

THE INTEGRATION OF UDL IN TEACHER TRAINING: A PATHWAY TOWARDS INCLUSIVE ASSESSMENT

INTEGRAZIONE DELL'UDL NELLA FORMAZIONE DEGLI INSEGNANTI: UN PERCORSO VERSO LA VALUTAZIONE INCLUSIVA

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ABSTRACT

Within the Universal Design for Learning (UDL) framework, accessibility implies reducing barriers and enhancing strengths. In this context, assessment must be rethought from a formative perspective, promoting reflection, growth and inclusion. This study explores how UDL teacher training can foster inclusive assessment practices that are technologically supported and adaptable to the needs of all learners.

Nell'ambito dell'Universal Design for Learning (UDL), l'accessibilità implica ridurre le barriere e valorizzare i punti di forza. In questo quadro, la valutazione deve essere ripensata in un'ottica formativa, promuovendo riflessione, crescita e inclusione. Questo studio analizza come la formazione docente UDL possa favorire pratiche valutative inclusive, tecnologicamente sostenute e adattabili ai bisogni di tutti gli studenti.

KEYWORDS

Universal Design for Learning; Universal Design for Assessment; Inclusive teachers, Training.

Universal Design for Learning; Universal Design for Assessment; Insegnanti inclusivi, Formazione.

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Introduction

In recent decades, inclusive education has established itself as a guiding principle in global educational policies, encouraging school systems to redefine their social and cultural habitus in favour of teaching practices that embrace diversity as a resource. In this context, it becomes increasingly clear that a humanistic and relational vision of education must be rediscovered, one where inclusion is not an add-on, but the very foundation of the educational project. Mura & Zurru (2022) argue that by adopting a "new humanism" that values subjectivity, cooperation, and educational justice, schools can redefine their mission along lines of welcoming and social co-construction. This paradigm invites a reconfiguration of the entire educational experience considering the rights, dignity, and full participation of every student, transcending normative and exclusionary approaches.

This transformation requires a profound rethinking of the teacher's role, who is called upon not only to transmit content but to build inclusive, equitable, and participatory learning environments, regardless of students' special educational needs (SEN), talents, or socio-economic and cultural backgrounds (Biesta, 2015; Domenici & Biasi, 2019). For this change to turn into effective practice, it is essential to reflect on initial and ongoing teacher training, which increasingly must focus on acquiring pedagogical knowledge, operational competencies, and a positive attitude toward inclusion according to the principles of *Universal Design for Learning* (UDL) (Rose, 2001) and *Universal Design for Assessment* (UDA) (Thompson et al., 2002).

The challenges posed by the growing heterogeneity of students and the complexity of educational practice require innovative approaches in training processes as well. Innovative technologies and the use of artificial intelligence (AI) therefore emerge as strategic resources: intelligent digital environments, virtual tutors, and adaptive systems can offer personalized professional development pathways, supporting the acquisition of inclusive competencies in a flexible and targeted manner (Liparoti, 2024). Such training becomes even more relevant considering the importance of acquiring and developing the capacity to assess in fair and meaningful ways. Inclusive assessment represents another critical node in teacher education and the school system in general for achieving inclusive education (Viganò, 2023). It steers the entire educational process by valuing individual progress and promoting self-regulation through formative feedback and transparent tools such as rubrics and portfolios. However, a structural criticality still hinders the full realization of a truly

inclusive school: the practical implementation of UDL and UDA paradigms demands a profound reconfiguration of teacher training. The marginalization of assessment in initial and ongoing training, along with the structural weakness of evaluative research in our school system, represents one of the main barriers to change (Corsini & Losito, 2023).

Against this backdrop, the following sections will define the problem addressed in this study.

1. Definition of the Problem

In recent decades, education has undergone a profound and complex transformation that has progressively redefined its theoretical, methodological, and organizational foundations. This radical change cannot be simply interpreted as a technical adaptation or a modernization of existing educational tools and environments. Rather, it represents a true paradigm shift, the result of a historically and culturally situated process. The impact of the dynamics of "liquid modernity" (Bauman, 2012), characterized by instability, flexibility, and the continuous redefinition of traditional institutions, has deeply influenced schools and their educational models. Moreover, social, cultural, and political tensions, alongside a growing global awareness of human rights, have increasingly challenged the notion of school as a static educational agency, urging a rethinking of its educational mission and social role (Bruni, 2023).

