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DECODIFICANDO EL DISEÑO UNIVERSAL PARA EL APRENDIZAJE: ¿QUÉ EVIDENCIA EMPÍRICA LO RESPALDA?

DECODING UNIVERSAL DESIGN FOR LEARNING: WHAT EMPIRICAL EVIDENCE SUPPORTS IT?

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Abstract

At a time when the Universal Design for Learning (DUA) has burst with force the educational system promoted by the LOMLOE, it is relevant to consider what research supports the fact that educational policies have adopted the DUA as an unquestionable solution to educational inclusion. The DUA is presented as one more step to address and include the diversity of learning rhythms and needs in the classroom, eliminate barriers, achieve personalization of education and, with all this, respond to the fourth objective of the 2030 Agenda for Sustainable Development. In practice, it implies that attention to individual learning needs should no longer be carried out through adaptations of a common curriculum, but that the teacher must personalize the curricular path under the premise that all students are diverse, different, and unique in their way of learning. This article analyses the differential characteristics of DUA, examines what empirical evidence supports them, and reflects on the suitability of this approach in relation to the desirable equity that the universal right to

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education should achieve in every educational system in a democratic society.

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INTRODUCTION

The concept of Universal Design refers to the design of products and environments that all people can use without the need for subsequent adaptation or specialized design (Connell et al., 1997) and emerged in the field of architecture with the idea of creating universally accessible spaces that improve the quality of life of their users. But how does this concept land in the educational field? Is it a methodology, a pedagogical model, a teaching philosophy, or guidelines? In any case, how does it materialize in the classroom, what characterizes it and what research supports it?

The DUA has entered the education system hand in hand with the latest educational reforms, both in basic education (article 5 of Organic Law 3/2020, LOMLOE), and in vocational training (article 2 of Organic Law 3/2022). It aims to respond to the fourth goal of the 2030 Agenda for Sustainable Development, approved by the United Nations and subscribed by Spain, which establishes the commitment of the signatory countries to "ensure inclusive, equitable and quality education and promote lifelong learning opportunities for all". (Asamblea General Naciones Unidas, 2015, p. 16).

The most visible consequence of the inclusion of the DUA in educational legislation is the disappearance of curricular adaptations. With the DUA, attention to individual learning needs must no longer be provided through adaptations of a common curriculum for students who need them, but rather teachers must design learning contexts where each student can develop personally and socially, considering his or her abilities, rhythms, motivations, and interests. In this way, a curriculum with shared learning goals, in which contents, objectives or methods are adapted to those who need them to achieve them, is replaced by a flexible and personalized curriculum that emanates from the learning needs and rhythms of each

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student. In other words, instead of making individual adaptations to a few students so that they acquire the knowledge and skills programmed for all, the initial design should be based on the consideration that each student is unique in his or her way of learning.

It is paradoxical, however, that the DUA is prescribed in the royal decrees of minimum teachings for basic education that deploy the latest educational reform, precisely in the article that deals with pedagogical autonomy. In other words, schools and institutes are granted autonomy to ensure that all students learn and progress, but this autonomy is limited to a specific model. It is pertinent, therefore, to ask what empirical evidence supports the fact that educational laws have embraced the DUA as the unquestionable solution to educational inclusion.

1. WHAT IS DUA?

The DUA is a framework created by the Center for Applied Special Technology (CAST), a Boston-based, non-profit organization founded in 1984, originally dedicated to designing flexible computing tools and environments for students with disabilities. It was promoted in the educational field by the US Department of Education in 2010 (US Department of Education, 2010). CAST presents the DUA by organizing it into thirty-one checkpoints, which are the set of specifications or guidelines on how to carry out each of the nine guidelines into which they are grouped. These guidelines are grouped into three principles, which are intended to improve and optimize teaching and learning to reduce barriers and maximize learning opportunities. Specifically, the three principles —which the LOMLOE endorses in its preamble (LO 3/2020, p. 7)— are: (1) provide multiple forms of engagement, (2) provide multiple forms of representation, and (3) provide multiple forms of action and expression (figure 1).

