Universal Design for Learning: a new educational approach

Alessandro Frolli¹, Francesco Cerciello², Clara Esposito², Luigia Simona Sica³

Abstract

Universal Design for Learning (UDL) is an approach to educational design that is based on the assumption that diversity is a constant in all contexts and in all individuals, which is why the interventions must be planned through a flexible teaching proposal and characterized by plurality since their design. Brain diversity, as well as the variability and uniqueness of each person's learning processes, have been recognized by research. The identification of the three brain networks (Affective, Strategic, Recognition Networks) has provided multiple meanings of representation (the "what" of learning), in order to offer students different possibilities of acquiring information and knowledge. The UDL proved to be a promising approach to enabling students with developmental disorders to be located in inclusive and accessible educational contexts, created through the integration of UDL and technology, but it may be extended to everyone in order to create an individualized educational approach.

Keywords

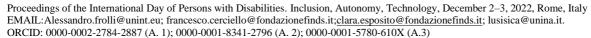
Universal Design for Learning; UDL; networks; educational; approach

1. Introduction

Universal Design for Learning (UDL) is an educational design approach that assumes that diversity is constant in all situations and across all individuals, which is why interventions must be planned with flexible instructional delivery and incorporated in the design Diversity is characteristic. UDL arose from the field of architecture where Universal Design (UD) was born, with the aim of universalizing accessibility. This goal can be achieved by designing spaces and environments that take into account the diversity of those who will benefit, rather than by adjusting structures after the fact to offset accessibility for disabled and non-disabled people. Universal Design (UD) was founded by Ronald L. Mace (1941-1998), traditionally considered the father of the movement and the 7 principles of UD. Mace founded the Center for Universal Design at North Carolina State University in 1989.

The 7 principles of UD were created with the participation of architects, designers, engineers and researchers in the field

environmental design. Initially, UD researchers focused their attention on the creation of assistive technologies, compensation tools, and software that would enable students with disabilities to face compensation and overcome the difficulties encountered [1]. In the late 1980s, there was a growing awareness of how the focus on assistive technology in terms of methods for conceptualizing instructional advice could overshadow the dominant role that the school environment can play in facilitating or hindering the learning process for students. Considering the difficulties that people with disabilities and/or people with special educational needs (SEN) may experience in educational settings, the UDL is primarily geared toward accepting limitations and removing barriers created by disability status, while also promoting the identification and removal of Barriers imposed by the educational environment. In the early 1990s, the Center for Specially Applied Technology (CAST) argued that the





¹ DRC - Disability Research Centre, University of International Studies of Rome, 00147 Rome, Italy.

² Fondazione Italiana Neuroscienze e Disordini dello Sviluppo (FINDS), Caserta, Italy

³ University Federico II, Via Porta di Massa 1, Naples, Italy

concept of universal design contained useful aspects that could address the challenge of creating Education for All through the concrete application of standards capable of directing teacher practice toward transformational global training systems [2]. UDL and UD share ideas for creating physical environments and tools within the school system to enhance each student's experience. Applying accessibility concepts to learning environments is a much more complex process because teaching and learning are structured as distinct activities and are more nuanced than the design and construction of new spaces. It is not only a matter of ensuring the integration of all students into the school environment, but also of facilitating the accessibility of the institution's proposed learning spaces, respecting the complexities of cognitive, affective and relational processes that impose the limitations of the curriculum proposal.

2. Discussion

UDL proposes developed a functional, organized model of the brain in which three main interconnected neural networks can be identified. In the back of the brain is the recognition network (the "what" of learning), which directs the reception and initial processing of information received through the senses. Thus, this network identifies elements that reach perception and makes them available to memory and the other two main networks. According to Rose and Meyer, this network is activated unconsciously whenever we are in receptive mode about the world around us. The second network, defined as the strategy (the "way" of learning), sits at the front of the brain and processes the information received from the recognition network. This network allows us to provide answers to complex questions through reasoning. Although the recognition network determines

As with how information is received from the outside, strategic networking is concerned with how the individuals who select and organize this information reintroduce it into the environment. The last is the affective network (the learned "why"), which is responsible for reporting information processed by the other two networks and setting priorities based on interests, remembered thoughts, and emotions. This network can act as a brake when a certain event or memory evokes negative emotion like anxiety or stress. It also can spur motivation when it's positively affected by emotions like happiness. Both of these networks can interact with one another to perform different functions. Each individual's health or the environment impacts one of their networks. This causes variation among learners, as well as interindividual networks. Variation among learners increases when one of the networks impacted by

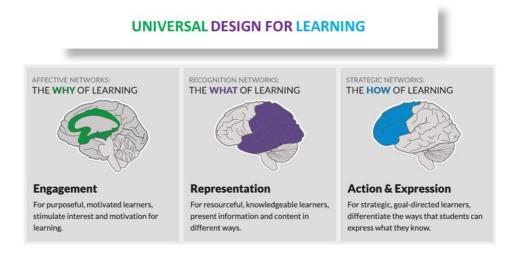


Figure 1: Exemplification of the functioning of the three neural networks according to the CAST.