In this context of deep transformation, the expansion of inclusive policies, supported by international conventions and a growing ethical and legal awareness (UNESCO, 1994), has led to a significant shift in perspective: from viewing education as reserved for "special categories" to promoting a universal school model centered on the inclusion and appreciation of diversity as a fundamental and enriching element of educational coexistence. The right to education is no longer conceived as an exceptional or marginal need to be addressed through alternative solutions, but rather as an ethical and democratic imperative involving the entire education system (Gaspari, 2017; De Luca, Domenici, & Spadafora, 2023). If education is the process through which individuals develop their humanity in relation to others and the world, then welcoming and valuing diversity is not optional, it is the very foundation of educational action. In this sense, inclusion is not limited to managing needs but recognizes the variety of human trajectories as the essential condition

for personal growth and social cohesion (Mura & Zurru, 2022; Cambi, 2017; Morin, 2000).

Consequently, educational planning, curricula, methodologies, and objectives must be profoundly rethought, adopting an inclusive perspective that views differences not as obstacles to be overcome, but as valuable resources to be cultivated within a shared educational project (Rogahang et al., 2024). Within this framework, John Dewey's pedagogical thinking is rediscovered, he envisioned the school as a democratic community, an educational environment where diversity serves as a stimulus for individual and collective growth (Dewey, 1916).

This renewed social mandate of the school is not a linear or obstacle-free process. It requires not only a revision of regulatory frameworks but, above all, a sustained commitment to pedagogical reflection and the innovation of educational practices aimed at anticipating and valuing diversity rather than confining it within predefined categories. One key framework here is Universal Design for Learning (UDL; Rose, 2001), which proposes the design of accessible, flexible, and participatory learning environments from the outset. It gives instructional design an inclusive methodological orientation that makes both individual and collective educational goals feasible (Cottini, 2022). Through multiple means of content representation, competency expression, and motivational engagement, UDL translates the pedagogical principle of inclusion into concrete practices, promoting educational pathways that are truly centered on the cognitive and cultural diversity present in today's classrooms.

A genuine culture of inclusion cannot be exhausted in instructional design alone; it must also encompass assessment, recognizing that evaluation is a fully educational act, both final and initial, as a recursive dimension in which individuals and educational contexts are continuously interconnected in a dynamic of mutual influence (Dell'Anna, 2024; Corsini, 2018). Assessment accompanies moments of identity growth and transformation in students, decisively contributing to the development of conscious and participatory subjectivities.

From a UDL perspective, even the epistemic framework of assessment has evolved, moving beyond the traditional concept of *Assessment of Learning*, understood primarily as final certification of acquired performance, to embrace the paradigm of *Assessment for Learning*. This sees evaluation as an integral part of the learning process and a tool to support, guide, and enhance ongoing learning (Hall et al., 2018). With the awareness that every student carries a unique, situated experience that cannot be reduced to abstract normative parameters, assessment must be

rethought as formative, dynamic, and process-oriented, deeply intertwined with the learning path and the development of subjectivity (Batini & Martina, 2020). This critical perspective is rooted in Universal Design for Assessment (UDA; Thompson et al., 2002), an educational epistemology that recognizes and supports diverse ways of learning and expressing knowledge. Going beyond normative evaluation, UDA promotes an inclusive approach that values cognitive and learning styles, restoring to assessment its authentic pedagogical meaning: a tool for emancipation, human development, and democratic construction (Bruni, 2018).

The concrete implementation of UDL and UDA paradigms requires a deep reconfiguration of teacher training. The marginalization of assessment in both initial and ongoing teacher education, combined with the structural weakness of evaluative research in our school system, currently represents one of the main barriers to realizing a truly inclusive school (Corsini & Losito, 2023). The solution is not to simply add technical modules to teacher preparation but to promote a cultural transformation of the teaching profession, one capable of critically integrating the assessment dimension into the educational project (Magni, 2019). Inclusive training thus requires not only operational competence in using differentiated and reliable tools but also the development of a reflective and conscious perspective on assessment as an interpretative, situated act, deeply connected to the promotion of each student's subjectivity and potential.

The central role of teachers in contemporary education systems implies that they must possess not only disciplinary knowledge but also a set of methodological-didactic competencies that are essential for ensuring effective, high-quality teaching (Nuzzaci, 2019). Pedagogically, these competencies include educational planning, management of teaching and learning processes, reflective use of teaching strategies, formative and summative assessment, and the ability to create inclusive, motivating, and participatory learning environments. These skills form the epistemological and operational basis of the teaching function, so that knowledge becomes actionable (Rivoltella & Rossi, 2017; Galliani, 2015), contextualized, and dynamic, enabling teachers to interpret students' educational needs, adapt practices to educational contexts, and promote meaningful learning. In this sense, the quality of teaching is closely connected to the development and integration of such competencies, within a framework of continuous training and professionalization of the teacher's role.

