

Enhancing inclusive teaching. A teacher professional development research grounded in UDL principles¹

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Abstract

The international scientific literature emphasizes the importance of inclusive education, which places the valorization of all diversities at the core of every learning environment. It also highlights the Universal Design for Learning (UDL) as an educational framework that promotes accessibility in learning, enabling all students to fully participate regardless of their abilities by designing flexible and customizable educational material. In light of this, the UDL can serve as a model for crafting educational pathways aimed at supporting the academic success of all individuals while promoting full participation in creating a new democratic educational culture oriented towards equity, universality, and belonging. Against this background, the paper focuses on the implementation phases of a Teacher Professional Development Research (TPDR) pathway involving a group of in-service teachers in UDL approaches within lower secondary education. Its objective is to assess whether this pathway leads to an increase in inclusive practices in the classroom, a positive change in teachers' perception of their professional agency, and a positive impact on students' perception of their learner agency. The research aims, on the one hand, to contribute to the scientific literature on teacher professional development and inclusive education and, on the other hand, to promote the co-construction of knowledge within the teachers' community of practice, which is significant as it is deeply rooted in the real context, fostering transformative change in teaching practices and inclusive processes from an emancipatory perspective.



1 Introduction and background

Addressing the themes of inclusion today leads us to explore a widely discussed subject in recent years, both internationally and within scientific and political spheres. Reflections on this topic are crucial, yet they can be ambiguous if isolated from theoretical and contextual frameworks, which are fundamental for defining it (Bocci, 2018; Liasidou, 2012). In light of the above, it is essential to outline the dimensions of inclusive education assumed in this work, examining its cultural,

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practical, and values-driven aspects. We refer to a systemic-transformative perspective that sees inclusion as an ongoing journey towards creating a new democratic culture that fully embraces differences and promotes the empowerment of all individuals. Thus, Inclusion becomes a dynamic process built and participated in by all educational community members (Ainscow et al., 2006; Booth et al., 2003; D'Alessio et al., 2015).

To lead to genuine progress in terms of empowerment, development, and democratic coexistence, the inclusive processes must be guided by a project that integrates theory and practice, embracing an approach based on dialectical interaction, which aims to promote continuous change and evolution. That means adopting the complexity paradigm to interpret reality to ensure access to quality education for all on one side to foster a sense of belonging and promote active participation within the community on the flip one (Bocci, 2021; Chiappetta et al., 2013; Florian & Beaton, 2018). Moving away from an integrative vision seeking to assimilate individuals into predefined models is necessary to achieve this goal. Instead, inclusive education requires a proactive and conscious approach that focuses on overcoming barriers to learning and identifying strategies to ensure that no one is excluded or disadvantaged (Cologon, 2019; Florian, 2019; González-Gil et al., 2013).

From this viewpoint, schools play a fundamental role in fostering individual and collective fulfillment, outlining a model of high-quality education that seeks to transcend the dichotomy between “normality” and “specialty” (Dovigo, 2019). This transformation entails a shift from an education based on homogenization and standardization towards an approach that celebrates and values the richness of individual differences. In this new paradigm, schools become places where every student is supported in their learning journey. At the heart of this transformation lies the close connection among the key actors in the school, their diversities, and the surrounding context. This context should act as a catalyst to ensure that each individual can fully develop and contribute to the community's well-being through the participatory exercise of freedom (Cottini, 2017; Pedone, 2019).

1.1 The inclusive professionalism of teachers

An educational approach embracing the paradigm of inclusion unfolds along two interconnected action lines: from one angle, it aims to ensure the quality of teaching-learning processes to enable all students to reach their full potential; from the other, there is a constant commitment against any form of discrimination to remove barriers to learning and promote an inclusive and democratic culture (UNESCO, 2016). These reflections underscore the crucial importance of teachers in enhancing the quality of education and educators from an inclusive perspective (Aiello et al., 2016; Nigris et al., 2020). What emerges for teachers is a professionalism that goes beyond the acquisition of cultural, didactic, relational, and organizational skills; rather, it represents a habitus, a stable yet dynamic posture guiding their practices (Magnolia, 2011). It is an ongoing professionalism that evolves through experience and the ability to learn from it: a praxis capable of integrating theory and practice, which configures teaching as a process of continuous action research (Baldacci et al., 2020; Buysse, 2011; Portelance et al., 2014; Vanhulle et al., 2015). In this sense, the teacher's professionalism is characterized by its fluidity (Salvadori, 2019) and continuous interaction with diversity, generating a constant process of self-assessment aimed at regulating their actions (Falcinelli, 2010), which, precisely due to its characteristics, translates into the transformation of contexts accessible to all, where each individual is valued and actively involved with a view of active participation.

