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UNIVERSAL DESIGN FOR LEARNING (UDL) AND ITS IMPACT ON INCLUSIVE EDUCATION IN TEACHER TRAINING: SYSTEMATIC REVIEW 2016-2022

DISEÑO UNIVERSAL PARA EL APRENDIZAJE (DUA) Y SU IMPACTO EN LA EDUCACIÓN INCLUSIVA EN FORMACIÓN DOCENTE: REVISIÓN SISTEMATIZADA 2016-2022

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ABSTRACT

From the paradigm of inclusive education, UDL is an optimal tool to achieve true educational inclusion. This tool provides the necessary scaffolding for a holistic approach to knowledge, considering the included student and anyone who needs it. Through the use of different materials and resources, it seeks to transcend social integration to achieve academic inclusion. It is believed that quality education should not only go as far as possible, but it should provide everyone with the same level of access and opportunities. Even when it is with different modalities, materials or resources, it should facilitate equity in the use and access to knowledge, and ultimately, to learning. The development of research is crucial to encourage the use of UDL as a strategy for educational inclusion and to generate a greater wealth of knowledge in this regard. In this context, this work aims to systematize the bibliographic production in the period 2016-2022 in relation to the use of UDL in the classroom and its impact on educational inclusion in teacher training. To this end, a systematic review was carried out following the Prisma model (2020). By applying the inclusion and exclusion criteria, 25 articles were obtained referring to educational experiences developed at the tertiary level, and more specifically, in teacher training. This review allowed us to conclude that the use of UDL in the classroom generates a positive impact for educational inclusion and allows both quality education and educational continuity.

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Palabras clave:
DUA, inclusión educativa, formación docente.

RESUMEN

Desde el paradigma de la educación inclusiva, el DUA es una herramienta óptima para lograr una verdadera inclusión educativa. Esta herramienta brinda los andamiajes necesarios para el abordaje de los conocimientos de manera holística considerando al alumno incluido y a todo aquel que lo precise. Mediante el uso de diferentes materiales y recursos, se busca trascender la integración social para alcanzar la inclusión académica. Se considera que una educación de calidad no debe llegar hasta donde sea posible, sino que debe brindar a todos el mismo nivel de acceso y las mismas oportunidades. Aun cuando sea con diferentes modalidades, materiales o recursos, se debe facilitar la equidad en el uso y acceso al conocimiento, y en definitiva, al aprendizaje. Es crucial el desarrollo de la investigación para incentivar el uso del DUA como estrategia de inclusión educativa y generar mayor caudal de conocimiento al respecto. En este contexto, este trabajo tiene como objetivo sistematizar la producción bibliográfica en el período 2016-2022 en relación con el empleo del DUA en las aulas y su impacto en la inclusión educativa en formación docente. Para ello, se realizó una revisión sistemática siguiendo el modelo Prisma (2020). Al aplicar los criterios de inclusión y exclusión, se obtuvieron 25 artículos referidos a experiencias educativas desarrolladas en el nivel terciario, y más específicamente, en formación docente. Esta revisión permitió concluir que el uso del DUA en las aulas genera un impacto positivo para la inclusión educativa y permite una educación de calidad y la continuidad educativa.

Introduction

Universal Design for Learning (UDL) is beginning to gain momentum in the area of special education. However, it has not yet been fully echoed in regular education classrooms. There, access to quality education is not always provided on an equal basis, and students with different abilities often do not benefit from the best conditions. Thus, the National Inspector of Special Education in Uruguay remarks (Castellano, 2014). It stresses that educational inclusion is a right and that quality education must emphasize equity in access.

In this scenario, Echeita (2014) is a reference that teaches how to visualize the magnitude of educational inclusion as an educational tool and analyzes how it is cited in university educational jargon. Sandoval (2017), on the other hand, highlights the need to inquire further about educational inclusion and its role in equal access in pursuit of quality education.

In Uruguay, the development of research in this area is incipient and is gradually beginning to gain relevance. Among the most outstanding antecedents are the investigations of Dolan, et al by Dolan, et al. (2005); Candelario (2010); Azorín and Arnaíz (2013); Fernández (2014); Pastor (2014); Castro (2015); Sánchez, et al. (2016); Terán (2016); and Zamora (2016).