In this scenario of redefining teachers' educational profile, it is now essential to also include in pedagogical reflection the role of advanced educational technologies and

artificial intelligence (AI), not only as tools for personalized learning but also as key instruments for fair and accessible assessment (Panciroli & Rivoltella, 2025). Intelligent digital environments, adaptive platforms, and automated feedback systems, if consistently designed according to UDL and UDA principles, can facilitate the creation of multimodal assessment paths that are sensitive to the diversity of cognitive styles and the specific needs of students, particularly those with special educational needs. However, unlocking the innovative potential of these tools requires solid professional competence on the part of teachers, not just on the technical level, but especially on the critical and ethical ones. Therefore, both initial and in-service training must include mechanisms to develop pedagogical awareness regarding the ethical, inclusive, and reflective use of digital technologies, avoiding the risk of delegating complex evaluative decisions to machines, decisions that require value judgments, interpretation, and care in the educational relationship. In this perspective, teachers' digital skills cannot be reduced to instrumental abilities, they must be part of a reflective professional profile capable of integrating the opportunities offered by technology with an educational vision focused on promoting subjectivity, equity, and the potential of every student (Wiese et al., 2025). The challenge is not merely methodological but cultural and pedagogical: to ensure that technology does not replace teachers, but amplifies their ability to read and interpret situations, support, and accompany learning processes in an authentically inclusive manner.

Considering the pedagogical transformations currently challenging schools to make education truly inclusive, this study aims to critically analyse the role of initial and ongoing teacher training in developing assessment practices aligned with the principles of UDL and UDA. Specifically, the study seeks to explore how teacher training can support the development of inclusive assessment competencies, using recent digital technologies, and to highlight how such training can promote accessibility and value the diversity of learning pathways.

To this end, the reflection will be guided by three core research questions:

RQ1: Is there an effective alignment between the theory and practice of assessment?

RQ2: What assessment tools are used and how are they applied in practice by teachers?

RQ3: How does technology support inclusive and differentiated assessment in teachers' actual practices?

The goal is to identify, through a critical review of recent scientific literature, the ways in which both initial and ongoing training programs promote teachers' assessment competencies capable of adapting to the plurality of learning styles and real educational contexts. This reflection aims to provide practical recommendations for improving teacher training programs, orienting them toward a flexible and inclusive school model.

2. Universal Design for Learning: a theoretical framework

The concept of Universal Design (UD), initially developed in the field of architecture by Ron Mace, an architect with a disability, marked a significant turning point in how accessibility is conceived. Mace proposed a design model in which inclusivity is not a marginal or additional feature, but a structural and original component of built environments. This vision, grounded in the idea that truly inclusive environments must be designed from the outset to be accessible to all, has since influenced the field of education. In this context, barriers are not necessarily physical; more often, they manifest in instructional and organizational methods which, if not consciously designed, may exclude a significant portion of the student population. Like architectural spaces, educational environments can become inaccessible if they are not designed to accommodate the characteristics and needs of every individual.

It is within this framework that the theoretical and operational model of UDL developed by the Center for Applied Special Technology (CAST) (CAST, 2018), takes shape. UDL was conceived to address the need for equity and accessibility in learning, challenging the idea of a standardized, one-size-fits-all educational model. Instead, this paradigm takes the neurobiological, behavioural, and motivational variability of learners as a fundamental pedagogical principle, designing learning environments capable of responding to the plurality of individual needs and the diverse ways in which students access and interact with school life (Leinenbach & Corey, 2004). Through the development and dissemination of UDL, CAST significantly shifted pedagogical reflection from post-hoc adaptation of teaching practices to universal design, understood as the anticipation and valuing of differences within learning environments and processes.

The UDL framework is based on evidence from cognitive neuroscience and learning sciences. Specifically, it recognizes that educational processes are supported by the

dynamic interconnection of brain networks functioning across various levels of complexity (Liparoti, 2023). These include: recognition networks (responsible for the perception and understanding of sensory information), strategic networks (involved in planning, executive control, and problem-solving), and affective networks (which regulate motivation, sense of belonging, and engagement with tasks). This approach, aligned with the principles of neuroeducation (Rivoltella, 2024), challenges a reductionist view of intelligence and learning, instead embracing neurocognitive variability as a fundamental element of the educational experience. In this sense, UDL represents a paradigmatic example of the pedagogical application of the evidence-based approach (Calvani & Vivanet, 2014), as it is grounded in empirically validated findings to guide inclusive and effective instructional choices.

Contrary to conceptions that localize brain functions and promote a simplified view of the mind, recent developments in neuroscience have shown that functions such as memory, perception, language, and problem-solving emerge from the dynamic interaction of brain structures across multiple spatial and temporal scales (Bullmore & Sporns, 2009). This complex perspective implies that learning must be understood as a multifactorial, situated, and individually variable phenomenon. Every act of learning engages all three major brain systems mentioned above, echoing Vygotsky's tripartite model (1976), which emphasized the need to recognize, act, and be motivated in the learning process.