The challenge of inclusion is not merely technical, but it is based on the sharing of a set of values that involve mental aspects, relationships, perspectives, skills, and beliefs. An inclusion-oriented teacher training requires an open approach that involves them as a learning community (Wenger, 2010), guiding learning processes towards the development of effective and innovative practices to translate the guarantee of access to education into experiences of both individual and social well-being (Pedone & Moscato, 2023). This requires a profound reflection on the foundations of teacher education for and in inclusion to promote an inclusive culture and inclusive practices within the educational environment, allowing them to respond to the real needs of their context (Biesta, 2015, 2017; Domenici & Biasi, 2019; Dyson, 2010; McGarr & McCormack, 2016; Pedone, 2021).

It is evident how theories of agency play a crucial role in inclusive processes, and consequently, teacher agency represents a fundamental element in teachers' professional development (Florian & Linklater, 2010). From an ecological frame of action, the concept of teacher agency highlights two interconnected elements: on the one hand, the professional agency of the teacher encompasses their ability to act intentionally and constructively, directing their professional development while also contributing to the growth of their colleagues (Calvert, 2016); on the other, the literature emphasizes that the ability of teachers to act should be understood not only as a sum of individual inclinations, but rather as the complex result of the relationship established between personal characteristics, knowledge, skills, experiences, and values, in connection with external factors such as local policies or the structural conditions of the school (Sibilo & Aiello, 2018). These considerations lead to a reflection on a new approach to in-service training, which responds to the real needs of the context and allows teachers to build creative and participatory solutions to daily challenges (Pastori, 2017).

1.2 The universal design for learning

Against this background, it becomes evident how teachers, serving as vectors of emancipatory processes, play a pivotal role, just as it is equally indisputable that a quality school should prioritize the diverse needs of all students. Aligned with current regulations, such as Italian Legislative Decree 66/2017, and recommendations from the European Agency for Special Needs and Inclusive Education in 2014 and the European Union in 2018, schools are called to foster inclusive educational environments that uphold principles of equal opportunities and active participation for all students, redefining themselves with a universal approach on two interconnected fronts: methodological and didactic approaches that embrace student diversity, and the promotion of values such as equality, equity, respect for differences, and a sense of belonging (Booth & Ainscow, 2011). In essence, inclusive education can draw on an evidence-based body of research supporting the effectiveness of appropriate methodologies and their implementation (Hattie, 2012; Mitchell, 2011). However, it also requires a profound understanding of oneself, others, and the dynamics at play from all the protagonists involved in educational processes.

In this regard, the Universal Design for Learning (UDL) emerges as a valuable pedagogical and methodological approach to guide operational decisions within the framework of educational intentionality based on a specific set of values (Murawski & Scott, 2019). The scientific literature underscores the UDL's qualities concerning the breadth and depth of interventions promoted through an ecosystemic implementation to make learning sustainable, inclusive, and transformative for all (Traversetti et al., 2022). The UDL serves as a translational framework for the design of flexible objectives, methods, materials, and assessments that can be personalized

and adaptable to each student's needs, allowing them to choose *what* to learn, *why* to learn it, and *how* to share what they have learned (Mayer et al., 2014) thanks to the support of an operational model articulated in principles, guidelines, and checkpoints (CAST, 2018). It was developed in the '90s to overcome curricula focused on the "average student," which leads to exclusion as they fail to grasp the range of variability of abilities, motivations, and characteristics of the students who live in school daily (Sgambelluri, 2020).

The principles of UDL stem from research in various fields, including education, developmental psychology, and cognitive neuroscience, which have highlighted brain diversity and variability in learning processes as factors influencing each facet of the educational process. In particular, the UDL guidelines are articulated starting from the discovery of three neural networks in the human brain (corresponding to the prerequisites for learning identified by Vygotsky in 1962): the *recognition networks*, located in the posterior area of the cerebral cortex, related to how students perceive and interpret information in the environment and transform it into usable knowledge (the *what* of learning); the *strategic networks*, located in the frontal area of the cerebral cortex, related to how students plan, organize, and undertake targeted actions in the environment (the *how* of learning); the *affective networks*, located in the median area of the central nervous system, related to how students monitor the internal and external environment to establish priorities, motivate themselves, and engage in learning (the *why* of learning). This model aims to foster engagement, interest, and motivation in multiple ways: *representation*, using various means to represent content to ensure equitable access to information and facilitate initiative and competence; *action and expression*, offering a variety of alternatives for action and expression of one's learning, fostering strategic thinking and goal orientation; *engagement*, promoting interest and motivation towards school and growth mindset (Novak, 2016). The ultimate goal of UDL is to develop expert learners capable of transforming new information into meaningful and useful knowledge, strategic and goal-oriented, determined, motivated, able to endure effort, and regulate emotional responses. Competent, reflective, self-regulated students who are capable of autonomous decision-making.