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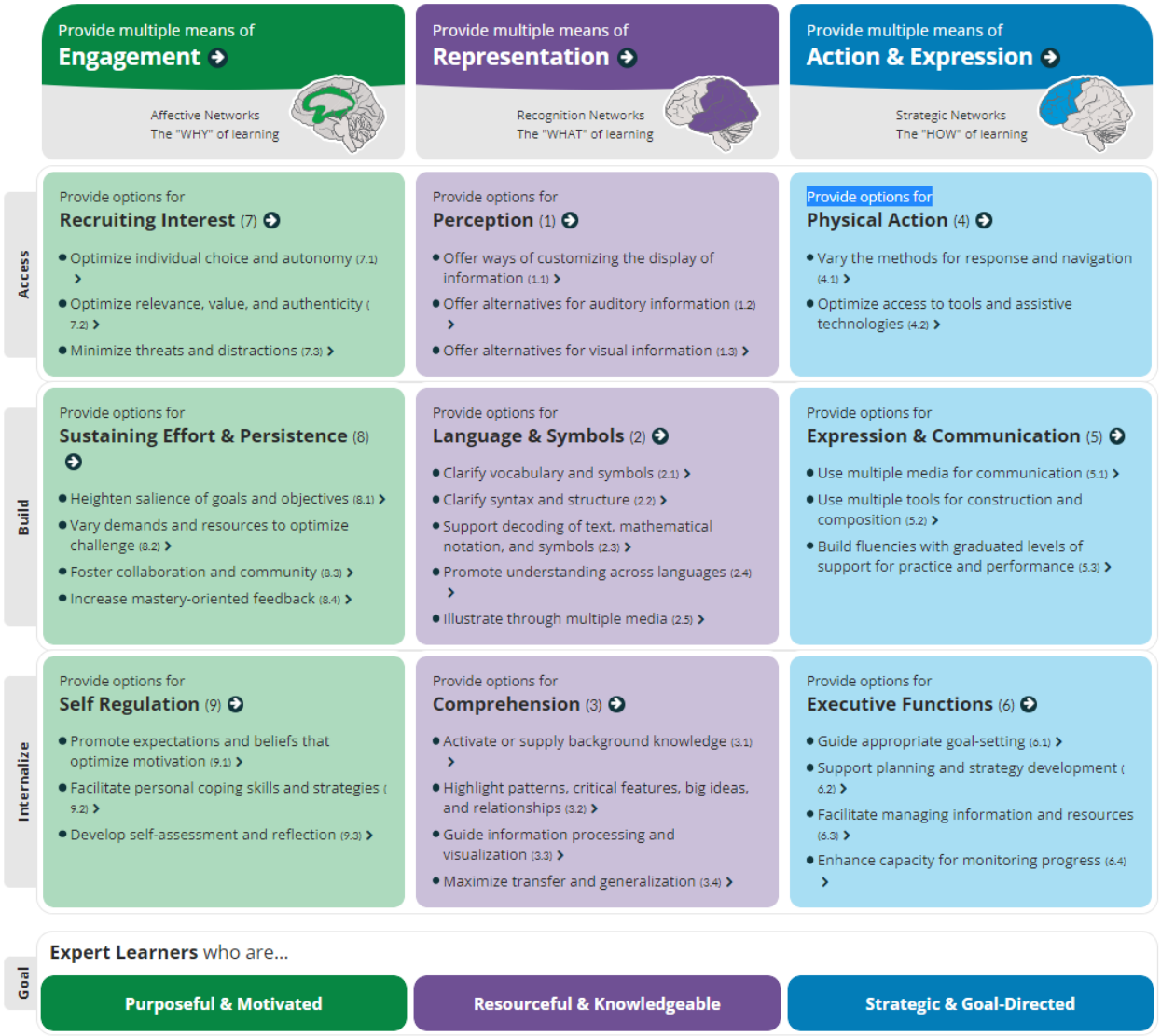

Figure 1. Universal Design for Learning principles, guidelines, and checkpoints.

Source: (https://udlguidelines.cast.org/)

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CAST does not specify what combination of all the elements that make up the UDL is essential and considered sufficient for an educational practice to be accepted within this framework: should it include one, two or all three principles? Should the nine guidelines be implemented, six or three be enough? How many of the thirty-one checkpoints must be met, is it enough that they apply to an assignment, a session, or an entire course? Should students always be given options to choose or is it enough in some occasions at the discretion of the teacher? On this matter, even the Universal Design for Learning Implementation and Research Network had to hold a summit in 2017 among whose conclusions highlighted the lack of an operationalization of what it meant to implement DUA (Boysen, 2021). For this reason, if it is not clearly defined what it means to implement UDL so that it is clearly distinguishable, measurable, and understandable by empirical observation, it becomes necessary to examine how research that has studied its impact on general education has been approached, as well as how the results have been reported.

