaching context increased the participants' use of varied co-teaching models, becoming a popular approach to special education service provision in inclusive classrooms.

These views allow us to maintain that the permanent adaptation to new devices or functionalities of assistive technologies, even if they are generated with the aim of improving people's lives, can end up being a problem for users if they are not accompanied in their adaptation. If we add to this a distance education environment, the full inclusion of people should be supported by a pedagogical design that integrates technologies into the curriculum so that they support educational objectives at any level.

5. Conclusions

Based on the reported findings, this section proposes a summary of the main trends in distance education mediated by assistive technology, so that they can serve as background concerning what has been achieved so far by the scientific production in the evaluation of the actual implementation of remote and inclusive educational policies and initiatives and future work orientations for the scientific and educational workers' community.

Main trends:

- Autonomy and independence: educational insertion directly impacts the progressive integration of students into social life, from daily activities to the development of personal projections of the life of people with special needs. Assistive technologies, both face-to-face and remote, can be oriented to strengthen aspects such as autonomy, self-valence, and independence in the educational and social spheres. In distance education environments, the use of assistive technologies should aim to develop academic skills together with functional skills that strengthen the sense of autonomy and the consequent participation in community life.
- Universal Design for Learning: As a theoretical–practical framework, the UDL principles can contribute as facilitators of inclusive educational designs in distance education mediated by assistive technology. Based on [26], the technologies that are designed from this universal perspective, instead of considering that there are "normal" and "abnormal" students within the same class context, propose the existence of a single community, made up of different abilities and characteristics (p. 13), but which finds in its conditions of diversity a balanced and democratic participation based on the possibilities of each member.
- Technological accommodation mediated from education: The state of permanent and accelerated change in technologies, many times instead of representing a benefit, can mean a problem for users. The "permanent need for accommodation" [48] (p. 89) requires means of evaluation and curriculum integration of technologies, capable of establishing bridges between the needs of users and technological functionalities aimed at responding to such problems [66]. As with any technology oriented to pedagogical use, assistive technologies require curriculum integration processes where the focus is learning and not technology [72].

- Areas studied and understudied: Visual and hearing disabilities seem to offer more interest or more availability than other disabilities to be studied. Studies on cerebral palsy [38] or cognitive disability [40] in distance education mediated by assistive technology are valuable, as they mark starting points towards research trajectories that remain to be traveled. Like visual and hearing disabilities, the rest of the disabilities need sufficient educational experiences and high-impact studies on them, so that the knowledge that is built serves as an input for policy makers, academics, schools, and rehabilitation communities, with the aim of directly impacting the well-being of people with special (educational) needs. Future research should address the correlation between studied and understudied areas according to the prevalence of those disabilities on determined populations.
- Joint work between family, teachers, and therapists: To achieve the well-being and educational–social justice that every person deserves, work between specialists, community, and family becomes essential. First, the initial and continuous training of teachers must have inclusive approaches that consider face-to-face and distance teaching. The incorporation of these perspectives is decisive in the disposition and creation of their pedagogical repertoire. Studies such as those by [39] demonstrate how teachers' attitudes change towards inclusive practices if they are mediated by initiatives of professional development in inclusive education. Then, the incorporation of tutors, counselors or therapists helps with adequate curriculum integration of assistive technologies into educational environments. Lastly, remote educational initiatives mediated by assistive technologies must consider both the needs of the students and their family in a context of progressive development of autonomy and participation in society [30].

Finally, our results show features and trends of scientific production which improve the knowledge in the assistive technologies area. However, according to our findings, it should be considered carefully that the research methods used do not always consider representative or randomized samples and, consequently, bias risk could blur results' accuracy.

Author Contributions: Conceptualization, J.R.-R., J.S. and J.A.-S.; methodology, J.R.-R., J.S. and J.A.-S. formal analysis, J.R.-R. and J.S.; investigation, J.R.-R. and J.A.-S.; data curation, J.S.; writing—original draft preparation, J.R.-R.; writing—review and editing, J.R.-R., J.S. and J.A.-S.; supervision, J.S.; project administration, J.S.; funding acquisition, J.S. All authors have read and agreed to the published version of the manuscript.