As stated by Echeita (2014, 2016), receiving an inclusive education is a right of students, not a mere principle to be assumed as far as possible, but all educational actors must come together to make this education possible.

When promoting inclusive education based on educational interventions, the different perspectives in which they are situated should be analyzed. In a more reductionist configuration, educational inclusion seeks to serve a minority sector segregated from society due to disability, ethnic minority, or homosexuality. On the contrary, from a more global vision, the aim is to cover all students regardless of their condition (Echeita and Simon, 2013; Echeita, 2016).

It is important to be clear about the position from which we are going to start and clarify whether we are going to speak from the perspective of *them*, the disabled, and *us*; whether we are going to question whose problem it is or where the problem lies; or whether we are going to identify the barriers that prevent the free development of diversity. We must be aware of what society we are seeking to forge, and towards what social project it is directed. This project should be based on two basic principles: sustainability and diversity. If a society is not sustainable and does not respect diversity, it is very difficult to talk about educational inclusion (Echeita, 2016).

As Echeita (2016) argues, a change of perspective is possible and necessary in order to move towards inclusion, to begin the journey that involves shared reflection, planning and participation of all parties, and where coordination by the pedagogical leader (principal) is vital.

In line with this idea, Echeita, et al. (2006) and Echeita (2016) propose inclusion as a systemic process of educational innovation to promote the presence, performance and participation of all students, paying greater attention to those most vulnerable to exclusion, marginalization and school failure, detecting the barriers that hinder this process. Then, in order to move towards educational inclusion, it is vital, as Echeita (2004, 2016) points out, to transform schools into true educational communities, where the teacher does not feel alone; and if necessary, it is necessary to work in pedagogical duos. It is key to foster a learning climate based on respect and tolerance, where

students must cooperate in order for their peers to learn. In short, they cooperate to learn and learn to cooperate, as the author mentioned above maintains.

For such inclusive education to be possible, the presence of the UDL is key. This design is based on three fundamental principles that are the basis for developing a flexible and open curriculum. According to CAST (2011, 2018), these principles involve: a) providing multiple means of representation (the what of learning), b) providing multiple means of expression (the how of learning), c) providing multiple means of engagement (the why of learning). As Skliar (2017) argues, we must educate from love, from empathy. The act of educating is a conversation between strangers.

In this context, the present study poses the following objective: to systematize the bibliographic production in the period from 2016-2022 regarding the use of UDL in classrooms and its impact for the development of educational inclusion in teacher training.

Method

In this research paper, we present the results of a systematic literature review (Sánchez-Meca, 2010; Gouch et al., 2017; Newman and Gough, 2020) that was conducted with the objective of locating and analyzing articles that show UDL as a tool for educational inclusion in teacher education.

Regarding the protocol used, in this review, the guidelines marked by the PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) statement for scientific systematic reviews were followed, with the purpose of preserving a methodical development and planning through methodological considerations and exemplification of elaborations in the presentation of the report (Hutton et al., 2015).

In accordance with the procedure and search strategies, the internationally recognized scientific databases ERIC, SCOPUS (through the Timbo Portal), OECD, EBSCO and La Referencia were consulted. Searches were conducted for scientific articles published from 2016 to 2022. The search was conducted during the months of June through December 2022.

The methodological design complied with the requirements of the *SALSA Framework*. Exclusion and inclusion criteria were applied, obtaining a sample of 25 articles. This was a systematized review to characterize the different visions and possible applications of the UDL in the aforementioned period. It should be noted that this method has been employed by different authors (Fernández-Martín et al., 2020; Galindo-Domínguez and José Bezanilla, 2019; Hinojo et al., 2019; Peinado et al., 2019a; Sola Martínez et al., 2019; Zainuddin and Halili, 2016, Franmis, et al., 2021). As Codina (2018) rightly states, the literature review is made up of two fundamental elements. Namely: the documents chosen for the review, in general, scientific articles; and the result of their interpretation. Therefore, a literature review is an investigation in which the selected documents constitute the primary data and their interpretation is the chosen method of analysis.