2. THE DUA AND RESEARCH ON ITS EFFECTS ON LEARNING

Over the last decade and a half, research has been conducted that has studied Universal Design for Learning and, in fact, numerous meta-analyses have been published (Al-Azawei et al., 2016; Baybayon, 2021; Capp, 2017; Crevecoeur et al., 2014; Dewi and Dalimunthe, 2019; Ok et al., 2017; Seok, 2018; Schreffler et al., 2019; among others) that yield very varied and contradictory conclusions, while raising doubts about the quality of the research design, as highlighted by Murphy (2020) and Boysen (2021). Thus, for example, in 2014 Crevecoeur et al. warned that conceptual frameworks (referring to DUA) should not be promoted until sufficient empirical evidence was available to validate their pedagogical usefulness in educational settings, while pointing out the need to carry out research using group comparison and case studies to demonstrate the causality of intervention outcomes and independently test the principles, guidelines and checkpoints of DUA. This paucity of studies with control groups is also

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highlighted in other meta-analyses. In this regard, Al-Azawei et al. (2016) cite three investigations using control groups with which to compare the results of the intervention, while Dewi and Dalimunthe (2019), Seok (2018) and Capp (2017) only allude to two. The latter further states that while the results of their analysis suggest that DUA can be an effective teaching methodology to improve the learning process for all students, the impact on educational outcomes has not been demonstrated. In the same vein, Baybayon (2021) concludes that, even though studies published between 2012 and 2018 show a positive effect of DUA, few studies have used a pretest-posttest design and, moreover, these do not explain how the intervention conducted complies with the principles and checkpoints of DUA. Similarly, Ok et al. (2017), after highlighting the potential of DUA-based instruction, highlight the lack of consistency in terms of its effectiveness, with disparate effect sizes and enormous variability in how the authors reported how they applied DUA in their interventions. Similarly, Ok et al. (2017), after highlighting the potential of DUA-based instruction, highlight the lack of consistency in terms of its effectiveness, with disparate effect sizes and enormous variability in how authors reported how they implemented DUA in their interventions. Consistently, the DUA Research and Implementation Network Committee itself had to define in 2018 the criteria that researchers had to follow in reporting the findings of their studies (Rao et al., 2018), and whose validation confirmed the lack of consistency in published research regarding the reporting of DUA application and its results (Rao et al., 2020). In addition to the methodological shortcomings highlighted, there are other types of shortcomings in the design of the research reported in the meta-analyses, such as: the lack of longitudinal studies or research that analyzes variables related to the sociocultural and economic context, a fundamental aspect when equity and inclusion are priority elements for assessment. Likewise, there is no mention of studies that include data from external evidence to

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demonstrate the effectiveness of the paradigm, nor is there any mention of replicated research —to the extent that research in the field of education can be replicated— that would increase the reliability and validity of the results.

The analysis of some primary research such as the study conducted by Yavuzarslan and Arslan (2020) in the area of mathematics in primary school and the one that Yuzlu and Arslan (2017) carried out in secondary school in the linguistic area, both with control and pretest-posttest groups, allows detecting some methodological deficiencies that raise relevant doubts regarding the conclusions they reach: none of the works examined clearly make explicit what learning was intended to be achieved, nor do they detail the DUA guidelines they have applied (nor how), nor do they explain the teaching methodology used in the control group with which they compare the results, beyond referring to this with vague concepts such as "traditional method" or "curriculum-based teaching". In fact, such research reaches generic conclusions such as: universal design for learning has a great effect on academic performance in English classes, that DUA increases self-regulation skills, that it increases students' attention and cooperation among them, or that it improves their interest and attitude towards the mathematics lesson. It is worth asking, then, what the teachers were doing in the control group classes, since perhaps the problem lay in how these classes were conducted. On the other hand, when the aforementioned studies state that DUA is the factor that increases learning, it is worth questioning whether this is independent of the teacher who teaches. This would be as much as inferring that the teacher is not relevant, but that the determinant is the model, which contradicts the extensive research that highlights that teaching effectiveness is multifaceted, multidimensional, and complex (Kleinsasser, 2014; Hattie, 2009) and that the teacher and his or her pedagogical knowledge of the content is a key

factor in supporting effective student learning (Berry et al., 2016). Hence, asking about the methodologies that were used in the classes conducted in the control groups or what makes what was done in them different with respect to the experimental groups becomes a key element of analysis. In this sense, Davies et al. (2013) examine the effect of DUA in intervention groups compared to control groups in undergraduate psychology students based on a series of indicators on the performance carried out by teachers: whether they actively engaged students in learning, whether they related key concepts to the broader course objectives, whether they started the lesson with a summary of what was to be developed in the lesson and synthesized the key points during or at the end of the session, whether they highlighted relevant aspects after showing instructional videos, whether they expressed personal enthusiasm, whether educational technologies were used to enhance learning, among other aspects. The question that immediately arises is: Are these strategies typical of DUA or are they simply characteristics of good teaching? In fact, all these behaviors that researchers attribute to the application of DUA fit perfectly in multiple methodologies, since they constitute basic principles for the adequate teaching practice. It is enough to review the proposal made in this regard by Rosenshine (2012) in his article *Principles of Instruction Research-Based Strategies That All Teachers Should Know* to find coincidences. Therefore, is it valid to infer that DUA is effective because the teacher correctly uses effective strategies that coincide with other methods? If so, why are its effects attributed to DUA? Similarly, Yavuzarslan and Arslan (2020), infer from their research that one of the causes of the benefits of DUA is that students achieve the highest level of learning when they can use what they have learned. However, is it only teachers who apply DUA that design activities for students to apply the knowledge they have acquired, and is it that the control group in their research did not have such tasks, which are not typical of DUA but of effective instruction? At this point, it is essential to

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identify what differentiates DUA from other methodological approaches and to examine what empirical evidence supports these particular characteristics of this paradigm.