It is clear how the model can support an educational approach focused on the conscious development of learner agency in students, where they are active protagonists of the entire learning process by being involved in choices regarding what to learn, why to learn it, and how to share what they have learned (Guerra, 2018; Manyukhina & Wyse, 2019; Mercer & Howe, 2012; Wenmoth, 2014). Studies carried out in this area (Aquario et al., 2017; Capp, 2017; Katz & Sokal, 2016; Roberts et al., 2011; Savia, 2016) have indicated that implementing UDL enhances accessibility, participation, progress, skill development, and overall performance for all individuals (Dell'Anna, 2021). Because UDL is built upon ethical principles of fairness, accessibility, and involvement, it enjoys widespread international recognition, with its principles seamlessly integrated into the broader framework of inclusion, which emphasizes equal access to education and societal participation for everyone. Therefore, it involves recognizing differences across a spectrum of systematic variability and embracing the diversity of human beings not as a challenge but as a constructive force in group learning. Thus, the focus of the educational system should be on the student, eliminating any labels that hinder, discourage, or impede the inclusive process (UNESCO, 2020).

2 Method

In light of the above, a Teacher Professional Development Research (TPDR) was launched in the 2022/2023 school year involving, alongside the authors, 21 lower secondary school teachers

together with the head teacher of an Italian educational institute. The TPDR has been considered an appropriate method as it is a self-analysis-based framework that primarily considers each participant's training and relational needs, able to support classroom work by collecting a corpus of shareable educational practices. It represents an innovative approach to research in schools and with teachers, aimed at promoting and guiding teaching professionalism while maintaining a strong focus on the uniqueness of contexts and the social identity of educational processes (Lave & Wenger, 1991).

The model, developed by CRESPI² researchers, is conceived as cross-cutting to the various and more specific methodological research approaches chosen by the researcher; even if localized, it ensures methodological rigor in the investigation, contributing to scientific literature and guiding the emancipatory process of changing educational and teaching practices. Therefore, it takes on a specific characterization of participatory research, attributable to the grafting between critical action research, socio-constructivist research, and reflexivity-centered research. Research and training synergistically intertwine from this angle, creating a context where teachers, administrators, and researchers actively collaborate to explore, understand, and improve educational dynamics (Asquini, 2018).

Through TPDR, the research community builds significant knowledge, negotiated by participants based on the needs and stimuli offered by the context from which it originates and articulated through a phenomenological study of practice. The professional researcher plays the role of trainer and facilitator: as an expert in method and education (but not in the educational practice), the “critical friend” (Losito & Pozzo, 1997) ensures the investigation process, promoting reflective processes and democratic negotiation, aiming to produce knowledge which is generalizable and communicable to the scientific community. Teacher-researchers participate in the development of the methodological process, design, apply, and analyze educational practices in their context to generate new knowledge (Nigris et al., 2020). The framework of TPDR is characterized by five key principles that outline its approach: i. clear research goals; ii. collaboration between researchers and teachers; iii. focus on operational contexts; iiiii. continuous and systematic comparison; iiiiii. impact assessment. These five fundamental assumptions outline that TPDR methodology aims not only to generate knowledge but also to translate it into innovative pedagogical practices, contributing significantly to the professional development of teachers based on self-assessment of the professional progress made, a crucial element for the continuous improvement of educational processes (Agrusti & Dodman, 2021).