The guidelines of the *SALSA Framework* (*Search, AppraisaL, Synthesis, Analysis*) were applied ensuring reliability, transparency and systematicity (Codina, 2018) through four phases: 1) search: using databases and search equations to ensure systematicity; 2) evaluation: applying inclusion and exclusion criteria to discard; 3) synthesis: extracting a record that allows synthesizing the relevant information or common dimensions of the articles; and 4) analysis: global assessment of the results and

their analysis. In summary, the application of the documentary analysis was guided by research objective 1. In each process, the actions required for compliance were identified:

Process 1. Search and inventory. Through the criteria definition subprocesses, information was sought in the SCOPUS, Scielo, ERIC, Dialnet, WOS databases. The items were saved and sorted.

Process 2. Selection of documents.

Process 3. In-depth reading.

Process 4. Cross-reading.

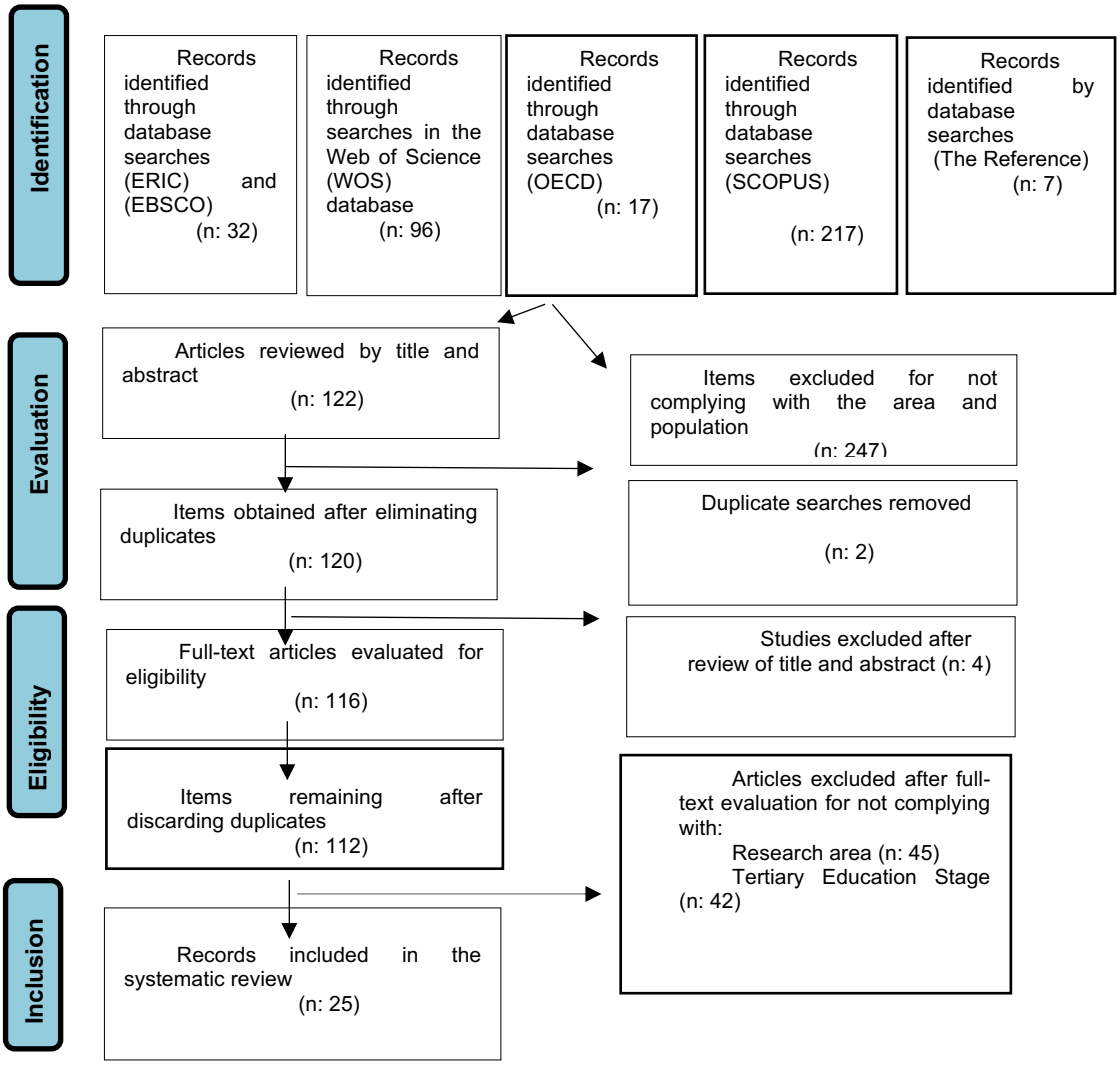
A preliminary review of the documents was made for background. A prudent date was established for determining this background between 2016-2022. The free-text terms "universal design for learning" and "teacher training" were used with their respective English translations ("universal design for learning", "teacher training") and related by means of the Boolean operator AND.

