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REVIEW ARTICLE

The Use of Distance Learning and E-learning in Students with Learning Disabilities: A Review on the Effects and some Hint of Analysis on the Use during COVID-19 Outbreak

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Abstract:

Even if the use of distance learning and E-learning has a long tradition all over the world and both have been used to keep in contact with students and to provide lessons, support and learning materials, there is an open debate on the balance between advantages and disadvantages in the use of distance learning. This debate is even more central in their use to support students with Learning Disabilities (LDs), an overarching group of neurodevelopmental disorders that affect more than 5% of students. The current COVID-19 outbreak caused school closures and the massive use of E-learning all over the world and it put higher attention on the debate of the effects of E-learning. This paper aims to review papers that investigated the positive and negative effects of the use of Distance Learning and E-learning in students with LDs. We conducted a literature review on the relationship between Distance Learning, E-learning and Learning Disabilities, *via* Scopus, Eric and Google Scholar electronic database, according to Prisma Guidelines. The findings are summarized using a narrative, but systematic, approach. According to the data resulting from the papers, we also discuss issues to be analyzed in future research and in the use of E-learning during the current pandemic of COVID-19.

Keywords: Distance learning, E-learning, Learning disabilities, Inclusion, Reasonable accommodations, Special educational needs, Disability, Universal Design for learning.

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1. INTRODUCTION

The use of distance learning and distance education has a long tradition all over the world and both have been used since the first decades of the previous century to keep in contact with students and to provide lessons, support and learning materials [1 - 3]. The first use of distance education appeared in 1920 and it was based on the use of Postal Service and Radio. With the development of television, distance learning started to use this new media [2, 3]. In 1990, as internet became accessible and with the spread in the development of Information and Communication Technologies (ICT), distance learning became mainly based on E-learning and ICT [4].

An open debate is still ongoing on the definition of E-learning [5 - 7] but there is an agreement on the view that E-learning as a concept covers a wide range of applications, learning methods, processes, and tools. Some years ago, Moore and colleagues [2] highlighted that all forms of E-learning can provide learning opportunities for individuals. There is also an

open debate on the effects of the use of E-learning and distance learning and on the following general advantages: flexibility, quality of learning and teaching, internet accessibility, and cost-effectiveness [8 - 12].

Over 10% of students have at least one Special Educational Need (SEN) and over 5% has Learning Disabilities/Disorders (LDs) (an overarching group of neurodevelopmental disorders that affect the development of primary and/or secondary academic abilities) [13 - 18]. According to the United Nations' Convention of the Right of People with Disability [19], they need "reasonable accommodations" (that means "necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms") to support their learning development. Some questions emerge on how to provide "reasonable accommodations" during E-learning and other questions emerge on the effects of the specific use of E-learning and distance learning in students with SEN and LDs [20]. In the last 8 months, because of the worldwide pandemic of COVID-19, school closure occurred in about 200 countries all over the world [21]. Aiming to prevent contagion and the

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spreading of the virus and to guarantee continuity in learning, “Face to face” lessons were stopped, and distance learning was activated, mainly based on the use of E-learning. Some authors [22] named “crisis distance education” this current peculiar kind of Distance learning, because it was unplanned and sudden. In some countries also, it was diffused without the necessary training for new skills and knowledge. The current massive use of distance learning and E-learning in schools and universities highlighted even more the need to better understand the effects of this kind of learning and of teaching approaches and methods on all students and specifically on students with LDs. Keeping in mind these aspects, if elsewhere we focused on the psychological aspects of the use of E-learning in students with LDs [20], in this paper we aim to review papers that have investigated the overall positive and negative effects of the use of Distance Learning and E-learning in students with LDs and we aim to analyze and discuss the following research questions:

1) What are the general advantage of the use of E-learning and distance learning with respect to the learning of students with LDs?

2) How did previous papers design E-learning approaches aiming to provide the “reasonable accommodations” needed for each student with LD?

3) How did previous papers describe ways to provide inclusive approaches also in the use of E-learning and distance learning?

