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A systematic review of academic interventions for students with disabilities in Online Higher Education

José Israel Reyes[a]*, Julio Meneses[a] and Efrem Melián[a]

[a] *Department of Psychology and Education, Open University of Catalonia, Barcelona, Spain*

*Rambla del Poblenou, 156, 08018, Barcelona, Spain. Email: jreyesrey@uoc.edu

The development of new educational environments based on the use of ICT has enabled the possibility to improve access and involvement for students with disabilities at the university level. Hence, this systematic review attempts to synthesize the main findings of previous interventions aimed to promote the inclusion of these students in Online Higher Education, as well as to analyse their contribution on the students' academic success, by considering the principles of both Universal Instructional Design and Universal Design for Learning. A systematic search was conducted in four databases (WOS, Scopus, ERIC, and ProQuest) following the PRISMA-P statement. This search yielded 16 articles according to the defined criteria. Four thematic categories were identified throughout a thematic synthesis: Accessibility, support, socialization, and academic success. The findings show that both accessibility and support are important factors for promoting the disabled students' academic success in Online Higher Education but also highlight the need to apply the Universal Design in the whole system. Furthermore, the issues of academic support, inclusive pedagogical practices, and socialization should be deeply analysed to inquire about their contribution to the students with disabilities' academic success. Lastly, the limitations of this study and future implication for research are discussed.

Keywords: Online higher education; universal design; students with disabilities; systematic reviews; academic interventions; academic success

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Introduction

The inclusion of students with disabilities (SWDs) in Higher Education has been analysed over the last three decades by the academic literature. The topic has gained relevance, especially from both the Salamanca Statement (UNESCO 1994) and the Convention on the Rights of Persons with Disabilities (United Nations 2006). On the one hand, inclusive education promotes equality for people, irrespective of their condition (Bunbury 2018). On the other hand, this approach also poses a need for improving the quality of educational systems aiming to offer education for all (Thomas 2016). These variables have required the development of practices regarding equitable access, involvement, and progress for all students. Nevertheless, putting this approach into practice is still a challenge for both Higher Education professionals and students with and without disabilities (Sanahuja-Gavaldà, Muñoz-Moreno, and Gairín-Sallán 2020). Given this scenario, Moriña (2017) asserts that the interconnection among all the stakeholders who are involved in promoting the participation of SWDs in university is crucial.

Furthermore, Higher Education has been adopting measures based on virtual formulas that emerge as alternatives or complements to face-to-face and more traditional practices through the introduction of ICT. This fact has enabled the inclusion of many people, previously excluded from university, by giving them the opportunity of carrying out their studies and allowing them to reconcile other responsibilities, whether personal or work-related (Henry 2018). However, this format also increases barriers for some students, especially regarding their incorporation and academic progress (Kent 2015; Burgstahler 2015). Hence, diverse empirical studies have evaluated the effectiveness of devices, tools, and services both in providing accessible content to

SWDs (Boticario, et al. 2012; Catalano 2014; McAndrew, Farrow, and Cooper 2012) and in their effect on students' success (Batanero et al. 2019) to suggest improvements in their functionality.

Considering that context, it seems reasonable to adopt the Universal Design principles (Mace et al. 1997), to facilitate the inclusion of SWDs in Higher Education, especially in online settings. This model, proposed by a multidisciplinary group of researchers, highlights the design of accessible products and environments for all the users. In educational contexts, Universal Design has adopted at least two frameworks: Universal Design for Learning (UDL) (Rose 1996, 1999) and Universal Instructional Design (UID) (Silver, Bourtque, and Strehorn 1998). Both frameworks emphasize the need for designing accessible and flexible teaching programmes, resources, and contents that are useful for all students' learning (Burgstahler 2001; Orkwis and McLane 1998).

UDL focuses on students learning specifically, thus it could be applied in a generalized manner in both OHE and other formats. This framework is based on three fundamental principles: contents in different and flexible formats, flexibility to organise and express what the students learn, and multiple ways of participation and motivation (Orkwis and McLane 1998). Meanwhile, UID focuses on both teaching and learning, presenting little differences when applied in OHE. Regarding the design of educational products and environments, Burgstahler (2001) and Scott, McGuire, and Shaw (2003) presented a list of nine principles. To apply them in distance education, Elias (2010) adopts them as follows: equitable use, flexible use, intuitive and straightforward use, perceptible information, tolerance for error, low physical and technical error, provision of support and promotion of a community of learners and suitable instructional climate.

Little research has analysed the empirical evidence on the inclusion of SWDs in online universities. The databases register two reviews focused on analysing the intersection of disability and OHE around the world; Kinash, Crichton, and Kim-Rupnow (2004) and Edwards (2019), but no-one has analysed the literature systematically. Hence, we considered appropriate carrying out this systematic review aiming to analyse the results of previous academic interventions that promote the SWDs' inclusion in OHE and their contribution to academic success.

Methodology

This investigation adopted the methodology of a systematic review (Gough and Thomas 2016; Xiao and Watson 2019). So, we followed the procedure established in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) 2015 statement (Moher et al. 2015).