Funding: This report was supported by the Chilean National Research and Development Agency (ANID) Basal Funds for Scientific and Technology Centers of Excellence, project number FB0003.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Rueckert, P. 10 Barriers to Education That Children Living in Poverty Face. 13 August 2019. Available online: https://www.globalcitizen.org/en/content/10-barriers-to-education-around-the-world-2/ (accessed on 30 April 2024).
2. Mcnaughton, D.; Bryen, D.N. AAC technologies to enhance participation and access to meaningful societal roles for adolescents and adults with developmental disabilities who require AAC. *Augment. Altern. Commun.* **2007**, *23*, 217–229. [CrossRef] [PubMed]
3. Ruppar, A.; Kurth, J.; Bubash, S.; Lockman Turner, E. A Framework for Preparing to Teach Students with Extensive Support Needs in the 21st Century. *Teach. Educ. Spec. Educ.* **2023**, *46*, 26–43. [CrossRef]
4. Scherer, M. Outcomes of assistive technology use on quality of life. *Disabil. Rehabil.* **1996**, *18*, 439–448. [CrossRef] [PubMed]
5. Choo Bee, G. A Systematic Review of the Influence of Teacher Self-Efficacy on the Use of Assistive Technology. In Proceedings of the 2021 International Conference on Education 2021, Virtual, 20–21 September 2021.
6. Parette, H.P.; Stoner, J.B. Benefits of assistive technology user groups for early childhood education professionals. *Early Child. Educ. J.* **2008**, *35*, 313–319. [CrossRef]
7. Markelz, A.; Scheeler, M.C.; Riccomini, P.; Taylor, J.C. A systematic review of tactile prompting in teacher education. *Teach. Educ. Spec. Educ.* **2020**, *43*, 296–313. [CrossRef]
8. Hirsch, S.E.; Griffith, C.A.; Kelley, M.H.; Carlson, A.; McKown, G. Increasing Preservice Teachers' Knowledge and Skills Using a Mixed-Reality Simulator: The Tale of Two Studies. *Teach. Educ. Spec. Educ.* **2023**, *46*, 204–222. [CrossRef]