2. METHODOLOGY

We conducted a literature review on the relationship between Distance Learning, E-learning and LDs, *via* Scopus, Eric and Google Scholar electronic database, according to PRISMA Guidelines [23]. We used the following search keywords: “learning disabilities” combined with the “AND/OR” Boolean operators and “E-learning platforms”, “E-learning”, “distance learning”. Then literature was selected, and results were analyzed. The following inclusion criteria were established: papers on the use of E-learning and/or distance learning with students with LD; written in English and with time range from 2010 to 2020. The following exclusion criteria were established: metareviews; papers on the use of E-learning and or distance learning only with students without LD. According to the needs, the keywords were searched in the publication title or abstract. A total number of 15021 papers was found. Two authors independently reviewed the chosen references, deciding to exclude further papers and to remove duplicate references. Papers were analyzed with respect to their content, and papers with content that were not fully within the scope of this review were eliminated. A group of 50 full-text articles were considered. Starting from the references in the full-text of the articles derived from the literature review, some other papers were included (15 articles). After the reading of the full-text, a total of 30 papers were then considered for the final analysis. After examination of included articles and according to the quality of the studies and to the research questions, meta-analysis was not considered suitable; the findings are summarized using a narrative, but systematic review.

3. RESULTS

Table 1 describes the papers that met the selection criteria.

The included works revealed that authors all over the world have addressed the topic of the review and they focused on the use of E-learning and distance learning in students with LDs both in school and in university. In the following, we will describe the findings from each paper with reference to the main research questions.

3.1. What are the General Advantages of the use of E-learning and Distance Learning with Respect to the Learning of Students with LDs?

According to the review of the literature, we will now briefly discuss overall advantages and disadvantages of the use of E-learning for students with LDs described by the chosen papers. As expected, the papers in this review proposed the following definition of LDs according to DSM-5 and to other international diagnostic criteria; it refers to an overarching category of specific learning disorders, whose features are specific impairments in primary and/or secondary academic abilities and whose clinical manifestations depend on the ages of the student [17, 24, 25]. All the authors put attention on the high heterogeneity of the learning and the functional profiles of the students, and the need to individualize and personalize the learning/teaching process, even more if possible when designing and providing E-learning environments and using ICT [26 - 29].

Regarding the use of E-learning and ICT and according to the categorization of E-learning proposed by Bjekic and colleagues [30 - 32] and a similar classification of Lipka and colleagues, the selected papers described two different approaches to the use of E-learning in students with LDs. The first kind refers to the use of Assistive technology that represents “any mean, be it hardware or software, used to increase, improve or maintain capabilities of persons with disabilities and/or any specific interventions with specific groups of students with LDs aimed to support or increase specific impairments or cognitive abilities or academic abilities”. The second use of E-learning refers to a “system of procedures, processes and instructional materials that support learning” [30 - 32].

The papers described the use of E-learning and ICT both in school settings and in university settings. Regarding school settings, the authors focused mainly on the effects of specific approaches/instruments/devices related to the first use of E-learning proposed of Bjekic’s classification with the aim to increase and support specific academic abilities, specific cognitive and metacognitive abilities. Some papers also described the use of e-platforms and other tools. There is a general agreement on the following positive effects of E-learning on specific academic abilities (reading, writing, calculating, arithmetical reasoning) [34 - 36] and on specific cognitive and metacognitive abilities (decision making, metacognitive processes, increase long-term retention of learning materials, goal setting, problem-solving, and determination, self-regulation learning skill) [34, 36 - 43].

Some authors focus on positive effects on LD students’ attitude on learning, motivation and engagement, interest, active engagement, attention and on cooperative dynamics between students [39, 40, 42, 44]. Other papers have described

the effects of E-learning on general development and on learning path of students with LD (it equips students with LD with adequate skills to allow them to continue with further study through various pathways) [34, 35, 37].

Table 1. Characteristics of the papers which met the inclusion criteria.