Research question and objectives

The following research question delimited the review: What were the results of the previous interventions addressing the inclusion of SWDs in OHE over the last three decades? The following research objectives helped to answer this question: To identify interventions aimed at promoting the inclusion of SWDs in OHE; to identify their purpose, their domains, and the approaches; to synthesise the achieved results following the principles of both the UDL and the UID; and to analyse their effect on the students' academic success.

Search strategy

We carried out an extensive search for scientific publications in the databases Education Resources Information Center (ERIC), Web of Science (WOS), Scopus and

ProQuest. This search began with the terms: 'students with disabilities', 'online education', and 'higher education' and their equivalents so that the three thematic blocks articulating the inclusion criteria in this systematic review are combined. Figure 1 illustrates the search strategy.

Figure 1. [near here]

Inclusion and exclusion criteria

The selection of studies was based on the following criteria: a) scientific articles available in electronic databases published in English and examined by a peer-review process; b) academic interventions about the inclusion of SWDs in OHE; c) empirical studies published between 1990 and 2020, based on quantitative, qualitative, or mixed methods; and d) studies including SWDs in their sample.

Concerning the exclusion criteria, this review has not considered a) investigations about SWDs in face-to-face environments or hybrid models combining both formats, b) studies whose objective was not to evaluate interventions addressed to SWDs' inclusion, c) publications from conferences or congresses, as well as from books and doctoral or master's dissertations.

The search yielded 3278 results. Once eliminated 1194 duplicated, 2084 articles were examined by reading their title and abstract, as shown in Figure 2. The first and third authors individually carried out this process, selecting so 122 publications. In the next phase, we applied the inclusion and exclusion criteria to determine which studies should be considered for the synthesis. This process led to the exclusion of 106 articles according to the following reasons: non-empirical investigations (n=85), empirical investigations whose full-text was not available, or if so, in another language different than English (n=6), empirical investigations that did not include SWDs among their

participants (n=9), studies about blended learning (n=3), studies following research methodology different than qualitative or quantitative (n=1) and empirical investigations whose objective was not the evaluation of interventions addressed to the inclusion of SWDs (n=2). Finally, 16 studies were deemed eligible for the synthesis.

Figure 2. [near here]

Assessment of quality

The entire 16 papers were assessed for research quality using the Evaluation Tool for Qualitative Studies (Long and Godfry 2004). The usage of this tool was based on the nature of the synthesis. All the papers were considered against 14 criteria including 42 items considering the study overview; the phenomenon studied, setting, and samples; data collection, analysis, and risk of bias; ethical issues; policy and practice implications and other comments, not with the intention of excluding them but to highlight the quality of the evidence in which they are based. The assessment revealed that 9 of the studies have a high weight of confidence, 5 have a medium weight of confidence, whilst 2 have a low weight of confidence.

Codification and analysis of data

A thematic synthesis (Thomas and Harden 2008) was conducted to codify and analyse data. Firstly, the authors agreed to extract the following information: bibliographic data (author(s) and year); context (university and country); participants; methodology; objectives; domains, themes, and approaches; as well as the results, including limitations and recommendations. A second phase consisted of developing a double coding process employing the provisional strategy (Miles, Huberman, and Saldaña1994) that led to the identification of descriptive themes.

Results

Sixteen articles met the inclusion criteria (Table 1). Some studies approached the phenomenon of SWDs' inclusion in OHE from the Universal Design principles, whether considering this approach as a conceptual framework (n=6) or, indirectly, emphasizing the importance of applying its principles (n=3). The methodology in the interventions is balanced (7 studies used qualitative methods, 7 used quantitative, and 2 employed mixed methods). The case studies (n=10) and the experimental or quasi-experimental (n=6) were the most used research designs. Finally, most of the studies were developed in European countries (n=11). The rest were carried out in North America (n=3) and Latin America (n=2).

Table 1. [near here]

Four domains were identified through the thematic synthesis: Accessibility, support, socialization, and academic success. Accessibility focuses on two dimensions, a pedagogical one and a technological one. Meanwhile, support refers to the pedagogical practice, provision of assistive technologies, technical support, and the promotion of wellbeing both in psychological and emotional contexts. Regarding socialization, the results emphasize the contact within SWDs and their peers, as well as the communication with the academic staff and other people in the university. Finally, the interventions analyse the SWDs' academic success in OHE, both considering their own perspective and by analysing indicators. Figure 3 illustrates these domains and themes, thoroughly presented in the following sub-sections.

Figure 3. *[*near here]

Accessibility

The pedagogical dimension of accessibility

Online Education provides an important opportunity for SWDs to access Higher Education (Richardson 2016). Thus, results in Amado-Salvatierra et al. (2016) show that accessibility in OHE is a priority from its development until its presentation. Therefore, to begin with a suitable course design requires employing a clear language (Luke 2002), presenting a fully accessible content in different and flexible formats (Catalano 2014; Rodrigo and Tabuenca 2020), and, especially, making sure to consider all the users' needs (Amado-Salvatierra et al. 2016; Batanero et al. 2019). Besides, it is necessary to provide sufficient flexibility so that the students have an adequate control as well as enough freedom to self-manage their learning (Catalano 2014; Dickinson 2005; Nganji, Brayshaw, and Tompsett 2012; Rodrigo and Tabuenca 2020).