9. Park, J.; Bagwell, A.F.; Bryant, D.P.; Bryant, B.R. Integrating Assistive Technology into a Teacher Preparation Program. *Teach. Educ. Spec. Educ.* **2022**, *45*, 141–159. [CrossRef]
10. Moyle, W.; Murfield, J.; Lion, K. Therapeutic use of the humanoid robot, Telenoid, with older adults: A critical interpretive synthesis review. *Assist. Technol.* **2022**, 1–8. [CrossRef] [PubMed]
11. The United Nations International Children's Emergency Fund. *Education and COVID-19—UNICEF DATA*; The United Nations International Children's Emergency Fund: New York, NY, USA, 2020. [CrossRef]
12. Reyes-Rojas, J.; Barahona, M. Learning to teach during COVID 19 times: A taxonomy of technological difficulties confronted by EFL student teachers. *Rev. Int. Pedagog. Innov. Educ.* **2021**, *2*, 49–72. [CrossRef]
13. Andaluz-Delgado, S.; Ordoñez-Olmedo, E.; Gutiérrez-Martín, N. Assessment of Digital Teaching Competence in Non-University Education. *Educ. Sci.* **2023**, *13*, 1237. [CrossRef]
14. Choi, H.; Chung, S.; Ko, J. Rethinking Teacher Education Policy in ICT: Lessons from Emergency Remote Teaching (ERT) during the COVID-19 Pandemic Period in Korea. *Sustainability* **2021**, *13*, 5480. [CrossRef]
15. Christodoulidou, P.; Sidiropoulou, C. Teachers' Experiences of Online/Distance Teaching and Learning during the COVID-19 Pandemic in Mainstream Classrooms with Vulnerable Students in Cyprus. *Educ. Sci.* **2024**, *14*, 189. [CrossRef]
16. OECD. *Lessons for Education from COVID-19: A Policy Maker's Handbook for More Resilient Systems*; OECD Publishing: Paris, France, 2020. [CrossRef]
17. OECD; UNESCO Institute for Statistics; UNICEF; The World Bank. *From Learning Recovery to Education Transformation: Insights and Reflections from the 4th Survey of National Education Responses to COVID-19 School Closures*; UNICEF: Paris, France, 2022. [CrossRef]
18. Perla, L.; Agrati, L. Online Practicum Effectiveness: Investigation on Tutors' and Student-Teachers' Perceptions Pre/Post-Pandemic. *Educ. Sci.* **2023**, *13*, 1191. [CrossRef]
19. Sato, S.N.; Condes Moreno, E.; Rubio-Zarapuz, A.; Dalamitros, A.A.; Yañez-Sepulveda, R.; Tornero-Aguilera, J.F.; Clemente-Suárez, V.J. Navigating the New Normal: Adapting Online and Distance Learning in the Post-Pandemic Era. *Educ. Sci.* **2024**, *14*, 19. [CrossRef]
20. Pérez-Jorge, D.; González-Herrera, A.I.; Alonso-Rodríguez, I.; Rodríguez-Jiménez, M. Challenges and Opportunities in Inclusive Education with ICT: Teachers' Perspectives in the Canary Islands during the COVID-19 Pandemic. *Educ. Sci.* **2024**, *14*, 283. [CrossRef]
21. Phua, C.; Chua, K.; Bong, W. Experiences of Parents and Teachers with Virtual Classrooms during the COVID-19 Restrictions: A Study Focusing on Inclusive Education in Malaysia. *Educ. Sci.* **2022**, *12*, 884. [CrossRef]