Author(s), Year	Title of the paper	Country	Reference to LDs (yes or no)	Definition of disabilities/LDs	Definition of E-learning/distance learning and/or description of E-learning approach/es	Type of school/university
Adam and Tatnall, 2017 [37]	The value of using ICT in the education of school students with learning difficulties	Australia	Yes	The term 'Learning Difficulties' (LD) is used to refer to a condition of a large group of children who need extra assistance with schooling and arises from a vast range of cognitive and physical impairments	ICT in teaching (WEB, microcomputers, laptops, ipads, software)	2 special schools
Alamri and Wood, 2017 [52]	Factors affecting learners with disabilities-instructor interaction in online learning	USA	Yes	Learning disabilities	Online courses synchronous tools (videoconferencing, audiostream, online chat sessions) and asynchronous tools (e-mail, discussion boards)	Higher education
Asuncion et al., 2010 [46]	Multiple perspective on the accessibility of E-learning in Canadian Colleges and Universities	Canada	No	Not specified	Adaptive hardware and adaptive software for accessibility Use of ICT for courses – E-learning Use of powerpoint presentations and web-based discussions	High schools and university
Baharuddin, 2019 [45]	Transforming learning spaces for elementary school children with special needs	Indonesia	Yes	Dyslexia	Computer connected to the Internet, virtual classrooms learning environment	School
Benmarrakchi et al., 2016 [44]	Exploring the use of ICT in supporting dyslexic' students preferred learning styles: a preliminary evaluation	Morocco	Yes	Dyslexia is a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence and socio-cultural opportunity.	ICT(digital technologies Multimedia applications)	Primary school
Berizzi et al., 2017 [39]	Metacognition in the E-learning environment: a successful proposition for inclusive education	Italy	Yes	Specific learning disorders, the most commons of which are dyslexia, dysgraphia, spelling disorder and dyscalculia	ICT (e-mail, Skype network conversations, videoconferencing, E-learning platforms, such as Moodle, Edmodo, and others)	Secondary school
Bjekic et al., 2012 [31]	Students with disabilities in e-environments: psychological view	Serbia /Greece	Yes	Not specified	E-environments (assistive technologies and E-learning/e-teaching)	Not specified
Bjekic et al., 2014 [30]	E-teacher in inclusive e-education for students with specific learning disabilities	Serbia /Greece	Yes	Not specified	E-environments (assistive technologies and E-learning/e-teaching)	Not specified
Burgstahler, 2015 [48]	Opening Doors or Slamming Them Shut? Online Learning Practices and Students with Disabilities	USA	Yes	Not specified	Online learning, E-learning or distance learning	University

(Table 1) contd....

Catalano, 2014 [47]	Improving Distance Education for Students with Special Needs: A Qualitative Study of Students' Experiences with an Online Library Research Course	USA	Yes	LD are neurologically based (and are generally defined as inhibiting information processing); ADD or ADHD; physical disabilities; blindness or low vision; deafness or hard of hearing; medical (which can include the presence of a disease or condition); speech or language disabilities; and psychiatric disorders (such as depression).	Adapted courses	University
Chen <i>et al.</i> , 2015 [53]	Learners with dyslexia: exploring their experience with different online reading affordance	Malaysia	Yes	Dyslexia, it a language-based disability in which individuals experience difficulties in phonological processing.	Web sitesonline learning	Secondary schools
Fichten <i>et al.</i> , 2009 [55]	Disabilities and E-learning Problems and solutions: an exploratory study	Canada	Yes	Learning disability	ICTE-learning as range of information and communication technologies that professors use when teaching their courses entirely in the classroom, entirely online, or combination of bothuse of Internet (course web pages, lectures delivered live online), CD-ROMs, presentation	Colleges and Universities
Fichten <i>et al.</i> , 2014 [54]	Digital technology, learning and postsecondary students with disabilities: where we've been and where we're going	Canada	No	Not specified	Powerpoint, Prezi, podcasts, videos, clickers, simulations, blogs, digital textbooks, web conferencingAssistive technologiesFuture trends	Colleges and Universities
Gaggioli, 2018 [34]	Digital classroom and students with learning disorders: a study to improve learning processes and teaching practices	Italia	yes	LD as Specific disorders that refer to a specific skill domain that prevents the normal acquisition of some scholastic skills	Assistive TechnologiesICT	School
Kent <i>et al.</i> , 2018 [56]	Students with disabilities and eLearning in Australia: experiences of accessibility and disclosure at Curtin University	Australia	Yes	Learning disability	E-learning in open universityAccessibility to online learning materials	University
Korsgaard Sorensen and Andersen, 2017 [64]	Strengthening inclusion of learners with attention difficulties through interventions with digital technology in processes of production	Denmark	Yes	Developmental and attention deficitsSyndrome Mix, ADHD, Learning disability, Autism spectrum disorders, Tourette, Anxiety	ICT-based pedagogical approach Templates in word, powerpoint, google docs, google slides or Bookcreator, document sharing in Google Drive, Office 365, learning management in Google Classroom Text-to-speech, voice predition, chat	Schools