The results also show the need for offering specific accommodations for students, both with visual disabilities and learning difficulties (Batanero et al. 2019; Luke 2002; McAndrew, Farrow, and Cooper 2012). To support these students, the technical-pedagogical structure of virtual campuses must present a simple design and a clear language (Catalano 2014; Luke 2002). For both groups, web sites with excessive textual content may increase their frustration and anxiety levels (Gerrard and Shurville 2007; Simoncelli and Hinson 2008). Furthermore, although some SWDs prefer content graphically, through tables (McAndrew Farrow, and Cooper 2012) or textual transcriptions, in the cases of students with hear impairments (Rodrigo and Tabuenca 2020), students with vision impairments face critical difficulties for accessing those formats (Freire et al. 2010; Luke 2002). Hence, reducing the textual content together

with incorporating other flexible and simple formats increases comprehension for most students (Catalano 2014; Luke 2002).

The assessment also appears as an important aspect when promoting the SWDs' inclusion. For instance, most SWDs prefer multiple options questions or items wherein they must choose among true or false statements (Dickinson 2005). Otherwise, those with learning difficulties express disconformity with essays and debate spaces as examination tools (Catalano 2014; Pena, Suárez, and Baelo 2016) since these increase anxiety feelings (Gerrard and Shurville 2007). Pena, Suárez, and Baelo (2016) also found that accommodations in examination processes help students with hearing impairments to manage anxiety, especially if evaluation strategies in flexible, simple, and different formats are employed (Amado-Salvatierra et al., 2016; Catalano 2014). Beyond the format, the evidence highlights the importance of offering accommodations in terms of time and space when the assessment process is being carried out.

The evidence also shows a controversy regarding accommodations. On the one hand, those measures are considered an important aspect for SWDs' performance (Batanero et al. 2019; McAndrew, Farrow, and Cooper 2012; Rodrigo and Tabuenca 2020). On the other hand, they are usually limited to facilitate accessibility for information, but still do not consider learning as an entire product (Simoncelli and Hinson 2008). Furthermore, when students should request this kind of support, some of them do not use it because they do not want to reveal their disability (Gerrard and Shurville 2007; McAndrew, Farrow, and Cooper 2012) or because of the bureaucratic procedures (McAndrew, Farrow, and Cooper 2012). Finally, the excess of accommodations is associated with lower self-efficacy levels (Pena, Suárez, and Baelo 2016).

Consequently, it is necessary to incorporate modifications both in the study programs and course design, including planning inclusive learning and teaching strategies (McAndrew, Farrow, and Cooper 2014; Nganji, Brayshaw, and Tompsett 2012) so that the earlier mentioned measures fit with all the students' needs (Catalano 2014; Dickinson 2015; Luke 2002; Rodrigo and Tabuenca 2020). This means that the students' opinion should be previously considered (Amado-salvatierra et al. 2016; McAndrew Farrow, and Cooper 2012) to promote changes aiming to improve their learning possibilities.

The technological dimension of accessibility

Although media accessibility is one of the first steps for the inclusion of SWDs in OHE, according to Batanero et al. (2019), research on this topic has just started. The results of the interventions point out that accessibility in online educational settings is a critical matter (Amado-Salvatierra et al. 2016) since it represents a necessary alternative for the achievement of higher studies for people with disabilities. Besides, accessibility depends on various factors: 'previous experience with online technology; the availability of immediate support when a problem arose, the presence (or absence) of clear help files; and the extent of familiarity with a given adaptive technology' (Luke 2002, 149).

Most interventions focus on software production or adaptation to facilitate SWDs' access, especially for students with sensory and learning disabilities. The evidence reveals that people with dyslexia and people with visual impairments experience more difficulties during navigation (Batanero et al. 2019; Luke 2002; McAndrew, Farrow, and Cooper 2012). Thus, the results in Batanero et al. (2019, 6) suggest that the adaptation of the learning platforms for students with sensory

disabilities demands considering different aspects such as 'the nature of the learning objects and its adaptations, the metadata provided for those learning objects and its adaptations, and, also, the students' personal needs and preferences'.

Concerning the effect of adaptive or assistive technologies, they seem useful to the students with sensory and learning disabilities in terms of improving accessibility (Amado-Salvatierra et al. 2016; Gerrard and Shurville 2007; Nganji, Brayshaw, and Tompsett 2012; Rodrigo and Tabuenca 2020), and academic success (Batanero et al. 2019). Nevertheless, sometimes, assistive technologies also cause accessibility barriers (Luke 2002), especially because of their low usability or because their functionality is inconsistent (Dickinson 2005; Gerrard and Shurville 2007). Hence, it is very important to identify all these barriers to avoid adverse consequences (Luke 2002), or, most importantly, to design virtual campuses and courses able to offer the adapted resources by itself for all the spectrum of users (Catalano 2014; Luke 2002; McAndrew, Farrow, and Cooper 2012; Richardson 2016; Rodrigo and Tabuenca 2020).