3. WHAT MAKES THE DUA A DUA (AND NOT SOMETHING ELSE)?

In practice, it is easy to confuse the DUA with other educational practices, since many of its guidelines coincide with techniques and strategies that teachers have used —and use— in a wide variety of methodologies (activating prior knowledge, making quality corrections, promoting high expectations, giving options of different levels of complexity, etc.). In any case, what makes the DUA different from other approaches? Or, in other words, what makes the DUA a DUA (and not something else)? Let's try to narrow down what it means for a class session to be based on the DUA. To do this, let us imagine a good teacher who teaches a class to two different groups: in the first, she schedules the session under the principles of the DUA and in the other (the same teacher) she employs explicit teaching (Rosenshine, 2012). From the very beginning, there will be a lot of overlap. For both sessions the teacher will have planned valuable activities and will start with a brief review of what was previously learned and encourage students to recall it; share with them the purpose of the class and give relevance to what they will learn; help students connect new information to what they already know and to understand and relate what they learn; provide models and guide practice; seek to capture interest and focus attention; involve students in their learning process (including assessment); stimulate them to think about what they learn by making sure they understand it; conclude the class by inviting them to recall what they have learned; make them aware of their progress and encourage them to learn from their mistakes; foster a trusting classroom climate; generate high expectations and encourage effort (among other actions). All of these strategies have empirical support

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because they have been shown to be effective for learning (Dunlosky et al., 2013; Hattie, 2012; Hughes et al., 2017; NSW, 2020; Stockard et al., 2018; Rosenshine, 2012), but then, if both explicit teaching and DUA match the guidelines in the example above, what does the teacher do in the first group (I will refer to it as the DUA group) that she does not do in the second?

DUA analysis allows us to identify four elements that characterize it in a specific way. On the one hand, it highlights the freedom it grants students to choose. Recall that each guideline begins with the phrase "provide options for". Thus, for example, while in the second group the teacher in the previous example will explain the new content by combining different channels of information, exemplifying, demonstrating, asking questions and trying to ensure that all students understand and progress through the activities she poses to them, in the DUA group she will grant students the freedom to decide the format in which they prefer to receive such information (e.g., with flexible formats as to the format in which they prefer to receive it). The DUA group will give students the freedom to choose the format in which they prefer to receive the information (e.g., with flexible formats in terms of text types, providing visual alternatives to oral information...), as well as to choose how they express the acquired knowledge (in writing, verbally, through illustrations, videos...).

To achieve such diversity of options, in the DUA group, the teacher will have to design the materials to offer alternatives both in terms of access to information, as well as for its processing and the demonstration of the result. For this purpose, she will need, in most cases, the support of digital resources. In fact, this is what CAST emphasizes on its website when it argues that the display of information in printed materials is fixed and permanent, while in digital materials, properly prepared, the display of the same information is very malleable and customizable. For all these reasons,

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the design of the learning material in the DUA is of fundamental importance, since without it is not possible to diversify the offer of itineraries and formats.

But why this need to provide options for the learner to choose from in each and every DUA guideline? The underlying idea is that each student is unique and has a particular way of learning. To justify this, neuroscience comes into play: "the learning styles of each person are as unique and diverse as one's own fingerprints, something that needs to be taken into account to achieve the activation of neural networks linked to learning" (Alba Pastor, 2018, p. 24). Thus, the DUA is built from three differentiated neural networks (each one associated with a principle), the activation of each of which is carried out by implementing its guidelines and checkpoints.

In summary, we can identify four characteristics that underpin the framework of Universal Design for Learning, which we will analyze below:

- Each student has a singular and unique way of learning.

- The application of the principles of the DUA activates specific neural networks.

- The relevance of digital media for the application of the DUA.

- The personalization of learning as the ultimate goal.

4. FIRST CHARACTERISTIC: EACH STUDENT HAS A UNIQUE WAY OF LEARNING

One of the main premises on which the DUA is based is that each student has a unique and singular way of learning, and, consequently, diversity in learning must correspond to diversity in teaching. Therefore, the

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teacher must provide options for students to choose how to engage in their educational process. In accordance with this premise, the teacher must design multimodal experiences of involvement, representation and action and expression (the three principles of the DUA) so that each student can choose the mode that best suits his or her preferences, interests, limitations or potential:

> *(...) all students are unique in their learning styles; therefore, it is very important to represent the information using different formats that allow students to grasp it by using the different senses: touch, sight, hearing, etc., the one or ones that are more favorable or that better guarantee each one the access to it.* (Alba Pastor, 2018, p. 28).