The inclusion criteria that were used, are detailed below: a- journal articles in Spanish and English, b-in the title must appear the keywords: educational inclusion-DUA, c-publication period 2016, d-published in research and review articles in digital journals, doctoral theses. The exclusion criteria were expressed as follows: a-book chapters, conference proceedings, b-the descriptor does not appear in the title: DUA, c-period of publication not included in 2016, bachelor's and master's theses.

As an initial result, 369 articles were found: 32 ERIC and EBSCO, 96 WOS, 17 OECD, 217 SCOPUS, 7 The Reference, after elimination for duplicity and non-compliance with the area. In order to limit the amount of research initially found in the repositories, a series of inclusion and exclusion criteria were applied for their selection, which have already been detailed.

Thus, after the identification and screening phase, a more detailed reading of all the sections that made up the articles was carried out, again applying the inclusion and exclusion criteria for obtaining studies. This procedure was fully related to the objective of this study. As can be seen in Figure 1, the final result generated a total of 25 articles for review and analysis.

Figure 1
Systematic review flowchart



Note. Adapted from Moher et al. (2009)

Once the search was carried out in the databases mentioned above, an ad-hoc bibliographic record was prepared with the following inductive categories: a- bibliographic references (author, year of publication), b- objective of the study and main results obtained, c- contextual variables (country where the study was carried out), d- methodology (instrument and/or data collection techniques).

The following deductive categories emerged from the analysis of the worksheets: use of the DUA inclusive tool, scope and limitations in learning.

Once the units of analysis were described, the paradigms were classified into three categories: quantitative, qualitative and mixed according to Delgado Meza (2020).

Results

A total of 369 articles were selected, of which 247 were excluded in a first filter for not complying with the area and population. By selecting them by title and abstract, the number was reduced to 122, and by reviewing them and eliminating duplicates, 112 were obtained. Then, it was identified that some did not meet the adopted criteria such as, for example, the area of research or the level of focal education. Finally, 25 scientific papers were analyzed in this research.

The results obtained from the review of the documents that met the inclusion requirements were structured in three sections, which are detailed below:

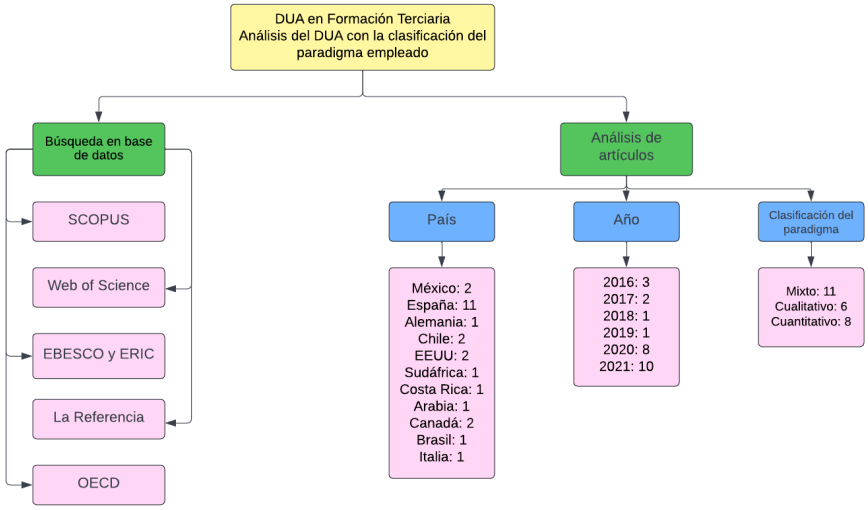
The review showed that there is a predominance of UDL studies in Spain (Figure 2). In articles from Spain and the U.S., a greater application of UDL as a tool to make educational inclusion effective was appreciated (Baldiris et al., 2016; Sánchez Fuentes et al., 2016; Díaz Vega et al., 2020; Moriña, 2020; González and Colmenero, 2021; Valle-Flórez et al., 2021).