The findings mainly suggest using a simple and consistent structure (Gerrard and Shurville 2007; Luke 2002) and presenting information that is fully accessible (Amado-Salvatierra et al. 2016; Freire et al. 2010; Luke 2002) and accurate (Luke 2002; McAndrew, Farrow, and Cooper 2012). Meaning, to conceal as many unnecessary links as possible (Dickinson 2005; Luke 2002), to use a clear language and to offer support (Catalano 2014; Luke 2002; McAndrew, Farrow, and Cooper 2012), and to develop the contents flexibly (Luke 2002; McAndrew, Farrow, and Cooper 2012; Nganji, Brayshaw, and Tompsett 2012; Rodrigo and Tabuenca 2020).

Support

Academic support

The results highlight the need for designing and applying academic support programs for all the students, especially for those with disabilities. These students often request help, especially to solve assessment activities (Dickinson 2005; Gerrard and Shurville 2007; Pena, Suárez, and Baelo 2016), an important aspect earlier analysed.

OHE institutions must pre-visualize all the difficulties that its educational format could present for the students. Accordingly, the SWDs face critical challenges concerning the use of technology and the virtual campus (Catalano 2014; Freire et al. 2010; Luke 2002). One of the first aspects to consider is the training in the use of digital technologies, and particularly, in the virtual campus, during the incorporation process (Catalano 2010; Luke 2002; McAndrew, Farrow, and Cooper 2012). However, if institutions are not prepared to offer this kind of training, at least they should offer flexible and clear support tutorials in diverse formats (Catalano 2014; Luke 2002). In addition, the results show that the SWDs often ask for advice in the use of the available accommodations (McAndrew, Farrow, and Cooper 2012), so that the development of this kind of resources looks like an appropriate mechanism for their academic support in OHE (Richardson 2016).

These results emphasize the importance of combining both accessibility and academic support to achieve full inclusion for SWDs. For example, although the students perceive accessibility as a valuable factor to succeed in OHE, the evidence shows that support from academic staff is also highly useful for them (Debevc and Peljhan 2004; Gerrard and Shurville 2007; McAndrew, Farrow, and Cooper 2012).

Furthermore, these students also value positively the support provided by their peers, whether it comes from a team group or peer support (Dyer 1991).

Finally, the staff should plan the academic support and learning. On the one hand, Freire et al. (2010) suggest that instructors and academic advisors, who play an important role in providing accessible content, should design a plan enabling them to coordinate support for SWDs. On the other hand, Naumova et al. (2017) observed that the combination of active methods with the use of ICT increases the students' motivation into learning, promotes reflection, and helps them to improve personal relationships.

Technological support

The assistive technologies are helping SWDs to improve their experience in OHE. Indeed, assistive technology is crucial in terms of accessibility for these students (Luke 2002). Different software help students with learning and sensory difficulties to access resources (Freire et al. 2010; Luke 2002), contents (Batanero et al. 2019; Catalano 2014; Dickinson 2005; Nganji, Brayshaw, and Tompsett 2012; Simoncelli and Hinson, 2008), and assessment activities (Batanero et al. 2019). However, employing these applications demands adequate technical support for the students (Dickinson 2005; McAndrew, Farrow, and Cooper 2012), whether as specific training for using special software or by means of learning platforms or by facilitating administrative procedures for requesting that aid (McAndrew, Farrow, and Cooper 2012).

Psychological and emotional support

Regarding the psycho-emotional support, the issues of motivation, self-efficacy, anxiety, and personal relationships stand out as the most important aspects. Thus, less

anxiety during the examination processes, the improvement of self-efficacy, and social support emerge as the most benefits of accommodations for SWDs (Pena, Suarez and Baelo, 2016). Although, results also show that excessive demands for adaptations are associated with low levels of self-efficacy, reducing autonomy and increasing anxiety in some cases. Furthermore, the evidence shows that attitude to learning along with communication among students, instructors, and peers are the main reasons for the SWDs' academic success (Naumova et al. 2017), beyond other individual factors such as attentiveness, working capacity, and operational efficiency.

Socialisation

The analysis of the participants' perceptions shows a close relationship among SWDs' socialization with both instructors and peers and their academic success (McAndrew, Farrow, and Cooper 2012; Naumova et al. 2017). Apart from the formal communication with academic staff and peers (Debevc and Peljhan 2004; Dyer 1991; Gerrard and Shurville 2007; Naumova et al. 2017; Simoncelli and Hinson 2008; Richardson 2016), for these students it is also important to interact, in an informal context, with other people within the university such as disability services officers (Richardson 2016). Finally, the results show that OHE promotes collaboration and collaborative learning among students (Dyer 1991; Gerrard and Shurville 2007), a scenario that seems highly beneficial, especially for SWDs. Moreover, socialisation is an important aspect not only for the students' learning but also for improving communication between academic staff when they design academic support (Dickinson 2005).

