

SHAPING THE FUTURE OF EDUCATION: THE ROLE OF UNIVERSAL DESIGN FOR LEARNING IN ADAPTIVE AND INCLUSIVE ECOSYSTEMS

PLASMARE IL FUTURO DELL'ISTRUZIONE: IL RUOLO DELL'UNIVERSAL DESIGN FOR LEARNING IN ECOSISTEMI ADATTIVI E INCLUSIVI



Double Blind Peer Review

Citation

Coppi, A., & Barone, S.L. (2025). Shaping the future of education: the role of universal design for learning in adaptive and inclusive ecosystems. *Giornale italiano di educazione alla salute, sport e didattica inclusiva*, 9(1).

Doi:

<https://doi.org/10.32043/gsd.v9i1.1476>

Copyright notice:

© 2023 this is an open-access, peer-reviewed article published by Open Journal System and distributed under the terms of the Creative Commons Attribution 4.0 International, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

gsdjournal.it

ISSN: 2532-3296

ISBN: 978-88-6022-509-2

Antonella Coppi
IUL Telematic University, Florence
a.coppi@iuline.it



Sabrina Lucilla Barone
Pegaso Telematic University, Naples & IUL Telematic University, Florence
sabrinacilla.barone@unipegaso.it & s.barone@iuline.it



ABSTRACT

The research analyses Universal Design for Learning (UDL) as a framework for inclusive educational environments, combining bibliometric mapping with empirical data on study approaches, beliefs, anxiety, and resilience. This integrated approach enables the development of personalised teaching strategies. Educational trust, Spaced Learning, Flipped Inclusion, and artistic practices expand the horizons of formative possibilities. The teacher emerges as an empathetic guide, capable of weaving together pedagogy, technology, and relational care.

La ricerca analizza l'Universal Design for Learning (UDL) per ambienti inclusivi, combinando mappatura bibliometrica e dati empirici su approccio allo studio, convinzioni, ansia e resilienza. L'approccio integrato consente strategie didattiche personalizzate. Fiducia educativa, Spaced Learning, Flipped Inclusion e pratiche artistiche ampliano le possibilità formative. Il docente è guida empatica che coniuga pedagogia, tecnologia e relazione.

KEYWORDS

Pedagogy of Inclusion; Adaptive Learning Environments; Systemic Pedagogy

Pedagogia dell'inclusione; Ambienti di apprendimento adattivi; Pedagogia sistemica

Received 30/04/2025

Accepted 17/06/2025

Published 20/06/2025

Introduction

Education is a generative process in the encounter, in the relationship that welcomes and transforms (Biesta, 2013; Mortari, 2015) and takes shape where body, mind and world intertwine in a shared sense, going beyond disciplinary linearity. In this horizon, the learning environment can no longer be understood as a neutral space but as a dynamic ecosystem capable of responding to the complexity of subjectivities.

In this framework, Universal Design for Learning (UDL) fits in, a pedagogical paradigm that goes beyond the compensatory approach to inclusion, promoting a flexible, anticipatory educational design sensitive to individual variability. Founded on the principles of universal architecture (Connell et al., 1997) and fueled by cognitive neuroscience (CAST, 2018; Meyer, Rose & Gordon, 2014), UDL articulates the three pillars of learning – representation, expression and involvement – in plural forms, capable of welcoming each student in his or her uniqueness (Dipace, 2014; Liodice, 2020).

Designing for all is a pedagogical and political act recognising diversity as an epistemological resource. In this vision, the teacher assumes the role of the relational weaver, capable of orchestrating knowledge, technologies and care (Mortari, 2015) to activate authentic and situated learning (Rivoltella, 2014a; 2014b; Sibilio, 2013).

The present paper intertwines two perspectives: a bibliometric analysis of UDL publications indexed in Scopus, carried out with VOSviewer (Van Eck & Waltman, 2010), and an empirical investigation based on AMOS tests (De Beni et al., 2014), aimed at exploring the cognitive, metacognitive and motivational profiles of students. The goal is to outline an educational model capable of transforming data into pedagogical action, building an educational ecosystem that welcomes and amplifies everyone's potential.