In countries such as Chile, studies were found in which the objective was to identify the UDL strategies most valued by student teachers, as well as to detect the facilitators and obstacles to their implementation (Gutiérrez Saldivia, 2020).

Among the selected studies in Spain, non-experimental descriptive studies were found to predominate (Valle-Flórez, 2020; González and Colmenero, 2020, Palaguachi, 2020). Meanwhile, in Cyprus, collaborative research was found (Gur and Yikmis, 2021, Zerbato, 2021), and in Chile, action research (Gutiérrez Saldivia, 2020).

Figure 2

Search procedure and study selection by country, year and research type



The information obtained from the articles analyzed showed that the highest percentage of studies is of mixed cut (42.8%). As for the rest, 31.9% represent quantitative studies, and 25.3% refer to qualitative studies.

As for the study entitled, *Enhancing Student Learning in the Online Instructional Environment Through the Use of Universal Design for Learning,* (Boothe, 2020) had the objectives of evaluating the impact of a final UDL project on student learning and

assessing overall perceptions of the project. The questions arise from the need to demonstrate the impact of UDL training programs. First, 37 students were taught how to apply the UDL in their classrooms during a two-week course; and then, an online survey was conducted on the impressions generated by that course. The participants were invited to carry out a project that consisted of creating presentations, children's books, brochures, and online games. The response rate for the online survey was 32%. Overall, participants found that the completion of the final project was positive for their learning and allowed them to adequately demonstrate their learning. All participants who responded to the survey expressed interest in using the UDL in their classrooms; and some indicated a desire to use it in interaction with other adults. The fact of being able to choose which final project to present was welcomed among the respondents. Regarding the general perception of the project, respondents identified the need to be creative as a challenge. It was concluded that it was a positive project and the possibility of providing options when carrying out certain tasks or projects was highlighted.

On the other hand, the study *Toward an Inclusive Pedagogy Through Universal Design for Learning in Higher Education: A Review of the Literature*, (Fornauf & Erickson, 2020), it should be noted that it is a review that sought to understand how higher education teachers and researchers conceptualize and operationalize UDL. The researchers searched for articles in the ERIC database, selecting those articles between 2002 and 2008 that focused on UDL in higher education. Thus, they selected 38 articles. With respect to operationalization, they found that the UDL is often used as a response to a specific problem of inequity or student dropout; and that it is conceptualized as a solution to a "problem" of students with identified disabilities. It was noted that many incorporate it to create and sustain inclusive environments; and others to comply with established accessibility standards. The study concluded that it is essential to establish conventions to create a consistency that demonstrates the usefulness of the UDA and its adaptability. It was also stressed that it should not be seen as a one-time intervention but as a conceptual approach or approach.

The study *Analyzing Barriers, Innovating Pedagogy: Applying Universal Design for Learning in a Teacher Residency* (Fornauf et al., 2020) aimed to describe the process of applying UDL as a pedagogical innovation in a teacher residency program. Meetings were held to explore the possibilities of UDL and discuss its incorporation into the curricula. In addition, an analysis of barriers to their incorporation was carried out. Applying the UDL in teacher training allowed them to improve their pedagogy and review their practices. Both in this paper and in the previous one, it was emphasized that UDL should not be seen as a concrete practice but as a lens through which to "look" at the whole. As in Boothe's work (2020), it was also positive to include the possibility of choosing how to demonstrate knowledge acquisition in different projects. In this regard, it was emphasized that care must be taken when presenting the options. These should not be mere options. On the contrary, emphasis should be placed on training in possibilities other than the written essay.