These premises lead to a radical redefinition of educational practices, one that rejects forcing students into a predefined normative model and instead promotes the design of flexible, dynamic learning environments that can adapt to diverse ways of functioning. The three core principles of UDL, multiple means of representation, multiple means of action and expression, and multiple means of engagement, are not mere technical adjustments; they are pedagogical paths that require a deep rethinking of the very purpose of schooling. Providing multiple means of representation acknowledges that access to knowledge cannot be mediated by a single form of expression; rather, it requires diverse modes (visual, auditory, symbolic, etc.) to be truly inclusive. Likewise, allowing students multiple ways to express and act goes beyond linguistic or written performance as the norm, legitimizing alternative forms of expression more closely aligned with each student's cognitive profile. Finally, varying modes of engagement means actively working on motivation, which must be built and sustained through stimulating

learning environments, positive educational relationships, and authentic teaching practices, as highlighted in neuroeducation literature (Liparoti, 2023).

UDL therefore advocates for a universal and proactive design, in which accessibility is built into the learning process from the beginning. In this transformative perspective, learning is redefined as a personal and situated process, where individual differences are not seen as deficits to be corrected but as legitimate expressions of human diversity. Returning to its original intent, the UDL approach, rooted in neuroeducational evidence, encourages a critical rethinking of the entire structure of educational practices: from curriculum design to assessment, and to the management of educational relationships. Thus, UDL emerges as a transformative pedagogical paradigm, capable of redefining the very meaning of "academic success" in a truly democratic and inclusive way.

3. Assessment through the lens of Universal Design for Learning

Within the UDL framework, schools are called to radically rethink their educational mission through a genuinely inclusive lens, one that values diversity as both the foundation and a resource of the learning process (Weeden et al., 2009). In this context, it becomes essential to question the deeper meaning of assessment and its pedagogical implications.

Inclusion, in fact, cannot be understood as a mere additional adaptation; it requires a systemic and cultural restructuring of the entire school structure. Therefore, assessment must also be reimaged in a transformative way, not as a technical procedure or final act, but as a strategic tool for building a school that is equitable, accessible, and focused on the development of every student's potential.

Educational assessment has undergone a profound epistemological evolution in recent decades (Castoldi, 2016). Once primarily centered on the objective measurement of results and the certification of standardized competencies, it has gradually developed into an interpretive, reflective, and situated practice aimed at understanding the complexity of learning processes and supporting the holistic development of those involved. The prevailing paradigm of *assessment of learning*, still widely practiced, is based on a summative and classificatory logic that tends to conceive of learning as a quantifiable and standardizable product. From this perspective, assessment risks legitimizing selective and exclusionary dynamics, functioning more as a bureaucratic tool than as a pedagogical one. It operates

under a normative rationale, often unaware of the plurality of cognitive styles and developmental rhythms unique to each learner.

In contrast to this model, the UDL approach calls for a radical reconfiguration of assessment, grounded in the principles of *assessment for learning*. In this view, assessment becomes a constitutive and continuous element of the educational process, accompanying, supporting, and guiding learning at every stage. The student is recognized as an active subject, endowed with voice, intentionality, and reflective capacity. From this perspective, assessment takes on a formative and transformative function: promoting awareness of the learning journey, supporting self-regulation processes, fostering the development of critical skills, and actively contributing to the construction of the learner's personal and cognitive identity. It is configured as a pedagogical process that, by transcending the logic of standardized measurement, recognizes and values the full humanity of the learner—in coherence with an educational vision centered on the *anthropos*: a cultural, relational being in constant transformation.

Within this vision, the concept of UDA naturally emerges as an extension of UDL into the field of assessment, grounded in a profound pedagogical assumption: for assessment to be truly formative and fair, it must be designed from the outset to be accessible, just, and capable of recognizing the plurality of forms of knowing and expression. In this sense, to assess means to create conditions that allow each learner to fully express their potential, in the awareness that every learning path is unique, situated, and relational.

UDL redefines assessment in terms of personalized instruction, while also transforming it into an essential diagnostic tool for identifying and analysing the environmental barriers that hinder access to learning. The outcomes of assessment thus become a critical mirror of the educational context itself, prompting reflection on its ability to welcome and support diverse learning trajectories. In this way, to assess also means to evaluate the environment.

This epistemic and operational interpretation of assessment is made even more urgent, and feasible, by the opportunities offered by digital technologies, which, when used with pedagogical awareness, expand expressive, communicative, and accessible options, allowing for the diversification of assessment tools and languages. However, the integration of technology does not guarantee equity: only when guided by inclusive design, sensitive to learner differences, can these tools become allies of an assessment process capable of recognizing the multiplicity of ways of learning and being in the world.