1. Theoretical framework and literature review

Every pedagogical theory guides educational action and, today, more than ever, to translate it into a transformative device. The proposed theoretical framework intertwines pedagogy, neuroscience, innovation and inclusion, configuring UDL as a flexible and fair paradigm based on ecosystem vision and creative and situated strategies (Biesta, 2013; Mortari, 2017; CAST, 2018).

1.1 Universal Design for Learning: origins, evolutions, perspectives

UDL represents a flexible and systemic response to the challenge of inclusion. Born from the encounter between universal architecture and cognitive neuroscience (CAST, 2018; Meyer, Rose & Gordon, 2014), it proposes a didactic design that anticipates the diversity of learning through multiple ways of access, expression and participation. From a disability-centered approach, it has evolved into a global framework for accessible and dynamic educational environments, applicable in the most diverse contexts, from experiential workshops to online universities (Espinoza-Ramos, 2024; Redstone & Luo, 2024). Its transformative scope is also recognised in specific disciplinary areas – from chemistry to physical education to computer science (Horna-Saldaña & Canaleta, 2024; Haegele et al., 2024; Salgarayeva & Makhanova, 2024) – and in complex geopolitical contexts, where it also assumes an ethical-political function (Banwari et al., 2023). Although supported by extensive evidence, the model today requires empirical consolidation and greater attention to implementation processes (Boysen, 2024; Craig, Smith & Frey, 2024). Not a prescriptive framework but an open epistemological framework, UDL calls for situated practices and reflective training, in which the role of teachers' and students' beliefs is decisive (Han & Lei, 2024).

1.2 Educational trust and adaptive ecosystems

Trust is at the root of authentic inclusion: not an affective inclination but an ethical posture recognising each student's transformable and value-carrying subject. This trust is not achieved through isolated technical tools but requires a pedagogical vision capable of reading diversity as a resource. UDL embodies this vision, founded on the idea that everyone can learn if educators design conditions to accommodate variability. As Han and Lei (2024) note, teachers' expectations shape opportunities for participation, while the perception of feeling valued directly affects self-efficacy (Redstone & Luo, 2024). The learning environment must be an adaptive ecosystem wherein biological, cognitive, relational and cultural factors coexist dynamically. Brain plasticity, a cornerstone of neuroscience, shows that learning requires stimulating and calibrated contexts (CAST, 2018), such as those promoted by UDL, which activates affective, cognitive and executive neural networks, facilitating self-regulation and motivation (Zhang et al., 2022). If integrated into a coherent design, educational technologies reinforce this approach, making the environment more responsive and personalised, as evidenced by using context-aware tools (Ayyal

Awwad, 2023). From this perspective, the school appears as a plastic organism capable of modulating its structure according to the real complexity of the class group (Bray et al., 2024).

1.3 Inclusive strategies between personalisation and creativity

In this context, teaching strategies are decisive in constructing truly inclusive environments. *Based on neuroscientific evidence, spaced learning alternates short and intense learning phases* with active pauses, facilitating memory consolidation and cognitive regulation (Basham et al., 2010). Integrated into UDL contexts, it effectively responds to the needs of vulnerable students, making the training load more sustainable. *Flipped Inclusion*, proposed by De Giuseppe and Corona (2017a; b), represents an evolution of the flipped classroom in an inclusive and relational key. Rooted in a systemic vision inspired by Morin (1999), Bronfenbrenner (2002) and Sibilio (2013), it anticipates access to content and transforms school time into a cooperative and reflective space. Expressive and autobiographical activities strengthen the sense of belonging and self-esteem, configuring the classroom as a learning community. *Artistic practices* – theatre, music, visual arts, and storytelling – activate bodily and emotional dimensions often excluded from the curriculum, offering alternative expressive channels that enhance subjectivity and resize failure (Glass, Meyer & Rose, 2013). Within the UDL framework, these approaches do not represent compensatory interventions but are tools to rethink educational architecture in a plural key. Common to all these strategies is the ability to generate flexible, welcoming and differentiated environments in which learning involves mind, body and emotion, making each student the protagonist of a possible and meaningful path.