Academic success

Beyond facilitating access, a critical challenge for Higher Education institutions is to increase SWDs' academic success. In this regard, the evidence shows that adapted learning platforms and objects influence their success (Amado-Salvatierra et al. 2016; Batanero et al. 2019; Nganji, Brayshaw, and Tompsett 2012). For instance, online classes using adapted resources increase the comprehension of material in comparison with a traditional lecture (Debevc and Peljhan 2004). Likewise, as Richardson (2016) has shown, online tutorials affect the SWDs' academic success critically due to their flexibility.

According to the analysed interventions, attitude towards learning along with communication with instructors and peers influences the SWDs' learning positively in OHE (Naumova et al. 2017). Hence, the promotion of proactivity also appears as a key strategy to improve their academic success (McAndrew, Farrow, and Cooper 2012).

Discussion

This article analysed the findings of interventions promoting the inclusion of SWDs in OHE. Therefore, this systematic review shows the following results. First, most interventions have focused on accessibility as a crucial factor in achieving their correct incorporation. Second, accessibility, in combination with socialization and inclusive pedagogical practices, increases the possibility for succeeding for SWDs in OHE. Third, academic support provided to SWDs is a priority, whether focused on academic, technological, psychological, or emotional aspects. Furthermore, we have identified gaps in the research concerning inclusive pedagogical practices as well as psychological support for SWDs. Finally, the interventions focused mostly on students

with sensory and learning disabilities as well as on students with physical disabilities or chronic illnesses.

The importance of accessibility in facilitating access to information and learning resources for all the students is obvious. So, the findings are in line with Batanero et al. (2019) on that, even now, accessibility in Higher Education is still in its infancy. However, as shown in the results, the literature registers important efforts made so that all the students can access and participate actively in OHE. This educational format offers some alternatives for different disadvantaged groups as the SWDs, thanks to innovative possibilities that allow them to learn flexibly, at their own pace, and thus to balance their studies with other responsibilities, as well as with the needs resulting from their disabilities (Henry 2018). However, Higher Education institutions should consider the challenges that OHE could present for these students, particularly due to technological barriers or the absence of physical contact with other people.

The inclusion of SWDs in OHE requires the combination of pedagogical, technological, psychological, and emotional factors. Accessibility is only one of the factors influencing the SWDs' academic success in OHE. Furthermore, promoting the active participation of all the students, as well as the flexibility of methodologies and learning strategies as a complement seems crucial for their inclusion (Catalano 2014; Simoncelli and Hinson 2008). Consequently, this process is supported by a suitable climate for teaching and learning (Elias 2010) based on an online collaborative network between all the university's members (Gerrard and Shurville 2007). Therefore, the combination of both UID and UDL principles is a viable well-validated alternative on research that enables the improvement of OHE conditions for SWDs.

Socialization is an essential requirement to materialise academic support and collaboration. From the SWDs' perspective it is very important keeping in touch with

both their peers and academic staff (Debevc and Peljhan 2004; Dyer 1991; Gerrard and Shurville 2007; McAndrew, Farrow, and Cooper 2012; Naumova et al. 2017; Richardson 2016; Simoncelli and Hinson 2008). Although physical contact between instructors and students is low in OHE contexts, or even almost non-existent in many cases, this situation emphasises the importance of collaborative methodologies as a tool for improving both the learning opportunities (Gerrard and Shurville 2007) and socialisation (Richardson 2016), by promoting effective communication among all the university members (Dickinson 2005; Naumova et al. 2017).

Furthermore, this review found that research concerning psychological support and its effects on the SWDs' academic success is still an unresolved mission. So, there are many challenges to deal with concerning the academic production around students with mental, intellectual, or emotional disorders' success in OHE. If the studies focus on accessibility, the most benefited users are those with sensory or learning difficulties. Hence, to emphasise the benefits of psychological support and accommodations both on the SWDs' psycho-emotional wellbeing and on their academic success would be meaningful.

Limitations

This systematic review examined studies that had gone through a peer-review process, were written in English, and published exclusively in electronic databases. Nevertheless, it is suggested to analyse the evidence in other sources and to consider academic studies written in other languages than English. As for the search strategy, the research team used a broad scope of terms enabling a whole and comprehensive vision over the topic. However, this decision could skip, inadvertently, some publications carried out with specific groups. Finally, it is important to consider, before

interpreting the findings, that some of the included studies were based on relatively small samples, especially some case studies, so that its generalizability could prove inadequate.

Future lines of intervention

Although most interventions have focused on accessibility, many issues still request special attention on this topic. For example, investigating the effects of applying UDL and UID in all the academic disciplines as well as to inquire into the opportunities to adapt contents, resources, and activities to the students' aspirations and needs, emphasising the effects of both frameworks in the general population of students' academic success, but specifically on SWDs.

Furthermore, it is necessary to evaluate the effectiveness of inclusive pedagogical practices that combine virtual education with collaboration. Future investigations should focus on this question as well as on examining the support programs, especially those addressed at providing psychological support, and thus, to contrast their contribution to the success and retention of SWDs in OHE.

Finally, research about inclusion in OHE requires a combination of both qualitative and quantitative methods. In this sense, the authors agreed with the path marked by the reviewed works where they point out the need to use research designs that select more representative samples. Likewise, it would be interesting to focus the analysis on variables such as gender, age, ethnicity, socioeconomic background, and the degree of disability.