4. Teacher training and inclusive assessment: UDL perspective and pedagogical challenge

The challenges posed by UDL and UDA make it necessary to rethink both initial and in-service teacher training. This training must focus not only on the acquisition of up-to-date knowledge and pedagogical practices, but more importantly, on building a professional profile that integrates values, attitudes, and practices aligned with the principles of inclusive education. Mura and Zurru (2022) emphasize that the teaching role must be rethought considering a broader educational responsibility, based on a relational and democratic approach to knowledge. Teachers are called to be promoters of cognitive justice, capable of creating learning environments where diversity is recognized as a foundational value.

In this regard, the *Profile of the Inclusive Teacher* ("European Agency for Development in Special Needs Education," 1997) serves as a guide for designing and implementing teacher education programs. It is not just a regulatory reference, but a pedagogical paradigm that informs training planning and plays a strategic role in assessment processes. It provides criteria and guidelines for developing the ability to create equitable, accessible, and participatory educational contexts. The OECD highlights that improving the professional profile of teachers is one of the most effective policy levers to raise student achievement levels (Furno, 2005). This assertion is supported by empirical evidence showing a positive correlation between training on inclusive themes and the development of favourable attitudes towards students with SEN, an increased sense of professional self-efficacy, and strengthened teaching competencies (Fiorucci, 2014; Kurniawati et al., 2017).

To translate the principles of the inclusive profile into concrete and transformative practices, it is crucial that teacher training is not designed as an abstract, decontextualized process. Instead, it must be situated anchored in teachers' real-world experience and supported by school contexts that foster shared reflection, instructional experimentation, and experiential learning (Norwich & Nash, 2011), thereby promoting a recursive interconnection between educational ecosystems and individuals (Sibilio, 2013). This direction is reflected in the recent Prime Ministerial Decree (DPCM) of August 4, 2023 (implemented in 2024) in Italy, which, through Annex A, redefines the content of the qualification pathway for initial teacher training. The decree explicitly includes inclusive, pedagogical, and assessment competencies among the priority domains of teacher professionalism. It outlines the profile of a teacher capable of designing, observing, and assessing in

heterogeneous educational settings. The focus on integrating teaching with educational technologies, on the informed use of assessment, and on adopting flexible and differentiated approaches aligns with the UDL and UDA paradigms, recognizing their effectiveness as a theoretical and operational framework for building equitable and participatory educational environments.

These considerations highlight the urgency of exploring how to design training pathways that support the acquisition of inclusive competencies, and what pedagogical and evaluative implications result from this process. A particularly significant contribution to defining quality criteria in teacher training comes from Darling-Hammond et al. (2017), who identify seven core indicators for designing effective training programs that generate a concrete impact on educational practice and learning quality. These include: focus on content and instructional mediation strategies; active teacher engagement; promotion of professional collaboration; modeling of practices; coaching and expert supervision; structured opportunities for feedback and reflection; and continuous support over time. These seven quality indicators align perfectly with UDL principles, both in pedagogical assumptions and in operational implications. Both are grounded in an ecological, reflective, and inclusive vision of education, where instructional and training design is oriented towards variability, accessibility, and meaningful participation for all.

In line with these principles, educational assessment is reflected in diversified, flexible, and accessible strategies. Notably, CAST (2020) published a guide encouraging teachers to rethink assessment as a reflective and continuous process to be activated already at the planning stage. Identifying clear, well-defined, and shared objectives is the first step in constructing a coherent and justifiable assessment system that avoids the introduction of implicit barriers linked to tasks misaligned with educational goals. Coherence between objectives, instructional strategies, and assessment methods is what enables the creation of authentic learning experiences. Assessment, in this sense, cannot be separated from teaching, it is an integral part of it, enabling students to find meaning in what they learn and allowing teachers to act in an informed pedagogical manner.

As highlighted by Roski et al. (2021), truly inclusive assessment, aligned with UDL principles, cannot be reduced to a merely procedural application of its guidelines. Rather, it requires intentional, systematic design grounded in solid epistemological criteria. It is crucial to minimize irrelevant variance in the assessment construct, elements that interfere with equitable measurement, such as linguistic, cognitive, or sensory barriers not directly related to learning objectives.

A study by Bellomo (2016) revealed a gap between teachers' perceptions of assessment and the practices they implement in the classroom. Although many teachers recognize the formative value of assessment and support its pedagogical foundations in principle, its implementation often remains fragmented, inconsistent, and anchored in quantitative and standardized models. Ciani & Rosa (2025), for instance, found that 65% of primary school teachers surveyed consider grades to be a clearer and more understandable tool for students and their families. Additionally, 5–10% believe that grades better differentiate levels of learning achieved. These findings underscore the challenges teachers face in communicating and implementing new assessment methods, which are often perceived as poorly understood or insufficiently shared.