Multiple types of Brains have been observed and proven by scientific research. This leads to the understanding that no two brains are the same. Additionally, each individual's unique way of learning is understood by research to be a key part of their personality. Regardless of their grade, students must understand these basic facts about education. UDL's principles and guidelines are based on three main assumptions. The first is the identification of three brain networks and the understanding that each person's mental processes are unique. The second is the creation of curricula that are flexible, accessible to all students and egalitarian. And the third is that the guidelines should be formed on the foundations of these first two assumptions.

Teaching students multiple methods of learning helps them understand and memorize new information. Different approaches to learning lead to differences in the information understood by each student. This idea comes from the "What" of education, which identifies multiple ways for students to learn through different materials and methods. Offering students a range of tools and methods to vary their content, long-term learning is sustained. Additionally, multiple options allow different learning styles to be accommodated. Provide multiple opportunities for action and expression (the "how" of learning) to give students a variety of opportunities to demonstrate their abilities. This principle refers to the opportunities for action and expression that students can use to demonstrate their learning. Meyer and colleagues [2] emphasized that teachers need to guide students to become experts, that is, to develop their executive skills in goal setting, self-monitoring of progress, and adapting learning strategies.

This can be useful in helping students express what they know and what they have learned, taking into account individual differences. Some students may feel comfortable expressing their feelings in writing but not in speaking, and vice versa. Others may have difficulty with the strategies, practices, and organization of the means of expression. Therefore, it is important to provide opportunities for action and expression. Providing multiple opportunities to engage (the "why" of learning) to engage and expand student interest and maintain high motivation to learn. The principle of multiple engagement opportunities requires students to engage in learning tasks that appeal to, stimulate, and engage them [2]. Meyer and colleagues [2] clarified that this engagement can be achieved by appealing to students' interest, supporting ways to sustain effort and persistence, and helping students self-regulate. In other words, it is also about tapping into students' interests, providing appropriate challenges, and increasing motivation. Attention is a fundamental aspect of learning and individualization because students vary significantly in their engagement and motivation to learn.

Several elements play an important role in individual variability, such as neurology, culture, personal relevance, subjectivity, and basic knowledge, among many others. Teachers who create multiple opportunities for engagement support affective learning by connecting to learners' interests and providing appropriate challenges to increase their motivation. These three principles form the basis for the new UDL guidelines [3], whose primary goal is to guide teachers to appropriately address the wide range of interindividual differences they encounter in every class of students. The guidelines provide ideas and concrete guidance applicable to all subjects so that it is possible to ensure that every student has equal learning opportunities and access to learning spaces that promote success.

Intelligence is the general mental ability that includes reasoning, planning, problem solving, abstract thinking, understanding complex ideas, effective learning, and learning from experience [4]. In the past, intellectual disability (ID) (formerly referred to as "mental retardation") was defined as: a) cognitive deficits identified by a standardized measure of intelligence, especially with a QI score of less than 70; b) significant deficits in functional and adaptive abilities, such as the ability to perform age-appropriate activities of daily living. The term "intellectual disability" used in previous editions of the DSM has been replaced with the diagnostic term "intellectual disability" or "intellectual developmental disorder" to reflect deficits in developmental cognitive abilities. The DSM-5 defines IDs as neurodevelopmental disorders with early childhood onset characterized by intellectual difficulties and difficulties in conceptual, social, and practical areas of life. According to the DSM-5, the diagnosis ID is based on three criteria: 1) Deficit in intellectual functioning

- "reasoning, problem solving, planning, abstract thinking, judgment, academic learning, and learning from experience"
- confirmed by clinical assessment and individualized standard tests IQ [5]; 2) Deficit in adaptive functioning that results in failure to meet developmental and sociocultural standards for personal independence and social responsibility. Without ongoing support, the adaptive deficit limits functioning in one or more activities of daily living (e.g., communication, social participation, independent living) in a variety of settings (e.g., home, school, work, community).

"The deficit in adaptive functioning must be directly related to the intellectual impairments described in Criterion A" [6]. In fact, one of the fundamental problems of people with ID is the inability to recognize and avoid both physical and social risks; 3) onset of intellectual and adaptive deficits during the developmental period. The age and characteristic features at the time of onset depend on the etiology and severity of the brain dysfunction. It should be noted that the DSM-5 does not specify a maximum age for onset of impairment.

Assessing intelligence in three domains (conceptual, social and practical) ensures that clinicians base their diagnosis on the impact of the deficit in general mental abilities on the functions required for daily living. This is particularly important for developing a treatment plan. The DSM-5 definition reflects a more comprehensive view of the individual than the previous edition. Thus, DSM-IV includes changes in general mental abilities that affect the individual's ability to function in areas of conceptual, social and daily life. The DSM-5 also abandoned the specific IQ scores as a diagnostic criterion, but retained the notion of general functioning being one or two standard deviations below the general population. The DSM-5 emphasised the area of adaptive functioning and performance in life skills in particular, as "individual cognitive profiles based on neuropsychological testing are more useful for understanding intellectual disability than a single IQ score" [6]. In contrast to DSM-IV, which states that impairments must be present in two or more skill areas, the DSM-5 criteria indicate impairment in one or more higher ability areas (conceptual, social, practical) [7]. ID, also in previous editions of the DSM, is indicated by the diagnostic terms "mild", "moderate", "severe" and "profound" to define the severity of the condition.