22. Millett, P. The Connected Life: Using Access Technology at Home, at School and in the Community. *Educ. Sci.* **2023**, *13*, 761. [CrossRef]
23. Santos-Villalba, M.; Leiva-Olivencia, J.; González-Sodis, J.; Alcalá del Olmo-Fernández, M. Resilience Strategies of Students in Highly Complex Educational Contexts: Opportunities for Inclusive Pedagogical Transformation. *Educ. Sci.* **2024**, *14*, 265. [CrossRef]
24. Uleanya, C. Reconceptualising Disabilities and Inclusivity for the Postdigital Era: Recommendations to Educational Leaders. *Educ. Sci.* **2023**, *13*, 51. [CrossRef]
25. Petretto, D.; Masala, I.; Masala, C. Special Educational Needs, Distance Learning, Inclusion and COVID-19. *Educ. Sci.* **2020**, *10*, 154. [CrossRef]
26. Myhill, W.N.; Samant, D.; Klein, D.; Kaplan, S.; Reina, M.V.; Blanck, P. Distance education initiatives and their early 21st century role in the lives of people with disabilities. In *Focus on Distance Education Developments*; Bailey, E.P., Ed.; Nova Science: Hauppauge, NY, USA, 2007; pp. 1–38.
27. Sánchez, J.; Reyes-Rojas, J. Chapter 10: MOOCS in Latin America: Trends and Issues. In *MOOCS and Open Education in the Global South: Challenges, Successes, and Opportunities*; Ke, Z., Bonk, C., Reeves, T., Reynolds, T., Eds.; Routledge/Taylor & Francis: New York, NY, USA, 2020; pp. 99–112. [CrossRef]
28. Reyes-Rojas, J.; Sánchez, J. How prepared was the world for emergency distance learning in K-12 Education? A literature review. In *Learning and Collaboration Technologies. Designing the Learner and Teacher Experience, Proceedings of the International Conference on Human-Computer Interaction, Virtual, 26 June–1 July 2022*; Zaphiris, P., Ioannou, A., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 1–15. [CrossRef]
29. Treviranus, J. Adding haptics and sound to spatial curriculum. In Proceedings of the 2000 IEEE International Conference on Systems, Man, and Cybernetics, Nashville, TN, USA, 8–11 October 2000; Volume 1, pp. 588–592. [CrossRef]
30. Akamatsu, C.T.; Mayer, C.; Farrelly, S. An investigation of two-way text messaging use with deaf students at the secondary level. *J. Deaf Stud. Deaf Educ.* **2006**, *11*, 120–131. [CrossRef] [PubMed]
31. Fenty, N.S.; Allio, A. Using Distance Learning to Impact Access of Diverse Learners to Advanced Placement Programs. *Q. Rev. Distance Educ.* **2017**, *18*, 39.
32. Johnson, L. Utah deaf videoconferencing model: Providing vocational services via technology. *J. Rehabil.* **2004**, *70*, 33–38.
33. Cain, H.M.; Merrill, Z. Distance education for master's students with visual impairments: Technology and support. *J. Vis. Impair. Blind.* **2001**, *95*, 572–575. [CrossRef]
34. Maćkowski, M.S.; Brzoza, P.F.; Spinczyk, D.R. Tutoring math platform accessible for visually impaired people. *Comput. Biol. Med.* **2018**, *95*, 298–306. [CrossRef]