Research into teacher training practices has also shown that while UDL principles are well implemented in instructional design, the adoption of flexible assessment tools remains a critical issue. For example, there is a significant lack of specific skills for designing multimodal and adaptive assessment (Melhem & Al-Rashid, 2023; Alqarni & Al-Asiri, 2022; Smith, 2018; Corsini & Losito, 2023). Furthermore, in the study by Mura & Zurru (2019), 69% of teachers from various educational levels viewed the presence of students with special educational needs as an opportunity to design instructional pathways aimed at reducing educational barriers and promoting personal development for all students. This reflects an inclusive and proactive view of diversity consistent with UDL principles. However, the study does not specifically analyse teachers' perceptions of inclusive assessment, highlighting a continued marginalization of assessment in educational innovation processes.

This gap between theory and practice stems, on one hand, from insufficient training on the epistemological, methodological, and ethical dimensions of inclusive assessment, and on the other hand, from a lack of shared and structured frameworks within schools to support a fair, reflective, and transformative assessment culture.

Another critical issue is that, both nationally and internationally, assessment of learning and school systems is primarily managed by centralized agencies such as INVALSI in Italy and the OECD internationally. These bodies operate through standardized measurement protocols aimed at benchmarking and comparing systems, classes, or student groups. While these tools are useful for monitoring and accountability purposes, they risk reinforcing a normative assessment model focused on uniform performance, which is at odds with the UDL and UDA emphasis on personalization and learning diversity. In this context, assessment risks

becoming a classificatory tool rather than an educational process aimed at valuing individual progress, different cognitive styles, and students' starting points.

Therefore, it becomes urgent to train teachers in a culture of inclusive assessment, also by adopting assessment tools designed according to UDA criteria, tools that promote accessibility, clarity, and transparency.

Scientific literature shows that the assessment tools used by teachers are diverse (e.g., formative feedback, evaluation rubrics, and competency portfolios). However, even these inclusive tools present critical issues. Several studies (Tur et al., 2019; Gregersen Oestergaard et al., 2024) have shown that their effectiveness heavily depends on how they are designed and applied, as well as on teachers' pedagogical awareness in using them in line with inclusion principles.

Robasto (2023) notably highlighted that, despite widespread theoretical support for formative assessment principles, their practical application is often fragmented, formalistic, and poorly integrated into instructional planning. Many teachers struggle to construct authentic evaluation rubrics that effectively guide feedback and feedforward processes consistent with UDL principles. Although teachers recognize rubrics as potentially effective tools for making criteria explicit, supporting self-assessment, and guiding feedback, they are rarely implemented authentically. When used, rubrics tend to be tied to bureaucratic or procedural logic rather than being integrated as pedagogical tools that support self-regulation and metacognition.

Furthermore, there is a fragmented understanding of formative assessment itself, often conflated with informal observation or summative monitoring, highlighting ongoing conceptual ambiguity. Other studies also reveal that rubrics may become mechanical or bureaucratic if not accompanied by real criterion-sharing processes with students (Tur et al., 2019), while portfolios risk being perceived as mere compliance tools unless integrated into reflective and formative learning paths (Hammad Al-Rashidi et al., 2023). Similarly, formative feedback, if not structured intentionally and continuously, can lose its regulatory and transformative function in learning (Cui et al., 2021; Wong, 2022).

Moreover, several studies (Gregersen Oestergaard et al., 2024; Nicol, 2009) report that teachers struggle to design truly adaptive tools capable of responding to diverse cognitive styles, starting levels, and specific needs. This highlights the persistent gap between inclusive principles and actual assessment practices, often due to insufficient training on how to use such tools critically, reflectively, and in a personalized manner.

These findings underscore the need for systemic training in assessment, training that goes beyond technical aspects to embrace the epistemological, pedagogical, and relational dimensions of inclusive evaluation. To bridge this gap, teacher training must systematically integrate the assessment dimension, promoting critical awareness, pedagogical-technical skills, and reflective capacity. Assessment should be seen as a didactic mediation tool that values student potential, supports individualized pathways, and provides an opportunity to rethink educational practice in a continuous improvement perspective.

Only a training framework that combines solid theoretical foundations, professionalizing experiences, and institutional coherence can give rise to authentically inclusive assessment, capable of transcending the logic of control to become an instrument of educational care, empowerment, and cognitive justice.

One of the most significant aspects of the UDL perspective is its emphasis on process evaluation, particularly of engagement, self-regulation, and strategy. This is not about judging attitude, but about valuing the metacognitive dimension of learning and encouraging students' awareness of their own learning process. This approach is rooted in Bruner's (1996) theory, which holds that to learn is to reflect on one's own learning process.