This terminology is useful as aspects of mild to moderate identification differ from severe to profound identification.

The DSM-5 retains this connotation, with more emphasis on daily living skills and less on specific IQ intervals.

3. Conclusion

Over the years, UDL has proven to be a promising approach that enables students with severe intellectual disabilities to navigate inclusive and accessible educational contexts created through the integration of UDL and technology. In relation to severe disabilities, the UDL framework states that students who need access to certain learning media should not be defined by their perceived impairments [7]. The UDL framework encourages teachers to expand their expectations of educational contexts and consider what might happen if curriculum were developed to provide multiple opportunities to creatively engage students with severe disabilities in the learning process and to demonstrate or implement their knowledge [7]. Teachers can use UDL to identify barriers within the curriculum and design and develop flexible curricula that minimise these limitations before assuming that students with severe disabilities cannot learn or benefit from instruction. In fact, UDL aims to reduce potential barriers to learning while increasing learning opportunities: The basic concept is that designing for diverse students leads to better learning outcomes for all individuals [8].

In addition, UDL promotes the perception that students with severe disabilities are seen as valuable students who can thrive and learn when curricula are proactively tailored to meet their individual needs [9]. The UDL framework supports teachers in making the curriculum more inclusive

the UDL framework supports teachers in making curriculum more inclusive and in understanding individual variability as something natural. It also provides teachers with clear ways to ensure student access to learning and to develop a lifelong passion for learning [10]. In other words, the UDL framework helps teachers understand that one of the main goals of education is to enable all students to acquire knowledge, which happens when students are motivated, enterprising, and strategically engaged in learning [2]. The process of knowledge acquisition is described as "Expert Student". Expert students are defined as: proactive and motivated, enterprising and competent, strategic and direct [2]. Research has actively supported the integration of UDL principles to improve accessibility for students with ID [11,12]. However, some of the systematic literature reviews show a dearth of studies on inclusion [13], especially in relation to students with ID [14]. In particular, we recall that Rao et al [14] propose some interesting questions to guide future research on the applicability of UDL to students with ID. First, Rao asks how UDL can be applied to curriculum design and individualised media to support inclusion of subjects with ID; specifically, how it can break down barriers and promote students' strengths to foster concrete inclusion. Second, Kao et al. ask how UDL can be used in synergy with existing evidence-based practises to support the academic, behavioural, and social goals of students with ID. Finally, they ask how UDL can be integrated into multi-tiered systems of support for students with ID, i.e., in the context of general education initiatives across the school landscape. It is possible to partially answer these questions by assuming that the effectiveness of students with intellectual disabilities and of education in general can be improved when educators promote learning through didactic strategies [15]. Indeed, integrating the UDL framework and didactic strategies such as functional behaviour analysis, teacher-directed interventions, classroom-wide peer tutoring, and curriculum modifications can promote universal design for learning and inclusive instruction [15,16]. UDL, in conjunction with pedagogical approaches and technology, forms a unifying model that encompasses multiple strategies to promote learning and collaboration [17]. As mentioned earlier, we should not forget the role of technology in supporting inclusion and individualising learning pathways for students with ID. McMahon et al [18]. Conducted a study on the effects of augmentative reality in UDL perspective versus vocabulary instruction in science for students with ID. The study demonstrated the effectiveness of computer-based instructional interventions implemented according to the three UDL principles of providing opportunities for action and expression, engagement, and representation. Although research on the applicability of the UDL approach to intellectual disabilities is ongoing and there are still large areas to explore, the studies conducted to date demonstrate the effectiveness of the UDL principles and guidelines in terms of inclusion, individualization, and accessibility for students with ID in the school context.

As demonstrated, UDL is a framework that provides a solid neuropsychological foundation that is applicable to intellectual disabilities.

As shown, the UDL is a framework that provides a solid neuropsychological foundation that is also applicable to IDs. The flexibility of the UDL model allows it to be implemented in conjunction and synergy with the various instructional strategies that can be adopted in the case of students with ID. Each of these didactic strategies reflects work on one or more of the networks described by UDL. For example, a reinforcement-based programme affects the functioning of the affective network, while a peer tutoring programme affects both the strategic and affective networks (Table 1).

Network	Program	Principles
Affective	Reinforcement	Engagement
Strategic	Peering	Expression and engagement
Recognition	Community-based Instruction	Representation and Engagement

Table 1: Examples of Educational Programs and their action on Neural Networks.

This association involves a reflection on the practical implications for the implementation of UDL-based strategies: In case of educational deficiencies or a failed strategy, it is possible to identify and strengthen the network (or networks) associated with UDL-based strategies. The existing education programme makes it possible to work on one or more of the networks involved. As a result, the deficient network can be stimulated through the appropriate multiple means to enable students with ID to achieve their educational success [19,20].

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