Conclusion

Most academic interventions analysed in this work have focused on assessing accessibility in virtual learning environments. Nevertheless, other factors such as

flexibility, support, and socialisation play an important role for SWDs' success in OHE. Hence, the application of both UID and UDL is a priority so that all the students can achieve their academic goals by employing inclusive teaching methods that promote collaboration, designing sufficiently flexible and adaptable environments and by providing suitable support programs.

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Figure 1. Search strategy.

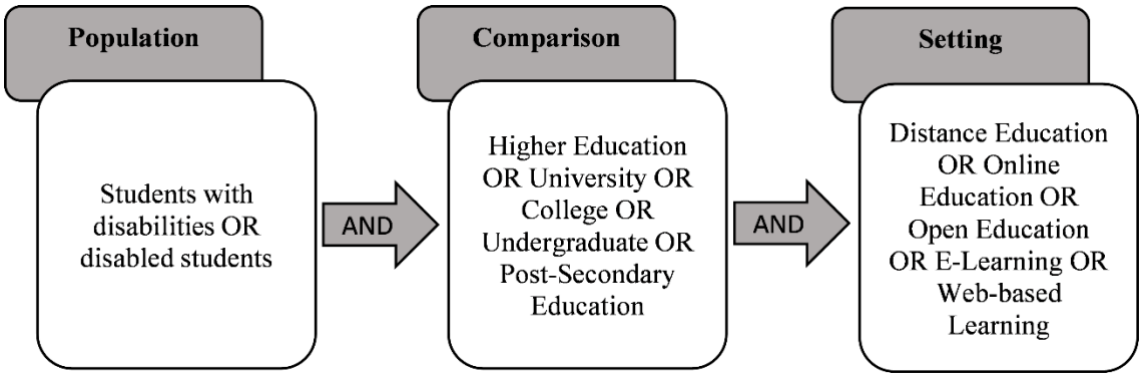
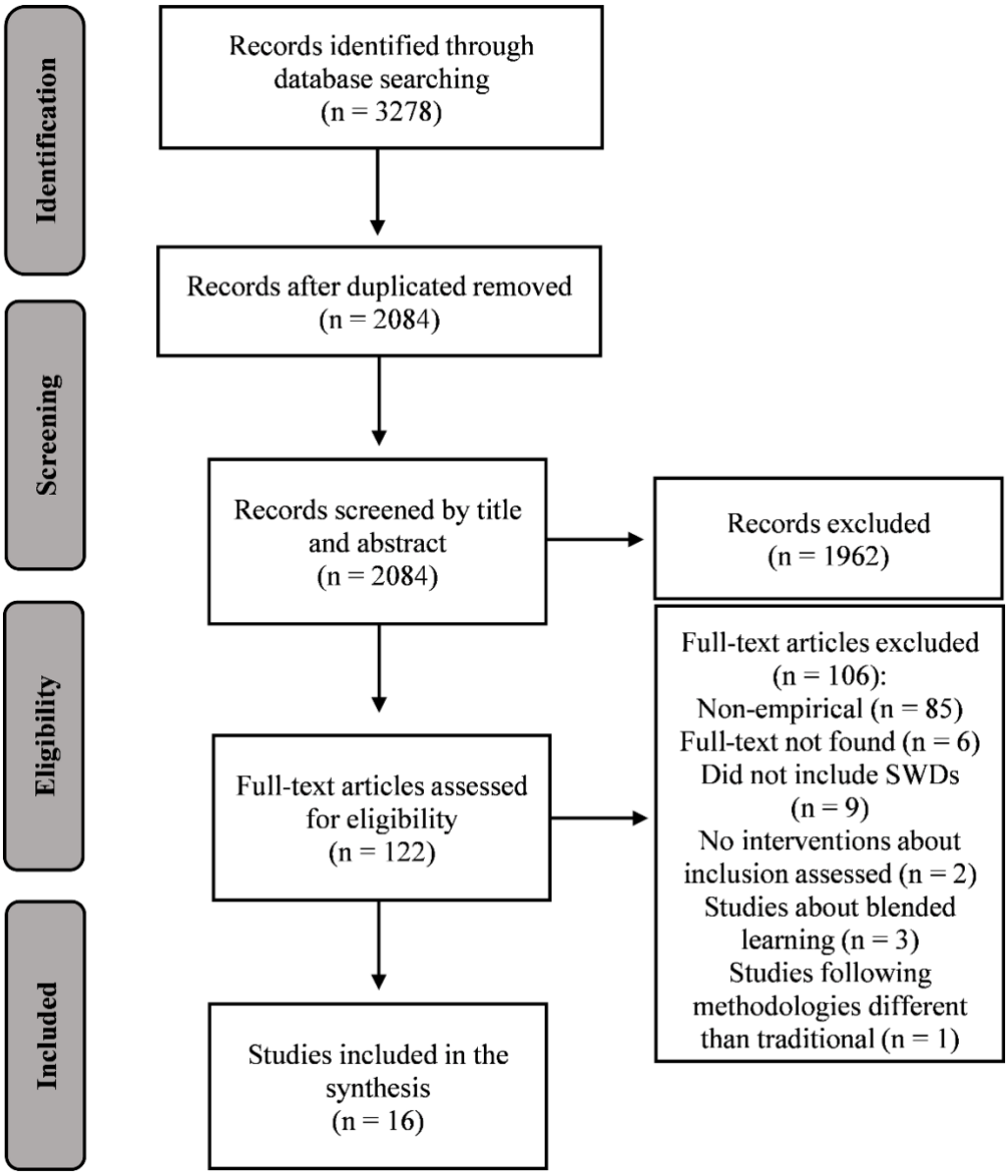


Figure 2. Flow diagram of the procedure for selecting studies according to PRISMA-P statement.