(Table 1) *contd....*

Lambert and Dryer, 2018 [57]	Quality of life of higher education students with learning disability studying online	Australia	Yes	Learning disabilities as a lifelong and neurologically based involving significant difficulties in acquiring and using skills in listening, speaking, reading, writing and reasoning or mathematics	Online learning environments	University
Pirani and Sasikumar, 2013 [26]	Accommodation for dyscalculic children in E-learning environment	India	Yes	Dyscalculia is a specific learning disability involving innate difficulty in learning or comprehending simple arithmetic	E-learning system Information and communication technology	Schools
Pirani and Sasikumar, 2014 [28]	Accessibility issues in learning management systems for learning disables: a survey	India	Yes	Learning disability are usually hidden disability that affect many individuals who usually have average intelligence but are unable to achieve their potential.	Learning Management system	Schools
Pirani and Sasikumar, 2015 [29]	Assistive E-learning system for the learning disabled	India	Yes	Learning disability are usually hidden disability that affect many individuals who usually have average intelligence, but are unable to achieve their potential	Assistive Learning environment	Schools
Pirani <i>et al.</i> , 2013 [27]	E-learning framework for learning disabled children	India	Yes	LD is a neurological disorder that affects the brain's ability to receive, process, store and respond to information	Technological intervention in education Individualized learning Remedial learning	Schools
Richardson, 2015 [49]	Academic attainment in students with dyslexia in distance education	UK	Yes	Dyslexia, specific learning disability is a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical calculations, including conditions such a perceptual disabilities, brain injury, minimal brain disfunction, dyslexia and developmental aphasia	Distance learning in open university, computer-based support, particularly CD-ROMs, dedicated websites and computer-mediated conferencing	University

(Table 1) contd....

Roberts <i>et al.</i> , 2011 [51]	Student with disabilities and online learning: a cross-institutional study of perceived satisfaction with accessibility compliance and services	USA	No	Not specified	Accommodations Accessibility Online courses Adapted courses	Higher education University
Sharabi <i>et al.</i> , 2016 [38]	Virtual connections, personal resources, loneliness, and academic self-efficacy among college students with and without LD	Israel	Yes	LD	Smart phones Internet	Transition to college
Shonfeld and Roner, 2015 [59]	Online learning for students from diverse backgrounds: learning disability students, excellent students, and average students	Not specified	Yes	A group of disorders that affect the ability to acquire and use listening, speaking, reading, writing, reasoning, or math skills	Online learning as a teaching tool	University (preparing K-2 pre-service teachers)
Smith <i>et al.</i> , 2016 [43]	Parental role and support for online learning of students with disabilities: a paradigm shift	Kansas	Yes	Learning disabilities	Online learning in online schools	k-12 school
Straub and Vasquez, 2015 [35]	Effects of synchronous online writing instruction for students with learning disabilities	USA Florida	Yes	Learning disabilities	Writing Instruction Online	k-12 setting
Terras <i>et al.</i> , 2016 [42]	Disability accommodations in online courses: the graduate student experience	North Dakota	Yes	Learning disabilities and ADHD	Accommodation in online courses	University
Vasalou <i>et al.</i> , 2017 [36]	Digital games-based learning for children with dyslexia: a social constructivist perspective on engagement and learning during group game-play	UK	Yes	Dyslexia is a learning difficulty	Drill and practice digital games-based learning Games-based pedagogies for students with special education needs	School
Ziadat, 2019	The impact of E-learning in developing academic skills and social interaction among students with learning disabilities in Jordan from the perspective of their teachers	Jordan	Yes	LD is a concept for a wide variety of learning problems. Their differences and problems affect how they receive, process, treat, analyze information or store it	Multimedia and information technologies; Internet to make available resources and to share and acquire information. Not shared definition of the term E-learning	School