Here becomes evident the similarity between the DUA and the theory of learning styles, based on the idea that students maximize what they learn when they learn using their preferred channel. However, the hypothesis that we learn best when the information we receive through our senses is in line with our preferred learning style (visual, auditory, reading-writing, or kinesthetic) has been largely dismissed by research (Cuevas, 2015; Pashler et al., 2008; Rogowsky et al., 2015). In fact, if learning styles worked, students' performance should be higher when teaching is adjusted to their learning style and lower when it does not, —a hypothesis that Howard-Jones (2014) highlights as the most influential and popular neuromyth of all those flooding the educational field—. Undoubtedly, there are many advantages of teaching using different media (oral, reading, visual, kinesthetic) because their adequate combination allows reducing the cognitive load of working memory and facilitates understanding, but this should not be confused with the existence of differential styles in the way of learning.

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Despite the lack of empirical evidence, the DUA takes a step beyond the learning styles theory and introduces a key factor into the equation: learner choice. However, CAST also fails to provide the research that supports the assumption that students learn more and better when they choose, according to their preferences, how they access information and how they express the outcome of their learning. Specifically, for the DUA it is not so much a matter of simultaneously using diverse media to present the same information (supporting a teacher's explanation with images, for example), but of having the same information available in multiple formats and media to allow learners to choose. But when students always opt for the same ways of demonstrating their learning (orally, for example) or accessing information (say, through the visual channel) because they feel more competent, because it is more comfortable, or simply because it is less effort, are we not limiting their progress in the ways they have not mastered (reading or writing, for example)? Are we not restricting the development of ways of thinking different from their supposed learning style?

For all these reasons, stating that teaching is more effective when it emphasizes different ways of learning over universal principles is a hypothesis that should be empirically tested if it is to support an entire pedagogical model. Even though each student may have his or her interests, capabilities, difficulties, or abilities, there is a big difference between the way someone prefers to learn and the way that actually leads to effective and efficient learning (Kirschner, 2017). So much so that decades of research on memory and human learning have found more similarities than differences in the way we reflect and learn (Dehaene, 2019; Ruiz, 2019; Willingham, 2011), contrary to what the DUA posits.

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5. SECOND FEATURE: THE APPLICATION OF THE PRINCIPLES OF THE DUA ACTIVATES SPECIFIC NEURAL NETWORKS

In words of Alba Pastor (2019, p. 59), in the DUA "the goal of teaching is that the different brain networks in each student are activated." CAST, on its official website, explains that the principles of the DUA emanate from a neuroscience-based empirical foundation that provides a solid foundation for understanding how the learning brain intersects with effective instruction, and, to this end, associates each of its three principles to three neural networks (figure 2). Specifically, the first principle, "provide multiple forms for engagement" would activate affective networks and thus relate to "why" we learn; the second principle, "provide multiple forms of representation" would activate recognition networks, in reference to "what" we learn; and finally, the third principle, "provide multiple forms for action and expression" would activate strategic networks, in response to "how" we learn.

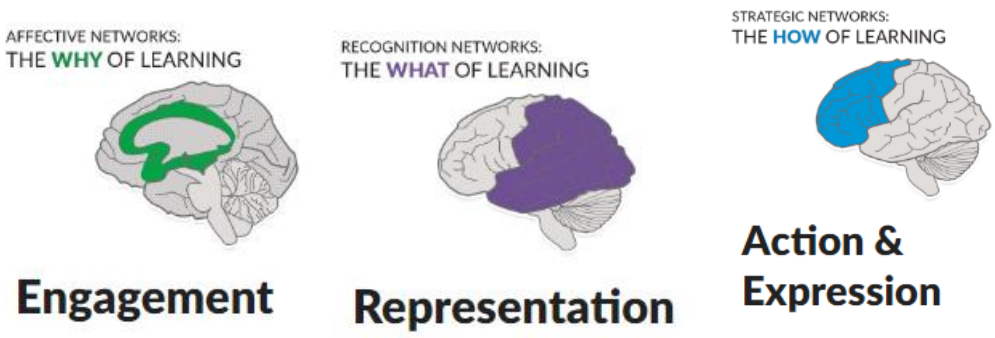

Figure 2. Principles of the DUA in relation to neural networks. Source: CAST. https://www.cast.org/impact/universal-design-for-learning-udl

Given the scope and relevance of such claims and, at the same time, the simplicity of a model where brain areas are activated and develop with