2.1 Design

By the chosen methodological model, the pathway is structured in five steps: i. group formation (aimed at negotiating the research mandate, detecting representations, expectations, acted practices, and group needs, identifying objectives, choosing methodologies, defining roles, and collaboration methods); ii. training and co-design (dedicated to the theoretical-methodological deepening of UDL, co-designing didactic actions, and co-constructing observation and data collection tools); iii. classroom implementation (focused on the use in the professional practice of the principles, guidelines, methodologies, and strategies deepened in the previous phases and

² The Interuniversity Centre for Educational Research on Teacher Professionalism (Centro Interuniversitario di Ricerca Educativa sulla Professionalità dell'Insegnante) is an Italian research center in the field of education that aims to connect and promote multiple lines of research on teachers' professionalism, from early childhood education to secondary education. For more information, <https://site.unibo.it/crespi/it>

aimed at data collection through the use of previously co-constructed tools); iii. assessment, self-evaluation, and feedback (dedicated to the evaluation, both individual and group, of the pathway, to data processing, feedback, and discussion of the results); iiiii. follow-up (aimed at assessing the research ex-post impact on participants and context). The research is implemented by a mixed methods approach with the collection and analysis of both quantitative and qualitative data to investigate different aspects of the phenomena, enriching the study with elements of interpretation and reflection (Creswell, 2015; Domenici et al., 2017; Trinchero & Robasto, 2019). The overall goal is to support the professional development of participating teachers and promote transformative learning with lasting impacts in the educational context. The intent is to verify whether teacher training on the UDL approach, conducted through a TPDR intervention, acts as a catalyst for inclusive processes in the classroom, leading to a significant improvement in the agentic skills of both teachers and students.

2.2 The exploratory investigation

The paper aims to show some of the results obtained from the exploratory investigation conducted during the launch phase of the TPDR through the administration of a qualitative-quantitative tool³ with a dual purpose: On the one hand, the intention was to assess whether and to what extent the principles and guidelines underlying the UDL framework were already implicitly present in the daily teaching practices of the participating teachers before the start of the training, to orient better and contextualize the design of the training intervention; on the other hand, following an ex-post administration of the instrument at the end of the process, a comparison between the data obtained aims to detect any variations in terms of practices and declared beliefs. More specifically, as outlined in Table 1, the tool consists of 4 sections to gather information related to different aspects of interest: i. *Personal information and knowledge of UDL* (8 multiple-choice items); ii. *Current application of UDL principles* (27 items on a 5-point Likert scale, from 1=Never to 5=Always); iii. *Potential barriers to UDL Implementation* (10 items on a 5-point Likert scale, from 1=Strongly disagree to agree 5=Strongly); iv. *Good practices from a UDL perspective* (31 open-ended questions). The choice to include a section with open-ended questions was driven by the need to capture, albeit within the constraints of a self-reporting tool, various nuances in teachers' perceptions regarding their educational practices, framing them within the UDL framework. Therefore, the qualitative questionnaire was designed based on the updated guidelines provided by CAST⁴ transforming each checkpoint into an open-ended question. Administration took place in person during the first group meeting, using pen and paper.

Table 1 Tool design

Questionnaire Sections	N. Items	Questionnaire answer
Personal information and knowledge of UDL	8	Multiple choice
Current application of UDL principles	27	5-point Likert scale (1=Never – 5=Always)
Potential barriers to UDL Implementation	10	5-point Likert scale (1=Strongly disagree – 5=Strongly agree)
Good practices from a UDL perspective	31	Open-ended

³ The tool was purposely designed starting from the translation and adaptation to the Italian context of existing tools (Alsalem, 2015; CAST, 2018).

⁴ <https://udlguidelines.cast.org/>

2.3 Participants

A questionnaire section collected demographic data to frame the 21 participants' ages, backgrounds, roles, and years of experience. As illustrated in the accompanying graphs, the lower age threshold among participants falls within the 31-40 bracket, while the uppermost age group surpasses 60 years. Specifically, one respondent reports an age range between 31 and 40 (5%); 10 teachers fall within the 41-50 age bracket (48%); 9 teachers declare an age range between 51 and 60 (43%); finally, a solitary respondent indicates an age exceeding 60 years (5%) (Figure 1). Turning to the secondary focal area, namely the subject domain, 6 teachers belong to the literary-historical-geographical disciplinary realm (29%); 5 teachers pertain to foreign language disciplines (24%); 5 respondents teach subjects falling under STEM categories (24%); 3 teachers specialize in Physical Education (14%); conversely, 2 respondents specialize in art education (10%) (Figure 2). Concerning their instructional roles, among the total cohort of 21 participants, 5 assert themselves as teaching assistants (24%), whereas the remaining 16 affirm their roles as classroom educators (76%) (Figure 3). Finally, participants were queried about their tenure in the teaching profession. Eight respondents report teaching experience ranging from 21 to 30 years (38%); 7 teachers disclose a tenure range spanning from 11 to 20 years (33%); 2 teachers have less than 5 years of experience (10%); another 2 respondents boast over 30 years of teaching experience (10%); finally, 2 teachers indicate a tenure range of 6 to 10 years (10%) (Figure 4).