Moreover, some studies are focused on the role of E-learning and ICT in supplementing learning processes, supporting different learning styles and bimodal-multimodal presentation of information (via visual and auditory channels and supporting multichannel approach) [38, 39, 44, 45].

There is also a general agreement on other general advantages of E-learning and ICT but some authors preferred to claim a higher attention during the development (and provision of ICT, learning materials and learning platforms) for students with LDs because they considered mandatory that they have certain pedagogical characteristics and an appropriate design to promote the previous described cognitive and metacognitive effects [40]. Authors claimed also that there is still a need to deeply explore which variables can facilitate

students' learning and skill development [40]. The same authors highlighted the importance of specific training for teachers in e-teaching to support teachers in developing and providing learning materials, tools and strategies [40].

With a focus on university, starting from the experience of the Open Universities, authors focused on the use of E-learning platforms and related approaches based on further development of E-learning, according to the temporal classification and evolution [2] or on specific features of different learning environments in E-learning (like Learning Management System (LMS) or Course Management System (CMS) or Virtual Learning Environment (VLE) [2]. Authors highlighted the need for a general design approach based on Universal Design for Learning, where individual differences in users are

considered since the first steps of designing [46, 47], with an interesting focus on the need to further employ an accommodations-only model as a proactive model based on the use of Universal Design approach [48]. Some authors agreed on some general advantages of the use of E-learning platforms for students with LDs that are mainly related to the increasing of autonomy and the development of personalized schedules of work (maintain their routine and increase scheduling abilities, work at their preferred time of the day instead of having to work during scheduled class times), the prevention of cognitive difficulties and the increasing of cognitive and metacognitive abilities (lower risk of cognitive and sensory overload than in the classrooms), the improvement of self-esteem and the reduction of stigma and the improvement of social interactions and relationships [30 - 32, 38, 49 - 59]. Once again, authors claimed that there are some aspects that are crucial when developing and providing distance learning with E-learning platforms, devices, tools, and learning materials. The first aspect is the promotion of accessibility to web sites, platforms and learning materials (the need for a better definition of shared guidelines and the risks that some kinds of disabilities could be less considered when the website and the learning materials are designed). The second one is the promotion of a personalized approach in the choice of specific assistive technology for each student with dyslexia (reasonable accommodation).

Aiming to promote accessibility and “reasonable accommodations”, some authors discussed the need for a better definition of shared guidelines and the risks that some kinds of learning disabilities could be less considered when the website and the learning materials are designed [49, 50, 56 - 58]. The same authors also claimed that there is a high risk of low attainments and of disparity in the completion rate and the pass rate between students with dyslexia or other LDs and other students, when all the previously described issues are not correctly considered in the design and provision of distance learning by E-learning platforms [49, 50, 56 - 58].

As in the school contexts, and also in the universities, there is a general agreement on the role of teacher training and on the role of the so-called “e-Teaching” [30 - 32]. The role of training is considered central both in the designing of websites, e-platforms and learning materials, in the choice of tools and devices and in the use of communication during the use of E-learning [49, 50].

3.2. How did Previous Papers Design E-learning Approaches Aiming to Provide the “Reasonable Accommodations” Needed for Each Student with LD?

Taking into account the great heterogeneity in the approaches to inclusion all over the world [18, 60 - 63] and the different approaches described in the papers of this review, in this paragraph we will discuss some topics proposed by some authors and related to the provision of “reasonable accommodations”. The first topic is on the development of strategies and/or models to provide “reasonable accommodations” as defined by CRPD for students with LDs during the use of E-learning and distance learning. The second topic is related to ways and strategies to provide inclusive

approaches for students with LDs during the use of E-learning and distance learning (this topic will be addressed in the third research question) [30 - 32, 48, 64].