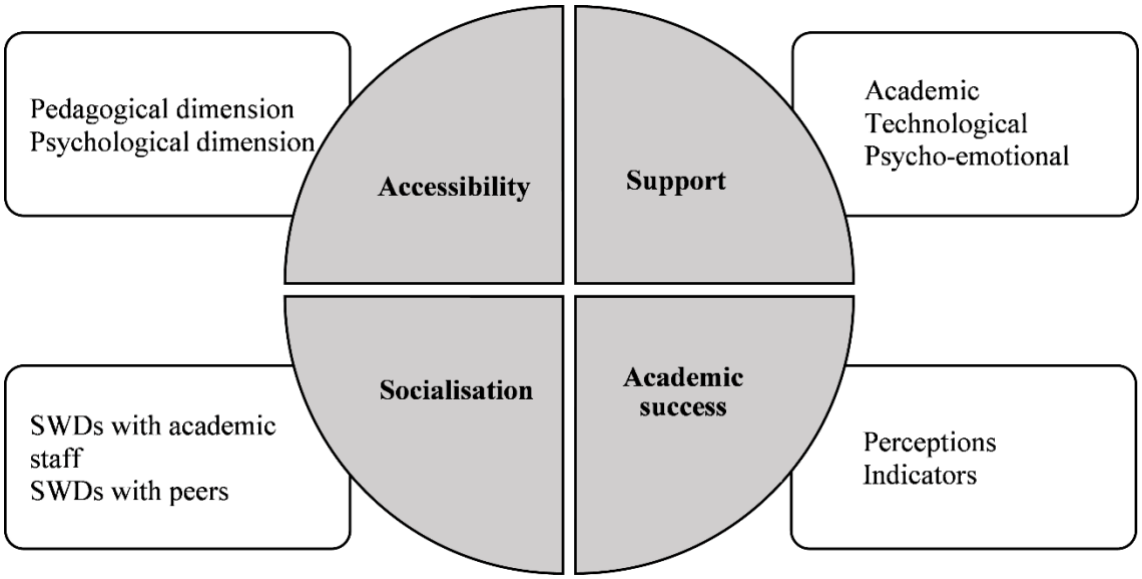


Figure 3. Domains, themes, and approaches discussed in the included interventions.

Table 1. Descriptive summaries of included studies.

Citation	Participants	Purpose	Methodology	Results
Amado-Salvatierra et al. 2016	937 students 748 instructors	To elaborate a methodological framework for accessible virtual educational projects.	Quantitative: experimental.	• ATs help SWDs to improve their experience in OHE. • Accessibility in OHE is a need in the whole system. • OHE provides an alternative for people with PD.
Batanero et al. 2019	23 SWDs	To evaluate SWDs' (VDs and HDs) academic attainment in VLEs.	Quantitative: Quasi-experimental.	• The adapted VLEs improve both accessibility and academic success for SWDs. • Braille devices help students with sensory disabilities to access any kind of information. • Adaptations in VLEs must cover several themes.
Catalano 2014	7 SWDs	To explain the SWDs' experiences in OHE and their validation in the academic literature.	Qualitative: Case study.	• UDL helps to improve distance education for all students. • Flexibility, clarity, and simplicity are essential for the SWDs' success. • Well-organized distance courses help students with their organization. • Online debates help students to express their opinions clearly.

				• SWDs have different preferences concerning exam formats.
Debevc and Peljhan 2004	63 SWDs	To determine video lectures' effectiveness for SWDs in comparison with the traditional ones.	Quantitative: Experimental.	• Online classes increase materials comprehension in comparison with the traditional ones. • A combination of a sign language interpreter, subtitled videos, and other additional materials support students with HDs. • Video-classes are very useful with traditional teaching methods although do not substitute instructor presence. • Traditional methods are useless in OHE. • Video-classes improve HDs students' academic success.
Dickinson 2005	2 SWDs 2 staff members	To describe the students with VDs' experiences when using screen readers to navigate in VLEs.	Qualitative: Case study.	• Communication between academic staff improves support for SWDs. • Clear items make written tests easier for SWDs. • Diagram's production is one of the big challenges for supporting SWDs.