1.4 State of the art: emerging trends in UDL literature

Over the past decade, research on UDL has evolved significantly, moving education towards a paradigm that anticipates diversity rather than corrects it. Bibliometric analyses on Scopus show a progressive transition from special education to a transdisciplinary approach, with repercussions on motivation and academic success (Almeqdad et al., 2023), but also with critical issues related to evaluation and implementation. Capp (2017) calls for overcoming the exclusive association between UDL and disability, while Fovet (2024) and Johnstone & Niad (2022) call

for the need to root the model in all cultural and political contexts. Integrating intelligent technologies, such as learning analytics and AI, opens new scenarios for personalisation (Roski et al., 2024) but requires attention to the primacy of the educational relationship. At the same time, a reflection on teaching professionalism as a transformative lever is making its way: the quality of implementation depends on the ability of schools to configure themselves as reflective and co-design environments (Griful-Freixenet et al., 2021; Molbæk & Hedegaard-Sørensen, 2023). The UDL is thus confirmed as a device in continuous redefinition, suspended between theoretical consolidation and experimental openness. The present research is placed in this liminal space to contribute to a truly universal education based not on normative abstractions but on deep listening, context and concrete transformation.

2. Methodology

The research adopts a Mixed Methods approach based on a complex and dialogical epistemological approach. The aim is to intertwine analytical rigour and interpretative depth, combining a bibliometric analysis of the literature on UDL (through Scopus and VOSviewer) with an empirical survey conducted on secondary school students using standardised AMOS questionnaires (Study Approach Questionnaire - SAQ, Questionnaire on Beliefs - QB, Anxiety and Resilience Questionnaire - ARQ). The bibliometric component has made it possible to map theoretical evolutions, conceptual nuclei and emerging trajectories; the empirical one explored school experiences, cognitive strategies and motivational dimensions. The methodological design enhances the interaction between theory and practice, which aligns with the vision of Creswell and Plano Clark (2018), according to which mixed methods not only broaden the understanding of educational phenomena but also generate deeper, situated, and transformative knowledge.

2.1 Bibliometric analysis: criteria, tools, observed period

The first phase reconstructed the theoretical evolution of the UDL model, investigating its trajectories and conceptual nodes. The search on Scopus, using the string “Universal Design Learning” applied to the title, abstract and keyword, covered the time frame 1999–2025, initially returning 5,335 results. An initial filter on the title field alone reduced the corpus to 546 publications, then further limited

to 426 contributions about the “Education” field. The analysis used VOSviewer (Van Eck & Waltman, 2010), software for constructing semantic maps and bibliographic networks. The survey identified distinct thematic clusters, co-occurrences between keywords, co-citation relationships and source density, offering an updated map of the scientific debate on UDL. In addition to the descriptive value, the analysis has taken on a heuristic and critical meaning, highlighting epistemological convergences, theoretical discontinuities and unexplored areas of research (Perianes-Rodríguez, Waltman & van Eck, 2016). Understood this way, bibliometrics functions as a hermeneutical and guiding tool, instrumental in grounding and supporting the subsequent empirical phase.

2.2 Empirical Detection

The second guideline involved the administration of three AMOS questionnaires (QB, SAQ, ARQ) to investigate school experiences, cognitive strategies and emotional and motivational dimensions. The survey took place in May and June 2024 via Google Forms anonymously and voluntarily, with the informed consent of the school institution and in compliance with ethical principles. The sample was selected for convenience, with stratification by year and address. Two groups from the “Regina Margherita” High School in Salerno participated¹: section A of the Human Sciences High School (mainly female and homogeneous in terms of educational orientation) and section L of the Linguistic High School, characterised by greater gender heterogeneity and a significant presence of students with diversified cultural and linguistic backgrounds. This differentiation enabled a comparative analysis of the data, which was aligned with the UDL perspective and focused on personalisation.