Figure 1 Participants' ranges of age

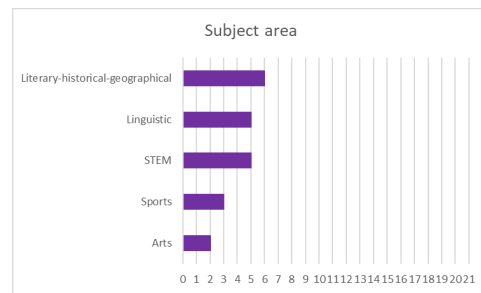


Figure 2 Participants' subject areas

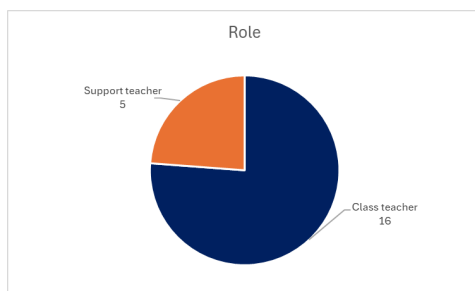


Figure 3 Participants' roles

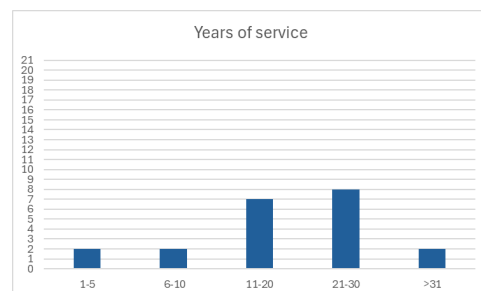


Figure 4 Participants' years of experience ranges

It is interesting to note that only 1 teacher reported being aware of the existence of the UDL approach before the training. This result is consistent with what emerged from the Italian literature, which reveals a limited familiarity with the UDL approach (Ghedin & Mazzocut, 2017; Savia, 2018). Therefore, within the framework of the present TPDR, the finding suggests that adopting the UDL approach could represent an innovation in the practices and cultures of the school involved in the research, encouraging the entire working group to continue on the path taken.

2.4 Data analysis

The initial quantitative data was analyzed using SPSS software. For this purpose, we present the means and standard deviations obtained from the analysis, divided into three sections: *Personal information and knowledge of UD*, Current application of UDL principles, and *Potential barriers to UDL implementation*. Qualitative research is closely linked to the paradigms of complexity, contextuality, and processuality, presenting itself as a situated activity connected to a series of interpretive practices aimed at making the world visible and transforming it during the process (Miles et al., 2020). Therefore, we aimed to examine whether and how the practices adopted by the involved teachers responded, even implicitly, to the principles that constitute the UDL guidelines. The raw data was analyzed employing researcher triangulation to overcome individual bias and ensure the reliability and validity of the results (Trincherro, 2015). The analysis focused on coding responses by identifying keywords or definitions representing typical modalities of answers. The organized data underwent a clustering operation to group homogeneous elements. They highlighted the main emerging themes by creating a binary matrix set (Table 2) to assign the identified response modality to each participant. This allowed us to calculate frequencies and identify the most commonly adopted strategies.

Table 2 Structure of the binary matrix of analysis of the collected data

	Item 1			Item 2			
	Mod. 1	Mod. 2	Mod. 3	Mod. 1	Mod. 2	Mod. 3	Mod. 4
T1	0	0	1	1	0	0	1
T2	1	0	1	1	0	0	0
T3	1	1	0	0	0	1	1
...

3 Findings

The section on the *Current Application of UDL Principles* consists of 27 items related to teaching actions based on UDL principles. Teachers were asked to indicate how often they use these strategies in their teaching practice, assigning a score from 1 (never) to 5 (always) to each. Analyses of the data collected regarding the current adoption of UDL principles show average scores ranging from 3 to 4 (Figure 5), indicating a good implicit theoretical adherence of teachers to the underlying principles despite not having explicit knowledge of the model. These results suggest that teachers are open to embracing UDL principles and guidelines. In the section on *Potential barriers to UDL implementation*, teachers were asked to express their agreement or disagreement with 10 propositions using a scale from 1 (strongly disagree) to 5 (strongly agree). The average scores obtained, summarised in Figure 6, indicate that teachers do not identify significant barriers in their work context to the implementation of UDL principles and guidelines.