Regarding “Reasonable accommodation”, some papers [26, 27, 30 - 32, 65] have highlighted the need to consider individual differences and provide specific assistive technologies and specific tools pertaining to each student’s needs. They proposed a model for the development of an appropriate E-learning environment for each student. The model proposed is based on the personalization of content, of the presentation format and on the development of pedagogical strategies through which learning/and/teaching processes can be effectively designed and implemented [26, 27, 30 - 32, 65].

If the papers of Pirani and colleagues [26, 27] focused on “Reasonable accommodations” and proposed an overall approach aimed to support the designing of E-learning platforms and learning materials for student with LDs, Bjekic and colleagues [30 - 32] are more focused on the role of teaching and e-teaching. Bjekic and colleagues defined “Inclusive teaching” as “recognizing, accommodating and meeting the learning needs of all students, acknowledging that all the students have a wide range of individual learning needs and that they are members of diverse communities” and these issues are even more evident in students with LDs [30 - 32]. According to some authors, in the definition of inclusive teaching there are three central aspects: differentiation, individualization and participation [30 - 32]. ICT and E-learning environment provide a central and supportive environment for the features listed as follows: multisensoriality, active role of students and participation, high level of individualization and personalization of teaching is possible, link between learning in school and daily life and activities of daily living, teachers who have good knowledge of e-teacher approaches can use new teaching elements (active facilitation, coordination, management, tutoring) [26, 27, 30 - 32].

Moreover, Bjekic and colleagues [30 - 32] have highlighted the central role of teachers in development and use of E-learning. There is a general agreement between papers on teachers’ specific positions and roles in the development of e-environments for students with LDs: they can apply new teaching elements and roles (active facilitation, coordination, management, tutoring), and new teaching assistive technology and E-learning technology. The authors have also proposed an interdisciplinary approach and an approach with good psychological and pedagogical bases, when developing an E-learning environment for students with LDs (educational technology, learning theories, E-learning models and approaches, universal design for learning approaches). In the following lines, some psychological fundamentals of e-courses design are proposed by the authors: integration of different media opportunities and involvement of different perceptual processes; transformation of information into different perceptive and cognitive channels (students with disabilities, especially students with specific LDs, learn better if the learning content is presented to them both visually, verbally and with written words) [26, 27, 30 - 32].

3.3. How did previous Papers describe Ways to Provide Inclusive Approaches also in the use of E-learning and Distance Learning?

Some authors have described also a list of interesting and evidence-based recommendations with the aim to promote inclusion and inclusive e-education: the creation of learning environments which open up spaces to develop creativity and collaboration and which are appealing to learners who could have various problems in conventional learning/teaching environments (attentional and cognitive ones and/or engagement problems); the promotion of empowerment and self-esteem in learners; the active engagement of learners in rich environments; the improvement of teacher-learner relationships by more collaborative approach with a central role of learners that can take control of their learning processes and develop increasing awareness of his/her own cognitive and learning processes and develop self-regulation abilities [31].

Moreover, other papers have discussed regarding inclusion of students with LDs [48], and some key factors in the development of inclusive approaches in E-learning: the promotion of basic digital literacy of all the teachers, the acknowledgement of the richness of social and cultural backgrounds of learners, the promotion of the role of external and internal social support in the learning process (family, peers, classmates and other external sources of social support), the promotion of skills, needs and expectations of all the users, the quality of technological and pedagogic choices in developing and using learning and E-learning environments, the availability of effective supporting roles of various kinds of mentors (peer and teachers) [30 - 32, 48, 64].