Formative feedback, in the UDL and inclusive pedagogy perspective, emerges as a crucial didactic and pedagogical tool to guide and support learning processes. As noted by Shute (2008) and Chappuis (2009), effective feedback does not merely correct errors; it guides future educational action, strengthens intrinsic motivation, nurtures self-efficacy, and stimulates critical and metacognitive thinking. It thus acts not only on the cognitive level, but also on the emotional and motivational planes, supporting learners in developing reflective awareness of their progress.

A literature review study on formative assessment in primary schools by Batini (2020) found that although awareness of the importance of formative assessment as a tool to support learning processes and promote student participation is growing, this does not systematically translate into coherent, structured, and intentional assessment practices. Often, assessment is used episodically and informally, without a shared methodological framework, resulting in predominantly descriptive practices not truly oriented toward continuous improvement.

Another critical issue concerns the lack of a shared assessment culture within schools: practices are largely individual, poorly coordinated within teaching teams, and weakly supported by educational leadership capable of steering assessment

innovation. There is no real co-responsibility in establishing common criteria nor a systematic exchange of reflective practices among colleagues.

Finally, the study emphasizes that this situation results from still insufficient initial and in-service training regarding the epistemological and methodological competencies required for genuinely formative and inclusive assessment. The absence of systematic opportunities for discussion, professional development, and experimentation makes it difficult for teachers to implement assessment processes that go beyond measuring achievement to become generative moments, aimed at the integral development of the student and the recognition of their uniqueness.

Thus, the research strongly calls for training design centered on assessment as a reflective and relational practice, founded on principles of equity, transparency, and professional co-responsibility.

These findings are fundamental for understanding how to guide teacher training pathways considering scientific studies demonstrating the effectiveness of co-teaching and co-assessment as practices structurally linked to school inclusion. Educational assessment from a UDL perspective is rooted in a collective and dialogic dimension. The idea of a community of practice (Wenger, 1999) implies that the design and reflection on assessment should be shared, discussed, and negotiated within professional groups.

In particular, the study by Ghedin et al. (2013) highlights the potential of co-teaching not only as an organizational model but as a formative and transformative device, capable of fostering integration of knowledge, educational co-responsibility, and shared instructional planning. In the analysed experiences, joint teaching between general and special education teachers proved effective in ensuring greater methodological flexibility, personalization of interventions, and higher levels of inclusivity in educational activities. The study also shows that when accompanied by co-assessment practices, co-teaching enhances the equity of assessment processes by enabling the comparison of multiple professional viewpoints. This approach helps overcome the subjectivity of the individual teacher and fosters the creation of more complex, authentic, and participatory assessments, aligned with UDA principles.

5. AI, Technologies, and Digital Competencies: Emerging Perspectives for UDL-Based Teacher Training

In an era marked by the widespread adoption of advanced digital devices and the integration of AI into education, assessment processes, particularly formative assessment from an inclusive perspective, require not only an update of the tools used but also a profound rethinking of teacher training. Such training must focus not only on acquiring assessment skills but also on developing critical digital competencies, which are essential for designing, managing, and interpreting technology-supported assessment practices aligned with the principles of accessibility, personalization, and educational equity.

The European DigCompEdu framework (European Commission, 2017) reflects this direction, identifying digitally supported assessment and the use of technologies to monitor and support learning as key areas of educators' digital competencies. Similarly, both UNESCO (2021) and the OECD (2023) emphasize the importance of training teachers to integrate technology not merely as a technical tool, but within a pedagogically and ethically grounded approach. Such an approach must promote inclusive, participatory teaching and assessment methods that are sensitive to the diversity of cognitive styles and learning contexts. The Italian Ministerial Decree of August 4, 2023 (implemented in 2024) further reinforces this vision by explicitly integrating digital, evaluative, and inclusive competencies as foundational elements of contemporary teacher professionalism. This direction acknowledges that educational innovation cannot be separated from a pedagogical vision focused on educational justice and the centrality of the learner.

A study by Kooli & Yusuf (2024) highlights the need for a holistic approach to AI integration in education, one that goes beyond technical aspects to include epistemological, didactic, and ethical dimensions. When properly designed, AI can support personalized learning, continuous progress monitoring, and the implementation of formative, adaptive, and inclusive assessment practices (Liparoti, 2024).