The study *Toward More Inclusive Education: An Empirical Test of the Universal Design for Learning Conceptual Model Among Preservice Teachers* (Griful-Freixenet et al., 2020) aimed to validate the DUA model as a whole in preservice teachers. For this purpose, 4775 pre-service teachers were contacted who were enrolled in a 3-year training program in 8 different universities that covered teacher training. They obtained 1134 responses from teachers who had had at least two weeks of practice. UDL actions were positively correlated with efficacy in inclusion, regulation and motivation to teach. As for the DUA practices rating, women rated better than men. In turn, those whose

mother had a lower level of education scored better. Teachers who had a direct relationship with a person with a disability also obtained better ratings. The creation of a learning community in teacher education environments is helpful in facilitating a climate conducive to inclusion and in facilitating collaboration between teachers and students. It is important that teacher trainers use DUA to encourage future teachers to use it in their classrooms as well.

In the *Universal Design for Learning (UDL) studio : Student and Faculty Perceptions* (Kennette & Wilson, 2016), a survey of Canadian students and faculty on the use and usefulness of UDL is proposed. There, the responses in both populations were compared. Most of the students mentioned that, frequently, the faculty used different media to present the topics, although to a lesser extent audiovisual content. In addition, they noted that all items related to the UDL were useful. When comparing the surveys in both populations, similarities were found in almost all items. In some cases, such as the number of manual activities proposed or the availability of an electronic version of the reading texts, some differences were found. Students, in general, perceived the UDL as more useful than faculty perceived it and valued peer critique as more important. Students also found it more useful than faculty in recording lectures for later listening, posting them on the virtual campus and the possibility of converting texts to audio. They also valued autonomy more than teachers. It should be noted here that the study dealt only with perceptions, without taking into account performativity data.

For the study, *Exploring online learning modules for teaching Universal Design for Learning (UDL): preservice teachers' lesson plan development and implementation* (Lee & Griffin, 2021), three four-week interactive UDL modules were delivered to improve the skills and ability to implement UDL in preservice teachers. Eight teachers participated, all of them women. It should be noted that half of them had no previous teaching experience. A pretest and posttest were applied, and a qualitative and quantitative analysis was performed. It was shown that teachers improved in the design and implementation of the UDL after being part of the online course. It should be noted that this finding was statistically significant.

The study, *Preparation and Experiences for Implementation. Teacher Candidates' Perceptions and Understanding of Universal Design for Learning* (Takemae et al., 2018), sought to examine perceptions of UDL from a phenomenological approach. Perceptions were probed in the following areas: understanding of the UDL, experiences and observations of how the UDL is developed in classrooms, implementation and learnings about the UDL, and experiences. For this purpose, individual interviews, a group interview and a review of lesson plans were conducted. It was concluded that a lasting understanding among UDL teacher candidates is achieved through constant reinforcement in classroom work and field experience. It was also seen that it is of utmost importance to have a structure that supports and supports the implementation of the UDL; and the need to provide opportunities for inclusive community-based and field-based activities. The study also concluded that technological support is essential for UDL.

On the other hand, in the study *Familiarity, Current Use, and Interest in Universal Design for Learning Among Online University Instructors* (Westine et al., 2019), 425 online university instructors in the United States were surveyed. A response rate of 42.2% was obtained. While 28% of respondents were not familiar with any of the UDL guides, 62% were familiar with at least one. The use of guides in the implementation of their classes ranged from approximately 4 to 14%. More than 30% reported frequent or very frequent use of these guides. About half of the participants said they felt

comfortable applying DUA without any assistance. It was concluded that although many instructors reported a lack of training in the application of the UDL, they were interested in doing so. The need arises then to incorporate more support for this in online teacher training curricula.

The article, *Assessing teachers' knowledge, readiness, and needs to implement Universal Design for Learning in classrooms in Saudi Arabia* (Alquraini & Rao, 2018), presents a survey of 131 teachers. The purpose was to answer research questions related to how knowledgeable teachers perceive themselves to be about UDL, to what extent they believe they use it in the classroom, and what they perceive as necessary for successful implementation of UDL. Regarding the results, 61% indicated that they had no formal UDL training and 75% indicated that they did not use it. It was encouraging that 75% believe that the DUA is not only for use with people with disabilities. Other questions, such as those on whether it is necessary to use all the items in the UDL guidelines, received varied answers. This indicates that the level of knowledge is uneven. In terms of needs, in many cases, they demanded more training, more technology, more educational resources and another person assisting. In an open-ended question regarding challenges, participants named lack of staffing, high student/student ratio, lack of collaboration between general teachers and special education teachers, and little flexibility given to teachers regarding the use of educational resources.