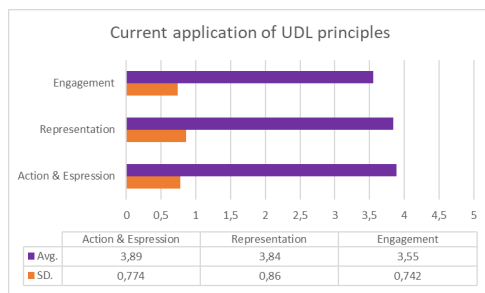


Figure 5 Means and standard deviations of the 3 areas related to the *Current Application of UDL Principles* section

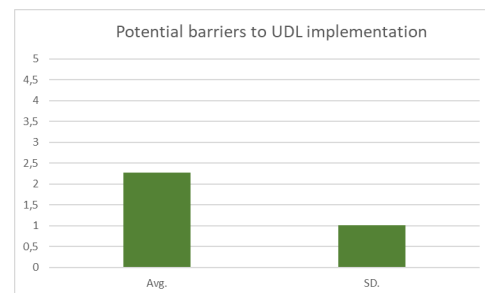


Figure 6 Mean and standard deviation of the section *Potential barriers to UDL implementation*

The previous results are confirmed by the answers provided by teachers when they were asked to describe the strategies used in their teaching practice with reference to the UDL checkpoints. For each item, they were called to reflect on whether they use the proposed actions or strategies in their daily teaching activities, describing the methods if they answered affirmatively. A summary of what the docents declared about each UDL principle will be presented below.

Table 3 Most frequent answers concerning the first UDL principle: *Provide multiple means of representation*

Guideline	Checkpoint	Main answers	Occ.	
1. Provide options for perception	Offer ways of customizing the display of information	ICT and Multimedia Educational Mediators	15	
		Iconic Mediators	9	
		No	1	
	Offer alternatives for auditory information	Iconic Mediators	10	
		ICT and Multimedia Educational Mediators	9	
		No	1	
	Offer alternatives for visual information	ICT and Multimedia Educational Mediators	9	
		Description and Read Aloud	7	
		No	1	
2. Provide options for language and symbols	Clarify vocabulary and symbols	Explanations and practical examples	6	
		Research & Insights	4	
		ICT and Multimedia Educational Mediators	4	
		No	4	
	Clarify syntax and structure	Explanations and practical examples	12	
		Anticipation of the topic, objectives, and milestones at the beginning of the lesson	3	
		No	4	
	Support decoding of text, mathematical notation, and symbols	Help and support, including through templates, summaries, and simplifications	Help and support, including through templates, summaries, and simplifications	12
			Iconic Mediators	7
			No	3
		Promote understanding across languages	Reading, clarifications, and translations	5
			Variety of language during the explanation	4
			No	9
	Illustrate through multiple media	ICT and Multimedia Educational Mediators	14	
		Iconic Mediators	11	
No		9		
3. Provide options for comprehension	Activate or supply background knowledge	Summaries, reviews, links, and summaries during the explanation	11	
		Teaching methods based on an interactive dialogue	5	
		No	2	
	Highlight patterns, critical features, big ideas, and relationships	Simplifications and guides to support comprehension	7	
		Iconic Mediators	5	
		No	3	
	Guide information processing and visualization	Examples & Guided Activities	8	
		ICT and Multimedia Educational Mediators	4	
		No	1	
	Maximize transfer and generalization	Links between theoretical concepts and their applicability in everyday life	10	
		Interdisciplinary teaching approach	7	
		No	1	

Regarding the first area, teachers answered 12 questions about the respective checkpoints. The results highlight a general tendency of teachers to adopt a teaching style aimed at providing flexible content that does not rely on a single sense, to communicate through multiple languages to promote shared understanding and to build meaning and generate new knowledge (Table 3).

In particular, the most adopted strategies involve the use of iconic, multimedia, and technological mediators to develop topics and share content, such as *padlets*, *power points*, or *through special programs in which to insert links, images, and sounds* (T4).