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certain modes of instruction, one would expect a robust body of empirical research to support such relationships, although CAST does not provide any scientific papers on its official website to support its revelations. Clearly, all learning produces changes in the brain, but, as Boysen (2021) states, academic performance involves many brain regions and connections between them. On the other hand, stimulation of specific brain areas offers no insight into how students should be taught. That is, regardless of whether the aforementioned neural networks or others are stimulated by applying the DUA guidelines, the information is irrelevant for teachers. Certainly, neuroscience, for the moment, can tell us which brain regions are activated when, for example, we play a musical instrument or what changes occur in the brain after such sustained practice, but it is not possible to infer from this which is the most effective method for learning to play it. Although neuroscience is valuable for understanding how the brain works, effective learning interventions cannot yet be inferred from it (Dougherty and Robey, 2018). On the other hand, if, as Murphy (2020) emphasizes, the neurological basis of the DUA can be considered more of a hypothesis than a fact, why then base a pedagogical framework on neural implications? It has been shown that the presence of irrelevant neuroscientific information makes arguments more convincing (Fernandez-Duque et al., 2015): could this be the reason why we assume the DUA without questioning it?

6. THIRD FEATURE: DIGITAL MEDIA ARE ESSENTIAL FOR THE APPLICATION OF THE DUA

The DUA was born and developed linked to the digital. As we have previously stated, for the application of the DUA, the teacher must deal with unique ways of learning, which requires offering students information in different formats so that each student can choose how to access it. Likewise, he/she must facilitate each student to demonstrate his/her

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learning according to his/her abilities, interests, or talents. Now, how can the teacher achieve such diversification of alternatives in the classroom? To achieve this, the DUA makes a clear and necessary commitment to the use of digital technologies as a means of learning, regardless of age, educational stage, or objective. In this regard, Rose, and Meyer (2002) argued that the DUA was possible because the new digital media made it possible to build more flexible and versatile learning materials and environments and, therefore, to achieve a more universal design as opposed to traditional textbooks and exhibitions.

At this point, it is appropriate to ask whether technology is essential to implement the DUA. Alba Pastor (2018) is blunt on this question when she states that "ICT not only play a fundamental role in the DUA, but their use is strictly necessary to be able to implement the approach" (p. 218). The author justifies this idea by pointing out the advantages of ICTs over traditional teaching-learning media, since it is not so much a matter of simultaneously using different media to present the same information, but rather of having it available in multiple formats to adapt to the individual capacities and needs of the students. CAST itself —it should be remembered that it is a center for applied technologies— asks what the role of ICT in the DUA should be and its answer is clear and unequivocal (CAST, 2011): although the educators involved always find ways to meet the needs of all students, regardless of whether or not they use technologies, the application of powerful digital media, together with the principles of the DUA, allows for easier and more effective personalization of the curriculum for students (CAST, 2011). Digital resources are thus consubstantial to the DUA, since, without them, the fulfillment of many of its checkpoints is greatly limited. This approach is aligned with the increasingly widespread concept of Personal Learning Environments (PLE), where large technology

companies find a substantial market niche, offering solutions for the implementation of the DUA in the classroom.

The translation into practice of the above is reflected in the Plan for Digitalization and Digital Competences of the Educational System, with a budget of over 1.3 billion euros, and which foresees, among other actions, the creation of the Classrooms of the Future aimed at designing flexible educational spaces (INTEF, 2022) with the invaluable collaboration of the technology industry. In this regard, it is enough to visualize the presentation of *HAZ Education* (2020), an alliance of corporate foundations and companies to "transform education" through public-private collaboration or listen to the conference of the pre-university director of Microsoft Spain entitled Accessible and Inclusive Technology at the service of the DUA (IBSTEAM, 2022) to observe the relevance that the so-called Edtech has achieved in education. It is a fact that large corporations have entered schools with hardly any reflection on the part of many policy makers or —sometimes— of the centers themselves. We have not even considered the reason why they offer us so many educational services free of charge. It is not trivial to recall here that Apple, Google and Microsoft are among the five most influential lobbies in the European Union according to the Corporate Europe Observatory (LobbyControl, 2022).

In spite of everything, research findings are compelling: the massive use of technology as means of learning ignores that the medium (screen or paper) conditions the process of cognition, comprehension and retention (Clinton, 2019; Sidi et al., 2017; Halamish and Elbaz, 2020), so the indiscriminate exchange of print materials for digital technologies is not only not indifferent, but may retard the development of reading comprehension and critical thinking skills, especially in primary education, unless accompanied by careful development of digital tools and learning strategies (Stavanger Declaration, 2018). Truly, technology has a curious

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ability to dazzle us. And it does so in the double sense of the term: on the one hand, we are fascinated by its innovations while being impressed by its possibilities and, on the other, it dazzles us, making us lose the ability to reason and to clearly observe its true impact on the cognitive development of children and adolescents. There is no doubt that ICTs can be a good tool for learning, provided that technology, pedagogy and knowledge of the content being taught are properly combined, since digital media as a means of learning are not neutral (Koehler and Mishra, 2009). In any case, shouldn't the teacher be the one to decide when, how and, above all, what to use technology for in the classroom, rather than being conditioned to use digital media to make the DUA viable?