35. Stadler, A.; Possolli, G.E. Assistive technologies in distance education and the inclusion of blind people: Case studies through oral history. *Rev. Espac.* **2016**, *37*, 2016.
36. Koustriava, E. Readiness of individuals with visual impairments for participation in distance education. *Br. J. Vis. Impair.* **2021**, *40*, 435–450. [CrossRef]
37. Da Silva, A.L. Comparative analysis of accessibility for blind digital environments for learning management for distance education. In Proceedings of the 5th Iberian Conference on Information Systems and Technologies 2010, Santiago de Compostela, Spain, 16–19 June 2010; pp. 1–5.
38. Dos Santos, D.; Gonçalves, E. Collaborative distance consulting in assistive technology for teachers. *Cad. Pesqui.* **2016**, *46*, 1100–1123. [CrossRef]
39. Hanline, M.F.; Hatoum, R.J.; Riggie, J. Impact of online coursework for teachers of students with severe disabilities: Utilization of knowledge and its relationship to teacher perception of competence. *Res. Pract. Pers. Sev. Disabil.* **2012**, *37*, 247–262. [CrossRef]
40. Mengi, A.; Alpdoğan, Y. Investigation of Teacher's Opinions about Distance Education Processes of Students Who Receive Special Education during the COVID-19 Pandemic Period. *Milli Eğitim Dergisi* **2020**, *49*, 413–437. [CrossRef]
41. Mulfari, D.; Mulfari, S. Assistive technologies to support distance learning for students with disabilities. In Proceedings of the 4th EAI International Conference on Smart Objects and Technologies for Social Good, Bologna Italy, 28–30 November 2018; pp. 312–313.
42. Voronov, V.I.; Genchel, K.V.; Voronova, L.I.; Travina, M.D. Development of a software package designed to support distance education for disabled people. In Proceedings of the 2018 IEEE International Conference Quality Management, Transport and Information Security, Information Technologies, St. Petersburg, Russia, 24–28 September 2018; pp. 746–751. [CrossRef]
43. Ulisses, J.; Oliveira, T.; Rocha, E.; Escudeiro, P.M.; Escudeiro, N.; Barbosa, F.M. Blind/Deaf Communication API for Assisted Translated Educational Digital Content. In Proceedings of the 2018 28th EAEEIE Annual Conference (EAEEIE), Hafnarfjordur, Iceland, 26–28 September 2018; pp. 1–9. [CrossRef]
44. Leech, L.L.; Holcomb, J.M. Leveling the playing field: The development of a distance education program in rehabilitation counseling. *Assist. Technol.* **2004**, *16*, 135–143. [CrossRef] [PubMed]
45. Yuknis, C. Removing the Disability from Distance Education. In *Special and Gifted Education: Concepts, Methodologies, Tools, and Applications*; IGI Global: Hershey, PA, USA, 2016; pp. 254–267. [CrossRef]
46. Mangina, E.; O'Keeffe, E.; Eyerman, J.; Goodman, L. Drones for live streaming of visuals for people with limited mobility. In Proceedings of the 2016 22nd International Conference on Virtual System & Multimedia (VSMM) 2016, Kuala Lumpur, Malaysia, 17–21 October 2016; pp. 1–6. [CrossRef]
47. Da Silva, A.R.; Ramos, B.O.; Biagiotti, B.D.A.; Fadel, L.M.; Ulbricht, V.R. Gamification in the MOOC Environment for the Deaf: Promoting Inclusion in Distance Education. *Rev. Educ.* **2018**, *12*, 104–120.
48. Blair, M.E.; Goldmann, H.; Relton, J. Accessibility of electronically mediated education: Policy issues. *Assist. Technol.* **2004**, *16*, 85–93. [CrossRef] [PubMed]
49. Do Nascimento, M.D.; Brandão, A.A.; de Oliveira Brandão, L.; de M. B. Oliveira, F.C. Overcoming Accessibility Barriers for People with Severe Vision Impairment in Web-Based Learning Environments: A Literature Review. In Proceedings of the 2019 IEEE Frontiers in Education Conference (FIE), Covington, KY, USA, 16–19 October 2019; pp. 1–8. [CrossRef]
50. Namoun, A.; Humayun, M.A.; BenRhouma, O.; Hussein, B.R.; Tufail, A.; Alshanqiti, A.; Nawaz, W. Service Selection Using an Ensemble Meta-Learning Classifier for Students with Disabilities. *Multimodal Technol. Interact.* **2023**, *7*, 42. [CrossRef]
51. Zeki, U.; Karanfiller, T.; Yurtkan, K. Subject dependent speech verification approach for assistive special education. *Educ. Inf. Technol.* **2024**. [CrossRef]
52. Drigas, A.; Mitsea, E.; Skianis, C. Virtual Reality and Metacognition Training Techniques for Learning Disabilities. *Sustainability* **2022**, *14*, 10170. [CrossRef]
53. Yenduri, R.; Kaluri, D.; Rajput, K.; Lakshmanna, T.; Gadekallu, M.; Mahmud, M.; Brown, D. From assistive technologies to metaverse–technologies in inclusive higher education for students with specific learning difficulties: A review. *IEEE Access* **2023**, *11*, 64907–64927. [CrossRef]
54. Bulathwela, S.; Pérez-Ortiz, M.; Holloway, C.; Cukurova, M.; Shawe-Taylor, J. Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools. *Sustainability* **2024**, *16*, 781. [CrossRef]
55. Lee, I.C.J.; Wong, P.; Goh, S.P.L.; Cook, S. A Synchronous Hybrid Team-Based Learning Class: Why and How to Do It? *Med. Sci. Educ.* **2022**, *32*, 697–702. [CrossRef]
56. Martín-Núñez, J.L.; Bravo-Ramos, J.L.; Sastre-Merino, S.; Pablo-Lerchundi, I.; Caravantes Redondo, A.; Núñez-del-Río, C. Teaching in Secondary Education Teacher Training with a Hybrid Model: Students' Perceptions. *Sustainability* **2022**, *14*, 3272. [CrossRef]
57. Beattie, J.; Spooner, F.; Jordan, L.; Algozzine, B.; Spooner, M. Evaluating instruction in distance learning classes. *Teach. Educ. Spec. Educ.* **2002**, *25*, 124–132. [CrossRef]
58. Bullock, L.M.; Gable, R.A.; Mohr, J.D. Technology-Mediated Instruction in Distance Education and Teacher Preparation in Special Education. *Teach. Educ. Spec. Educ.* **2008**, *31*, 229–242. [CrossRef]
59. Knapczyk, D.; Chapman, C.; Rodes, P.; Chung, H. Teacher preparation in rural communities through distance education. *Teach. Educ. Spec. Educ.* **2001**, *24*, 402–407. [CrossRef]