Table 4 Most frequent answers concerning the second UDL principle: *Provide multiple means of action and expression*

Guideline	Checkpoint	Main answers	Occ.
4. Provide options for physical action	Vary the methods for response and navigation	Use of classrooms and spaces offered by the school	10
		Teaching methods that involve group work	8
		No	6
	Optimize access to tools and assistive technologies	Digital Board and ICT during the lesson	18
		Use of the multimedia classroom	3
5. Provide options for expression and communication	Use multiple media for communication	ICT and Multimedia Educational Mediators	15
		Iconic Mediators	12
		No	1
	Use multiple tools for construction and composition	ICT and Multimedia Educational Mediators	10
		Iconic Mediators	4
		No	6
	Build fluencies with graduated levels of support for practice and performance	Laboratory activities, group activities, reality tasks	5
		Step-by-step presentation of content and guidance for the activity	5
		Iconic Mediators	5
		Customisation of tests	4
No		2	
6. Provide options for executive functions	Guide appropriate goal-setting	Choice by the teacher of objectives achievable by the students (also by level bands) starting from the observation and diagnosis of the starting levels	9
		Offering guidance and control tools	2
		Inputs that can motivate you to study	2
		No	2
	Support planning and strategy development	Support for the acquisition of an autonomous study method	6
		ICT and Multimedia Educational Mediators	5
		No	2
	Facilitate managing information and resources	Maps, outlines, and guides	8
		ICT and Multimedia Educational Mediators	7
	Enhance capacity for monitoring progress	No	1
Recovery, consolidation, and verification activities		8	
Self-assessment activities (personal/peers)		6	
		No	1

The second set of 9 questions, in line with the second UDL principle, aimed to investigate whether and how teachers provide their students with opportunities for movement, communication, and executive function development. The responses highlight a certain reluctance of teachers to relinquish portions of "teaching power" (Fiorin, 2017) and to promote the use of multiple tools to articulate their learning (Table 4). Teachers seem to prefer personally selecting the goals achievable by students based on *careful observation and accurate diagnosis of their starting levels* (T12).

Table 5 Most frequent answers concerning the third UDL principle: *Provide multiple means of engagement*

Guideline	Checkpoint	Main answers	Occ.
7. Provide options for recruiting interest	Optimize individual choice and autonomy	Positive reinforcement	7
		Margin of choice for the pupil in carrying out an activity	5
		No	1
	Optimize relevance, value, and authenticity	Links between the content presented, experiences, prior knowledge, and reality	12
		ICT and Multimedia Educational Mediators	6
		No	2
	Minimize threats and distractions	Strategic use of settings, timing, and tools	8
Provision of a serene and collaborative atmosphere		5	
8. Provide options for sustaining effort and persistence	Heighten salience of goals and objectives	Lesson contextualised to reality, also with concrete examples	7
		Clear and precise explanation of the teacher	6
	Vary demands and resources to optimize the challenge	Adaptation of activities to pupils' abilities	11
		Flexibility of the teacher to appreciate the commitment of each student	4
		No	1
	Foster collaboration and community	Use of teaching methods that involve group work	14
		Promotion of values such as empathy, solidarity, collaboration	3
		No	1
	Increase mastery-oriented feedback	Frequent, punctual, and specific feedback	6
		Feedback on results about the objectives, highlighting strengths and weaknesses	5
No		6	
9. Provide options for self-regulation	Promote expectations and beliefs that optimize motivation	Lesson contextualized to the reality and interests of the students, also with concrete examples	8
		Use of positive reinforcement	5
	Facilitate personal coping skills and strategies	Support, tools, or simulations to help overcome challenges	10
		Integration of group, laboratory, and individual activities	3
		Adapt teaching starting from the critical issues that have emerged	3
	Develop self-assessment and reflection	Targeted activities (written reflections, questionnaires, stimulus questions)	8
		When analyzing the results	5

The third UDL principle focuses on affective networks as a crucial element for learning. The 10 open-ended proposed questions focused on strategies to arouse interest, maintain engagement, and develop self-regulation. The responses confirm the teacher's central role in managing the teaching-learning relationship, with a tendency towards frontal teaching and using positive reinforcement to optimize student motivation and autonomy. However, there seems to be little space for promoting individual student choice; instead, it is the teacher who *provides extrinsic motivation and, if necessary, customizes an individual learning path* (T3) based on what the teacher has assessed regarding the needs and potential of the student in question (Table 5).

Overall, the data highlight that some of the guiding principles of the UDL framework find application in the teaching practices of the involved teachers, albeit unintentionally. This crucial aspect has been emphasized by the framework's creators themselves, who anticipated that

teachers might already be familiar with the principles and strategies they developed even before their intentional implementation (Catalfamo, 2016; Mayer et al., 2014).