These technologies offer new opportunities for providing real-time, multimodal, and differentiated formative feedback, enabling more accessible and continuous communication between teacher and student. AI-supported digital environments can deliver instant, personalized, and traceable feedback, offering study strategy suggestions, highlighting recurring errors, and fostering student self-regulation. However, as Kooli & Yusuf (2024) point out, the potential of AI in education can

only be fully realized when teachers are properly trained and able to manage technological processes critically and with clear educational goals. Thus, it is necessary to rethink both initial and in-service teacher training to include not only advanced digital competencies but also ethical-pedagogical skills for the responsible use of AI. Artificial intelligence cannot replace the educational relationship but can serve a supportive role when embedded in an intentional instructional and assessment framework focused on the holistic development of the learner.

This perspective is reinforced by the findings of Wang and Sitthiworachart (2025), who explore the integration of assistive technologies and UDL principles within the TPACK (Technological Pedagogical and Content Knowledge) framework in initial teacher education. The data show that the development of effective digital competencies in education cannot be separated from a systemic approach that integrates disciplinary knowledge, pedagogical expertise, and technological awareness from an inclusive, equity-oriented perspective. Technical mastery of tools alone is not sufficient; it must be accompanied by a strong understanding of pedagogical principles guiding the use of technologies for ensuring accessibility, active participation, and personalization of learning pathways.

Special attention must also be paid to biases in digital assessment systems, such as algorithmic discrimination or cultural insensitivity, which can reinforce exclusionary dynamics rather than reduce them (Bailey, 2023). It is essential that teachers are trained to recognize, analyse, and mitigate such biases to ensure fair, transparent, and diversity-respecting assessment processes.

Within this context, it is particularly important to build competencies aimed at using digital technologies as assessment mediation tools capable of supporting self-regulation, metacognition, and continuous formative feedback. Consequently, there is an urgent need to design training programs that go beyond the simple transmission of technical skills, offering authentic and situated experiences through real case experimentation, critical reflection, and peer collaboration. A reformulation of the educational project is necessary—one that prepares teachers not just as technology managers, but as relationship-builders and meaning-makers (Bruni, 2023; Bruni & Garista, 2024).

We must promote a pedagogy of technological awareness that educates for the deconstruction of bias and ethical responsibility in the use of technologies. Inclusive assessment should be designed as a reflective, intentional, and situated practice

that reveals and values the plurality of cognitive processes and the complexity of student subjectivities

Conclusions

The reflection conducted clearly highlights how both initial and in-service teacher training represents a strategic lever for consolidating a culture of inclusive assessment, capable of translating the principles of UDL and UDA into practice. The challenges posed by the growing heterogeneity of educational contexts, technological evolution, and demands for cognitive equity call for a radical rethinking of the teacher's professional profile, which can no longer be limited to the acquisition of technical or disciplinary skills but must instead be shaped as a reflective, relational, and transformative identity. From this perspective, the teacher is called to act as a mediator of complexity, capable of designing accessible learning environments and authentic assessments that value the diversity of cognitive styles, learning pathways, and starting contexts. As highlighted by numerous empirical studies, the coherence between teaching and assessment, the adoption of multimodal tools, continuous reflection on evaluative processes, and the use of collegial practices are essential conditions for equitable and participatory educational action. The introduction of digital technologies and artificial intelligence into assessment processes undoubtedly offers new opportunities to foster personalization, real-time monitoring, and the construction of differentiated feedback. However, these tools must be integrated within a conscious ethical-pedagogical framework that avoids automated drifts and maintains the primacy of the educational relationship. In this vision, technology does not replace the teacher but enhances their interpretive capacity, supporting the observation and documentation of learning processes in a dynamic and inclusive way.

Considering the findings, some operational guidelines can be outlined to guide future teacher training programs:

- Integrate assessment as a central axis of teacher training, not only in technical terms but as a reflective practice based on solid epistemological criteria and sensitive to the affective, relational, and motivational dimensions of learning.
- Promote situated and continuous training that values experiential learning, peer reflection, co-teaching, and co-assessment, encouraging the development of professional learning communities.

- Train teachers in assessment design aligned with UDA principles, guiding them in building authentic rubrics, effective formative feedback, and reflective portfolios—tools capable of supporting students' self-regulation and metacognitive awareness.
- Develop critical awareness of the use of technology in education by including modules on algorithmic bias, privacy, accessibility, and the ethical limits of AI in training, fostering a pedagogical vision of digital processes.
- Strengthen the link between initial training and school practice by encouraging synergy between universities and schools through teaching labs, expert mentoring, and opportunities for shared observation and planning.
- Move beyond the normative and standardized assessment approach by promoting a formative paradigm that values individual progress, documents learning processes, and centers on the learner as a person.

Ultimately, training teachers to assess inclusively means enabling conscious professionals who can read the context, value subjectivities, and transform the act of assessment into a space for educational care. Only in this way can we create a school system that is truly equitable, participatory, and oriented toward fully realizing each student's potential.

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