7. FOURTH CHARACTERISTIC: THE ULTIMATE GOAL OF THE DUA IS THE PERSONALIZATION OF LEARNING

The three previous characteristics converge to achieve the personalization of learning as the ultimate goal of the DUA. To this end, it is not a matter of designing methodological adaptations that facilitate that certain students acquire the knowledge and skills of a common curriculum; nor of designing one that is adapted when the student has special educational needs; Nor is it about ensuring the principle of universal accessibility for students with reduced mobility or hearing or visual limitations so that they can develop an ordinary curriculum, since all of this was already foreseen before the LOMLOE introduced the DUA —although it is true that with a wide margin for improvement, *de-bureaucratization* and the urgent *de-thereterpeutization* of education—. With the DUA, on the other hand, if each student is unique in his or her way of learning, the curriculum must be flexible so that each student can develop his or her own itinerary according to his or her interests and abilities. In this regard, it is necessary to differentiate between individualization and personalization of the curriculum: while in the former, the teacher adjusts to the pace and

needs of his students, but the educational objectives are the same for all, in the latter, he adapts the teaching to their specific preferences and interests in a fully personalized environment in which the objectives, content and learning methods may vary (Bray and McClaskey, 2010). It is true, however, that confusion persists among practitioners, policy makers, and researchers about the two models, especially about exactly how they relate to each other (Griful-Freixenet, et al., 2020).

The DUA justifies personalization based on two premises. First, it is considered that a single, rigid, and equal curriculum for all students does not serve to respond to the diversity of students and learning needs (Alba Pastor, 2018). Secondly, since it is the student who understands how he learns best, he himself can become an active participant in the design of his learning objectives together with the teacher (Bray and McClaskey, 2010). However, beyond the feasibility of this proposal in a classroom with more than 25 students, what ensures that a personalization of learning will not increase (contrary to its purpose) the initial inequalities? On the other hand, do such differences in the way we learn really exist? And finally, is what interests the learner the most interesting for his or her education?

We have two certainties that are widely contrasted and accepted: on the one hand, that we learn from what we already know (Ausubel, 1976; Hattie and Yates, 2013; Willingham, 2011) and, on the other, that the socioeconomic status of parents is one of the strongest predictors of students' academic performance and educational achievement (Broer et al., 2019; Egalite, 2016; Reardon, 2011; Sánchez, 2015). Based on these premises, inclusion should consist of providing opportunities for relevant knowledge and, therefore, progress and culture to each student, regardless of the social, economic, and cultural context in which he or she is born and grows up, and thus guaranteeing the right to education for all. And this is relevant from the perspective of learning because we understand new

concepts by using others that we already know. While the knowledge we have in our long-term memory is the catapult to new learning, the lack of it is a major barrier that prevents us from assimilating it. For example, I will better understand the structure of an atom and how electrons revolve around the nucleus by analogy with planets orbiting the sun, but only if I already know how the solar system works.

In this context, if one of the great purposes of school is to teach to think with one's own criteria, it is essential that students acquire in basic education a common general culture, since cognitive processes such as analysis, synthesis and criticism do not work in isolation, but need prior knowledge (Willingham, 2011). In this regard, I share Hirsch's (2019) reflection when he argues that only by specifying and organizing in a coherent and progressive way the specific knowledge to be shared by all students, we can guarantee equal opportunities. In other words, if students' prior knowledge is a key element in the acquisition of new learning, we should ensure that all students attain it. To achieve this objective, we need a well-structured curriculum that establishes relevant goals for all, with a gradation of learning that ensures its acquisition in a gradual and progressive manner, and not *ad hoc* curricular itineraries that may increase the initial differences between students.

In the now classic *La educación encierra un tesoro*, Delors et al. (1997) emphasized that it is general culture that "serves as a passport to lifelong education, insofar as it provides an incentive and also lays the foundations for lifelong learning" (p. 17). In this sense, I share Luri's (2019, p. 11) reflection when he says: "If a rich child finds the doors of knowledge closed when he arrives at school, he has other places to turn to. The poor child does not". The school should not deepen the cultural inequalities at the beginning, but rather reverse them and offer opportunities for valuable knowledge to all, since the interests, prior knowledge, and vocabulary of a child from a

rich environment (at least culturally) are not the same as those of a poor child. Even research has shown that vocabulary knowledge is a critical factor in the academic success of low-income children (Sinatra, 2008), that reading outcomes are conditioned by social and economic context (Hecht et al., 2000), and even that brain-behavior relationships in reading acquisition are modulated by that context (Noble et al., 2006). The school should go beyond students' preferences and interests and offer windows of knowledge that students would not open on their own initiative, and this in no way excludes the teacher's art of connecting what he or she teaches with students' interests and close reality to help them understand.