Bjekic and colleagues further take into consideration the analysis of another central factor in the promotion of inclusion: the individual cognitive and neuropsychological profile of each student [30]. The authors have highlighted the need to put higher attention on individual differences in cognitive and functional profiles of each students and each student with LD, and the need to place learners in the best possible learning environment pertaining to their needs, whatever those needs may be [30]. They suggested specific strategies to ensure that the specific needs of an individual are met: a comprehensive strategy to tackle every aspect of an individual learner's need, the provision of various learning environments in which the students can have a central and active role, the multisensoriality quality of E-learning environments (for visual, auditory or tactile skills and to take into accounts possible impairments in the learners). The authors claimed that teachers can have a central role also in the design of learning environments and learning materials, with a focus on stimulation of language, perception, memory, attention, but each of these abilities and cognitive functions are not to be taken for granted as partial or total impairment and/or difficulty of anyone with these skills may affect knowledge acquisition, construction and assimilation [30 - 32].

Moreover, the paper of Meskhi and colleagues [11] has discussed three different uses of E-learning and ICT in the promotion of inclusion of students with LDs (the use of digital technologies for exercise and repetition, the use of digital technologies for assisting in learning; and the use of digital technologies for expanding opportunities of learning) and claimed that even though each use has a role in the promotion of inclusion of students with SEN, the third has the higher role

because it facilitates the educational process, actively creating an opportunity to cooperate in the process. The authors have then discussed the role of E-learning tools 2.0 and E-learning tools 3.0 and specifically the role of E-learning tools 3.0 with Virtual Reality tools. They have also discussed some differences in the three uses of E-learning and ICT in inclusion, along with advantages and disadvantages of all of them [11].

4. DISCUSSION

This review has summarized the evidence regarding the effects of the use of E-learning and distance learning in students with LDs. The number of articles that met the inclusion criteria was 30. The results of this review give us a general vision on advantages and disadvantages of the use of E-learning and distance learning in students with LDs. Before starting to discuss these aspects, we briefly propose some general considerations. LDs is an overarching category of learning disorders that can affect one or more primary and/or secondary academic abilities [13 - 18]. Because of this issue, each intervention must consider all the individual differences behind the term "LD" which influence different ways of learning, and different ways of accessing to information [26 - 29]. A multidisciplinary approach is then needed in designing, developing and providing learning environments, learning materials and in the use of tools and devices if the aim is to consider all these issues. And an even more complex task is designing, developing and providing E-learning environments and to use ICT and Assistive technologies in learning. A high attention on pedagogical, psychological, neuropsychological issues is mandatory, and an even higher attention is needed in the e-teaching competencies and abilities [30 - 32]. Last, but not least, a huge attention must be paid on the matching between aims and tools and on the matching between persons and technology, both from the learner's side and the teacher's side [30 - 32]. The second issue is related to several approaches used in the support of schooling of students with LDs, that can be categorized into two main approaches: an "inclusive approach" where students with LDs share the same learning environments of other students, and a "Special education approach" where students with LDs share learning environments only with students with LDs and/or other SEN. The choice of one or another approach depends on political choices in school and it influences different aspects in the provision of different kinds of supports in school and university [18].

Bearing in mind all these issues, in this review, we have reviewed papers on advantages and disadvantages of the use of Distance Learning and E-learning in students with LDs, with a focus on inclusion and participation of students. According to the data resulting from the selected articles, we have focused our attention on different specific topics, described in three main research questions.

The first research question analyzed the effects of the use of E-learning and distance learning on the learning of students with LDs. According to previous findings on the effects of E-learning in students [5, 6, 8 - 10, 12], there is a general agreement on the advantages for students with LD, both with regard to specific cognitive abilities (attention, self-regulation), competencies and academic abilities, and general attitudes and engagement in learning. With reference to university settings, a higher attention of authors is on the advantages of using remote