Formally, teaching strategies are distinguished on three levels: organizational, evaluative, and instructional. Organizational strategies pertain to the planning and setup of the learning environment; evaluative strategies involve the selection of assessment criteria to monitor educational processes and their outcomes; instructional strategies relate to the organization and operational conduct of teaching interventions. It is upon these elements that teaching strategies acquire features of recognisability, transferability/adaptability, practical utility, and proven effectiveness (Bonaiuti, 2014). To date, all studies utilizing the results of UDL methodology application have proven to be extremely positive, also shedding light on the challenges associated with large-scale implementation and changes in educational systems. Research related to UDL has shown, in particular, increases in student engagement, learning outcomes, critical thinking, reading comprehension, positive behavior, self-concept, inclusivity, autonomy, and a good balance in terms of the risk/safety variable (Katz, 2012; Katz et al., 2019).

Although the UDL framework has proven effective in designing tools and lessons, its implementation in designing entire learning environments presents some limitations in research. In this regard, it is important to note that the majority of studies conducted on the subject have been limited to a few countries, with students sharing similar cultural and socioeconomic backgrounds: primarily the USA, Canada, and New Zealand (Al-Azawei et al., 2016; Creig et al., 2018; Mangiatordi & Serenelli, 2013). Consistent with the aforementioned results, MacArthur and Rutherford (2016) highlight a trend among New Zealand teachers to use a wide variety of teaching and learning theories as a means to engage all students, stimulating teachers to explore different ways of presenting information. Furthermore, a study conducted by Melhem & Al-Rashid (2023) to evaluate teachers' implementation of the principles of Universal Design for Learning found that the most central principle of UDL was the representation domain, ranking first, while the action, expression, and engagement domains ranked second and third, respectively. In the Italian context, the results outlined above are consistent with the survey conducted by Ghedin and Mazzocut (2017). In particular, the relevant aspects for the involved teachers concern the implementation of differentiated and multidimensional teaching practices about teaching that implicitly pursue the principles of Universal Design for Learning (UDL) applied to various components such as activity design, content preparation, various means through which to convey content or allow students to manipulate it, and evaluation. In the aforementioned survey, the highest level of agreement recorded in the results pertains to the idea that the class is composed of a wide variety of needs, preferences, and abilities of students and that a single teaching solution cannot be functional for everyone. This concept reflects the fundamental principle of the UDL model, as it is based on the idea of a universal design that can meet the needs of every individual.

4 Conclusion

The paper has examined the results of an exploratory investigation, which is an integral part of the start-up phase of a TPDR dedicated to the professional development of teachers through the implementation of the UDL framework and the promotion of transformative learning with significant implications in the school context. The main objective of this investigation was to assess whether and to what extent the principles and guidelines of UDL were already implicitly present in the daily teaching practice of teachers before the start of the training. Both quantitative and qualitative data, collected through a customized tool e during the first meeting of the working

group, were analyzed and compared to identify the implicit predisposition of the context for the adoption of the approach as well as common response modalities and declared educational and didactic strategies that reflected the UDL principles. Overall, the analysis of the results indicates a good theoretical adherence of teachers to the principles of UDL despite not explicitly knowing the model. However, they highlight the need for targeted training on strategies and methods for inclusive practice that offer equal learning opportunities to all students. This includes the creation of flexible educational objectives, methods, materials, and assessments that can be customized and adapted by students themselves based on their needs.

The collected data will be further analyzed using the Constant Comparative Analysis and Cluster Analysis (CIA), known as K-means, to fully understand the impacts and variations stimulated by the intervention. This work is part of a broader scientific reflection emphasizing the importance of teacher training to create inclusive environments that embrace and value student diversity. Furthermore, it is important to carefully evaluate the impact of the research in terms of educational solutions and process dynamics and the evaluation's ability to collect meaningful indicators. The presence of a comprehensive evaluation plan across multiple levels will allow for assessing the outcomes and long-term impact of the project on the community of practice, teachers, and the learning environment, thus contributing to transformative change in educational contexts.

5 Statement of researchers

5.1 Researchers contribution rate statement

This work is the result of the combined contributions of the authors, each of whom is credited in detail for their respective parts: Maria Moscato paragraphs 1.2, 2, 2.1, 3, 3.1, 3.2, 3.3; Francesca Pedone paragraphs 1, 1.1, 4.

5.2 Conflict statement

The authors declare no potential conflicts of interest.

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