60. Knapczyk, D.R.; Hew, K.F. An Analysis and Evaluation of Online Instructional Activities. *Teach. Educ. Spec. Educ.* **2007**, *30*, 167–182. [CrossRef]
61. Mavrou, K.; Symeonidou, S.; Tsakiri, M. Once inclusive always inclusive (?): Experiences of Cypriot teachers and parents of children with disabilities on the use of technology and collaboration before and during the COVID-19 pandemic. *Int. J. Incl. Educ.* **2024**, 1–17. [CrossRef]
62. Rock, M.L.; Gregg, M.; Thead, B.K.; Acker, S.E.; Gable, R.A.; Zigmond, N.P. Can You Hear Me Now?: Evaluation of an Online Wireless Technology to Provide Real-Time Feedback to Special Education Teachers-In-Training. *Teach. Educ. Spec. Educ.* **2009**, *32*, 64–82. [CrossRef]
63. Xiong, C.; Ge, J.; Wang, Q.; Wang, X. Design and evaluation of a real-time video conferencing environment for support teaching: An attempt to promote equality of K-12 education in China. *Interact. Learn. Environ.* **2017**, *25*, 596–609. [CrossRef]
64. Judge, S.; Simms, K.A. Assistive Technology Training at the Pre-Service Level: A National Snapshot of Teacher Preparation Programs. *Teach. Educ. Spec. Educ.* **2009**, *32*, 33–44. [CrossRef]
65. Hernández-Saca, D.; Voulgarides, C.; Etscheidt, S. A Critical Systematic Literature Review of Global Inclusive Education Using an Affective, Intersectional, Discursive, Emotive and Material Lens. *Educ. Sci.* **2023**, *13*, 1212. [CrossRef]
66. Smith, R.O.; Scherer, M.J.; Cooper, R.; Bell, D.; Hobbs, D.A.; Pettersson, C.; Seymour, N.; Borg, J.; Johnson, M.J.; Lane, J.P.; et al. Assistive technology products: A position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. *Disabil. Rehabil. Assist. Technol.* **2018**, *13*, 473–485. [CrossRef]
67. Tunc-Paftali, A.; Tekin-Iftar, E. E-coaching Preschool Teachers to Use Simultaneous Prompting to Teach Children with Autism Spectrum Disorder. *Teach. Educ. Spec. Educ.* **2021**, *44*, 255–273. [CrossRef]
68. Karnas, M.; Alpaydın, B.; Eker, A. Implications of distance education on children with disabilities. *Support Learn.* **2024**, *38*, 98–118. [CrossRef]
69. Ramirez-Montoya, M.S.; Weber, J.C.; Cox, G.; Tenorio-Sepulveda, G.C. Inclusive Digital Education on Open Platforms: A Case Study of the Complexity of the Future of Education. *Comput. Sch.* **2024**, 1–18. [CrossRef]
70. Griffin, C.C.; Dana, N.F.; Pape, S.J.; Algina, J.; Bae, J.; Prosser, S.K.; League, M.B. Prime Online: Exploring Teacher Professional Development for Creating Inclusive Elementary Mathematics Classrooms. *Teach. Educ. Spec. Educ.* **2018**, *41*, 121–139. [CrossRef]
71. Ploessl, D.M.; Rock, M.L. e-Coaching: The effects on co-teachers' planning and instruction. *Teach. Educ. Spec. Educ.* **2014**, *37*, 191–215. [CrossRef]
72. Sánchez, J. Integración curricular de TICs, concepto y modelos. *Rev. Enfoques Educ.* **2003**, *5*, 51–65. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.