learning and on the flexibility of learning (time, pace, rhythms) and increase of attainment and academic abilities. In both settings, there is an agreement on the need to pay particular attention on accessibility of sites, platforms and learning materials and on the need to develop a model able to take into account individual differences in learning and functional profile of each student with LD when designing and providing tools, materials and sites. The second and the third research questions are strictly related to each other and also related to the first one, and they are focused on the discussion on how to provide the “reasonable accommodations” needed for each student with LD during the use of E-learning and distance learning and how to guarantee inclusion. A general and agreed claim is based on the need to provide “reasonable accommodations” and personalization, taking into account the great heterogeneity of the neuropsychological and functional profiles of students with LDs [26 - 29]. Again, as expected from the previous literature, authors focus on the central role of teachers and their competencies in the field both for the promotion of inclusion and for an inclusive use of E-learning and ICT for students with LD. There is also an agreement on the need for a deep theoretical awareness and clinical and neuropsychological analysis of functional profiles of each student with the aim to provide personalization and “reasonable accommodation” [30 - 32]. In this field, future research is needed aiming to design a transdisciplinary approach to support implementation of models for designing and developing E-learning platforms, materials and tools based on the advanced knowledge and research evidence in neuropsychology, pedagogy, education, and E-learning sciences. Future research is also needed on the development of a model to match aims and tools and to match persons and technology, both from the learner’s side and the teacher’s side.

CONCLUSION

In summary, the present paper discussed advantages and disadvantages of the use of Distance Learning and E-learning in students with LDs. We can summarize some points of interests in the study, according to the papers analyzed in the review:

- E-learning and Distance learning have a long tradition in promoting learning and keeping in touch schools and university with students, and this aspect has become a need and an even more important feature during the current pandemic experience;

- E-learning and distance learning are strictly related to the so-called “e-teaching”, the knowledge and the competencies of the teachers in the use and the development of learning materials and learning processes using ICT; E-learning and the distance learning are strictly related to the development and the use of ICT and e-environments by teachers and within pedagogical and psychological based approaches, and a huge attention on the training and the empowerment of teachers in e-teaching is needed, aiming to prevent that they have a secondary role in the learning process and become merely “users” of unknown tools and learning environments and learning material;

- there are at least two strictly related approaches in the use of ICT and E-learning; the first one is the use of assistive technologies and /or the use of tools, devices, software aimed to promote specific abilities/competencies or to increase access

to information and learning, the second one is the use of e-environments specifically designed to promote learning;

- as a consequence of the two just described approaches, there are also at least two different but related aims in the use of ICT and e-environments: the first one aims to promote and increase abilities, competencies and the second aims to promote access to information and learning anywhere, as many times as needed and with an individualized time, pace and rhythm;

- there is an agreement on the risks in the use of E-learning and ICT with students with LDs when there is not enough attention on the provision of specific “reasonable accommodations” for each student’s need or when the accessibility is not well considered in designing and in implementing tools, devices and learning environments.

With the awareness that our paper has some limitations, one specific limitation is related to the fact that the papers included in the review considered the use of E-learning and distance learning before its massive use during COVID-19 outbreak and further research is needed to compare more directly previous and current use of E-learning in students with LD. Taking into account this limit, in the following, we propose some other issues of analysis on the use of E-learning and distance learning during COVID-19 outbreak.

As the pandemic is still ongoing all over the world, some countries are choosing to use a blended approach employing the use of “face to face” lessons together with distance learning/E-learning. In according with Al Lily and colleagues [22] and other authors that named “Crisis distance learning” the distance learning used during COVID-19 outbreak, we proposed some specific issues that are useful when designing and providing distance learning during the current epidemiological emergency [3, 9, 66, 67]. There is a need to put attention on the peculiarities in the use of E-learning/distance learning before and during COVID-19 pandemic and there are some central points to be considered. Even with the awareness that it is not a simple task, there is an agreement on the need to put great attention on continuity in learning and communication during the pandemic experience and on the role of the school community also in promoting coping strategies in students and in the spread of information useful to cope with the epidemiological emergency and to prevent contagion and difficulties. With reference to learning, there is an agreement on the need to focus attention on students with LD and with other SEN, aiming to prevent dropout of students with LDs, SEN and with different kinds of difficulties that could be exacerbated in the sanitary emergencies (for example, economic difficulties exacerbated by the epidemiological emergency) [68 - 73]. Last but not least, there is an agreement on the need to take into account all the barriers and difficulties in the use of E-learning both of students and teachers, and focus on the role of specific training in increasing adherence to the use of E-learning and ICT of both students and teachers [3, 9, 10, 66, 67, 74].

AUTHORS’ CONTRIBUTIONS

All the authors equally contributed to the design of the study. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST

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