CONCLUSIONS

Based on the hypothesis that each student has a unique way of learning, in order to respect diversity in learning, ensure inclusion and activate certain groups of neural networks, the teacher must design multimodal experiences of involvement, representation and action and expression so that each student chooses the mode that best suits his or her learning style, preferences, interests, limitations or potential, thus pursuing a personalized curriculum pathway with the help of digital media. This is, in short, the foundation of Universal Design for Learning, whose scientific endorsement we have analyzed in this article.

Numerous investigations have studied the DUA, although the contradictory results and doubts about the quality of the studies carried out should call for caution in generalizing its application. Similarly, the complexity of the model and its lack of operationalization hinder both its use in teaching practice and research on its effects, since it has not been established what combination of elements (principles, guidelines, and checkpoints) is necessary and sufficient for a DUA practice to be considered as such. Undoubtedly, there are no absolute certainties, nor can

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everything that occurs in a classroom —a singular context of human relations of enormous complexity— be contrasted by research, nor should research be the only reference point for making decisions in educational practice. However, if a certain pedagogical model —the DUA in this case— is elevated to the category of law and a single approach is adopted to attend to the diversity of students, it is desirable that it be backed by rigorous empirical support that guarantees both the quality of the knowledge obtained and the best learning for all students. Clearly, number of studies to prove the suitability of a model, a technique or a pedagogical strategy is important, but it is not enough if they are not accompanied by quality and rigor in their design. This is the only way to eliminate confirmation bias and achieve the necessary confidence to apply it.

On the other hand, we have highlighted that it is easy to confuse the DUA with other methods because many of its guidelines coincide with techniques and strategies that teachers use in a wide variety of methodologies, not that these belong to Universal Design for Learning, but simply are principles of good teaching (actively involving students in learning, helping to focus attention on substance, activating prior knowledge, making quality corrections...). For this reason, we have asked ourselves what makes the DUA a DUA, which has led us to identify and analyze four essential and specific elements, although none of them has a robust body of research that consistently supports them: (1) diversity in the way of learning over universality, (2) a supposed relationship between brain areas and its principles, (3) digital environments as means consubstantial to the DUA, and (4) personalization of learning over individualization of teaching.

Undoubtedly, guaranteeing universal accessibility, educational inclusion and equal rights and opportunities, regardless of cultural, social, or economic factors, among others, is essential to achieve a truly equitable

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and fair educational system. To this end, the educational administration must provide the necessary means, establish the necessary procedures and resources to enable the early identification of educational needs and create the appropriate conditions for schools to provide the most adequate response to the diversity of their students, all while favoring their pedagogical autonomy and relying on the professionalism of teachers. On this point, I share the reflection of Rodríguez and de la Herrán (2021) when they say that teaching should be centered on the person, and not on models, because these sometimes restrict and constrain, paradoxically, an effective education for everyone.

In this context, the fact that the LOMLOE (and the standards that develop it, among others) have prescribed Universal Design for Learning as the sole and generalized reference framework, despite the lack of conclusive empirical evidence on its efficacy, raises some questions for reflection: Why have educational policies adopted a pedagogical model that currently lacks sufficient, broad, consistent, and shared scientific evidence? And why this model and not another? For example, we could have opted for the RTI (Response To Intervention), an approach for the early identification and immediate support of students with learning needs, and which does have extensive research on its positive effects (Hughes, 2011; Hattie, 2012). Nevertheless, it does not seem that it should be a law that, beyond principles and guidelines, prescribes a pedagogical model -especially if the same law grants autonomy to the centers-. On the other hand, any new paradigm requires the relevant training of the professionals in charge of applying it, but should the educational administration design and implement teacher training plans on methodologies that are not guided by high quality research or proven successful experiences? Would this be acceptable in other areas such as healthcare? And finally, under these conditions in which teachers must include the DUA approach in their

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educational practice, what role should the educational inspectorate, a teaching body with independent technical criteria and advisory and supervisory functions, play in the face of uncertain pedagogical approaches in terms of their effects on learning, if its main mission is to ensure the right of students to the best possible education? I share the approach of Carballo Herrera et al. (2022) when they say that equity is the element that should harmonize the guarantee of rights and the participation of the education inspectorate in the supervision of the educational service. Therefore, the principle of equity and the progress of each and every student should guide the intervention of the educational inspectorate and not the use of a particular pedagogical model.

Certainly, the DUA can be one more approach to address the diversity of interests, abilities and learning rhythms that we find in classrooms. However, it cannot become the only alternative, as it does not have the scientific support to prove its clear and unequivocal superiority over other models and methods, because, despite strong claims about the benefits of DUA, research has yet to provide conclusive evidence of its efficacy.

Reception: Acceptance:

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