For its part, the study, *Educational Inclusion through the Universal Design for Learning: Alternatives to Teacher Training* (Diaz-Vega et al., 2020), carried out in Spain, analyzed the level of knowledge and implementation of UDL in university teachers. The participating teachers did not have prior training in DUA, but they did have access to their guides. The results showed widespread use of the tool despite little prior knowledge. 54% of the teachers responded that they were not familiar with the UDL. The number of teachers using technology in their classrooms to help students with disabilities was high. The possibility for students to demonstrate knowledge in a variety of ways was quite present in the survey. It was infrequent for teachers to end their classes summarizing the most relevant aspects, although it was more frequent in those teachers who had students with visual impairment in their classrooms. Finally, it was less common for content to be displayed in different formats.

In the study, *Developing Teachers' Competences for Designing Inclusive Learning Experiences* (Baldiris Navarro et al., 2016), the design, implementation, and evaluation of a professional teacher development program that applies UDL principles is presented. The duration of the program is 30 hours, 18 face-to-face and 12 online. They are provided with tools to share their learning and to create their own teaching content on the web. It was evaluated through the realization of a project with intermediate goals, based on the development of a lesson with technological tools. The objective was to evaluate the impact of the program on the teacher's capabilities. Forty-seven teachers participated, divided into three cohorts, who were administered a pre-test and a post-test that were evaluated by a group of experts. All cohorts demonstrated growth between pre- and post-test in relation to UDL principles. All cohorts scored low on evaluation skills. The study concluded that UDL training should be comprehensive and contextualized.

The study, *Implementing a UDL Framework : A Study of Current Personnel Preparation Practice* (Scott et al., 2017), aimed to interview program coordinators from accredited universities to determine what is currently being done to prepare educators to implement a DUA framework, and to what level this framework is implemented in teacher education. For this purpose, surveys were conducted with 23 questions, with an

open-ended question at the end. Forty-one coordinators participated; most of them (39%) were program directors. All programs reported some preparation in at least one of the UDL principles. It was observed that, although several programs integrated UDL training, very few did so at the more advanced levels. It was also noted that it is common to have training in UDL, but few real opportunities for practical training in the classroom. Many programs (35%) reported not using UDL tools or resources. The study concluded that there are still missed opportunities in terms of educator training in the implementation of a conceptual framework on UDL.

Discussion and conclusions

With respect to limitations, a small number of articles related to the topic in question have been found. This is evidence that it has been briefly addressed. In most of the articles, there is an invaluable recognition of UDL, which, more than a simple methodology, is considered a true conceptual framework, or a paradigm to be revitalized in order to approach teaching and make educational inclusion possible in the classroom. However, the analysis of the perceptions and knowledge that teachers have about the UDL shows that it is often perceived as a specific tool to solve a problem of educational inclusion, and not as a conceptual framework to be used by teachers (Fornauf and Eric, 2020).

Taking into account the approaches of the study by Sánchez and Martín (2016), the use of technology must establish a close link with the UDL in order to be viable and offer real opportunities for access to quality knowledge. An education that is accessible to all, regardless of whether or not they have a disability. Baldiris (2016), for his part, presents research on UDL and its impact in classrooms, concluding that more training is needed in this regard, given that teachers show great interest in obtaining trainings in this field. The UDL is more than a teaching tool. It is a framework that positively impacts the inclusion of all students, whether or not they have a disability or barrier to learning. It is in this way that a more equitable education can be developed, with more opportunities, in the context of a more just and democratic society.

A comprehensive and contextualized approach to UDL that is in line with the needs and potential of the student is required. Undoubtedly, all this requires further research to generate new inputs on the subject.

Some of the disadvantages found in the use of UDL as an inclusion tool refer to the fact that it is only applied in cases of disability, when it should be seen as a holistic tool (McKenzie, 2020; MacKeogeh, 2017). Likewise, it is pointed out that the means to motivate students to become involved in inclusive proposals that make use of the UDL in teacher training are not usually proposed. In this sense, there is also a low level of teacher training in this area (Ostrowdun, 2020).

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