Dyer 1991	35 SWDs	To describe some housebound students' experiences by using computer-mediated communication.	Qualitative: Case study.	• Interaction and collaboration among students in OHE increase their learning. • OHE promotes academic staff engagement.
Freire et al. 2010	1 SWD 2 staff members	To facilitate the use of interactive blackboards for students with VDs through an adapted prototype.	Qualitative: Case study.	• Previous discussion of content helps VDs students' learning and improves communication. • The academic staff plays an important role in providing quality content to SWDs. • The interactive blackboard used in this experiment is accessible solely by students with VDs. • Accessibility problems in ATs depend on developer software.
Gerrard 2007	10 SWDs	To investigate the SWDs' engagement levels in the VLEs and the extent of online classes' accessibility.	Qualitative: Case study.	• An online learning community fosters collaborative learning. • VLEs cannot substitute instructors but provide flexibility and confident resources for SWDs. • Unnecessary areas and tools of VLEs cause frustration and awkwardness to SWDs. • Debate spaces cause anxiety to some SWDs.

Luke 2002	8 SWDs	To examine the context wherein the VLEs are used and their relative accessibility in learning situations.	Qualitative: Case study.	• Previous experience with online technology, immediate support available, clear tutorial of support, and familiarity with the AT given determine accessibility. • Dense text, tables, and graphics raise barriers for VDs students. • The VLEs' technical-pedagogical structure could affect students with LD. • ATs raise accessibility problems, except for people with PD.

McAndrew et al. 2012	101 SWDs 10 staff members 7 services chiefs	To identify the contribution of EU4ALL model, and its services, to educational institutions' accessibility. To improve the existent conditions for attending the students, staff, and institutions' demands.	Mixed methods: Experimental and case study.	• EU4ALL could work in both OHE and conventional models. • SWDs need instructions for using available adaptations. • Participants prefer graphical contents rather than text-based presentations. • Participants prefer captioned videos and/or their transcriptions. • Personalised content is very useful. • EU4ALL provides self-provision and flexibility. • SWDs demand technical support, intuitive accommodations, and fewer administrative procedures. • SWDs prefer choosing adaptations on their own. • SWDs prefer both accessibility and support.

Naumova et al. 2017	6 SWDs	To identify the SWDs' psychological and educational characteristics. To examine the SWDs' learning process in distance education.	Quantitative: experimental.	• Active teaching methods increase motivation for learning and improve interpersonal relationships. • Active teaching methods with ICTs improve SWDs' learning in OHE. • Communication among SWDs with instructors and peers support their inclusion in OHE. • Knowledge acquisition is the main SWDs' motivation; the second is getting a certificate. • Attentiveness, working capacity, and operational efficiency influence the students' success. • SWDs' performance tends to go lower at the of activities depending on illness severity.
Nganji 2012	93 students	To show how learning resources and services personalization could be available for students in OHE.	Mixed methods: Case study and experimental.	• AT could provide an effective personalisation for SWDs. • ONTODAPS supports personalisation approaches that consider different learning styles and presents learning resources in alternative formats. • Using ONTODAPS, SWDs can have a learning experience equivalent to their peers without a disability. • ONTODAPS allows freedom and control to lead the SWDs' learning.

				• Students with multiple disabilities can access personalised content easily.
Pena et al. 2016	133 SWDs	To study the use of accommodations for HDs students at UNED University. To determine student's perception and satisfaction with accommodations.	Quantitative: Ex-post-fact.	• Students who receive adaptations show a higher satisfaction. • There is a correlation between accommodation requests and students' satisfaction. • Reduction of anxiety during examination processes, self-efficacy levels, and social support are the adaptations' benefits. • Excessive demands of adaptations negatively affect the student's satisfaction and self-efficacy. • High levels of self-efficacy reduce anxiety for SWDs. • Adaptations in exam formats increase the SWDs' satisfaction. • SWDs need adaptations in materials and examination processes.

Richardson 2016	4514 students.	To examine distance students' experiences, preferences, and academic success through face-to-face and online tutorials.	Quantitative: Ex-post-fact.	• Students choose online tutorials instead of face-to-face since their flexibility and/or face-to-face tutorials for physical contact. • There are no differences in qualifications between students with and without disabilities. • SWDs successfully finish their courses. • Online tutorials improve academic support for SWDs in OHE. • Online support positively affects SWDs' qualifications.
Rodrigo and Tabuenca 2020	161 students.	To evaluate the efficiency and accessibility of an online learning environment in higher education.	Quantitative.	• Text transcriptions are useful for students with intellectual and HDs. • SWDs positively appraise availability of resources to work offline. • The accessible and flexible VLEs fit SWDs' needs.
Simoncelli and Hinson 2008	5 students 1 instructor.	To investigate the effect of online teaching strategies in the students' perception. To examine the effect of modifications in the courses design on the	Qualitative: Case study.	• Incorporated modifications did not provide extra help for any group. • The kind of disability, age, and background define if AT is useful for SWDs.

	attitudes and attainment of students with LDs.	• Instructors in OHE often rely on doing modifications without confirming their efficacy or impact on students' learning. • Adaptations do not substitute interaction between instructor and students.

Note: SWDs: students with disabilities; HDs: hearing disabilities; VDs: visual disabilities; LDs: learning disabilities; VLEs: virtual learning environments; and AT: Assistive Technologies.