Although this is a case study (Trinchero, 2024), the results are not generalisable, and the methodology is transferable and replicable. There are some structural critical issues: the prevalence of women in a section, the inhomogeneity in voluntary adhesions and the variable number of responses. These variables, however, reflect the authentic complexity of the school context and reinforce the educational value of the survey.

¹ The authors would like to thank Director Angela Nappi for her availability to collaborate on the empirical research.

3. Bibliometric analysis: results and visualisations

3.1 Evolution of Scientific Production

The bibliometric analysis on the Scopus database returned a significant corpus of publications related to UDL, inclusive teaching and adaptive educational environments between 1999 and 2025 (Figure 1). To ensure the relevance of the sample, the research was restricted to papers featuring the key expression “Universal Design Learning” in the title to capture the most pertinent contributions aligned with the objectives of the present study.

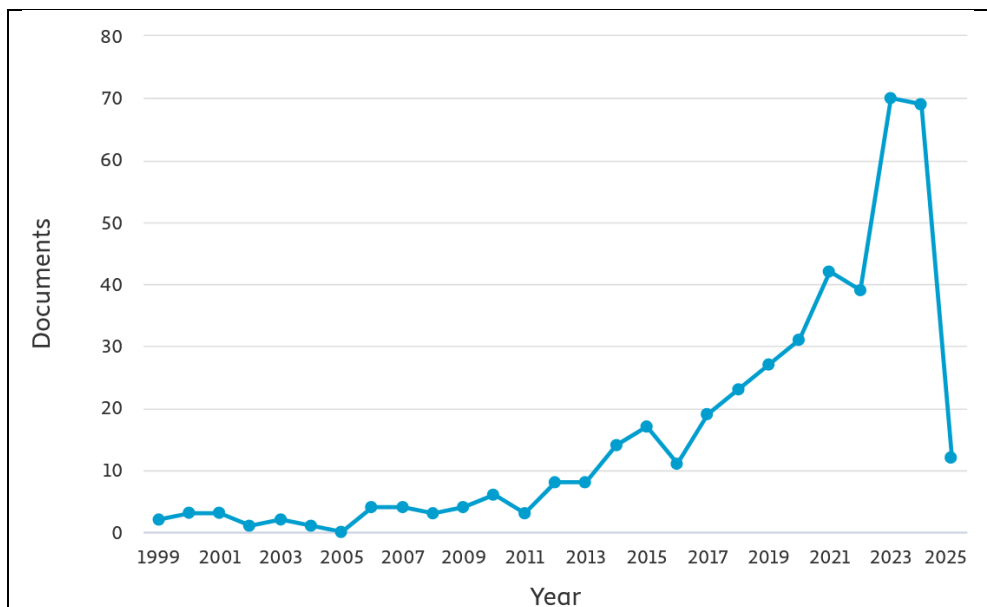


Figure 1. Documents by year. Source: Scopus

The evolution of scientific production shows quantitative growth, a progressive thematic coherence, and an increasingly solid theoretical articulation. Starting from 2015 - with a marked acceleration from 2019 - the publications are part of a paradigm in the process of epistemological consolidation, reflecting a maturation of the field. The peak between 2020 and 2024 coincides with a phase of intense critical elaboration prompted by educational crises and systemic transformations that have made it urgent to rethink models of access and participation. There is also a widening of application contexts and a greater geographical diffusion: from the school environment, UDL extends to higher education, vocational training and

digital design. The apparent decline in 2025 may be an effect of indexation delays rather than a sign of regression.

3.2 Research geography

The graph relating to the geographical distribution of publications (Fig. 2) shows an intense concentration in North America, with a predominance of the United States reflecting the origin and academic consolidation of the paradigm. What deserves attention, however, is the presence and absence: scientific production in this area excludes vast areas of the South of the world.

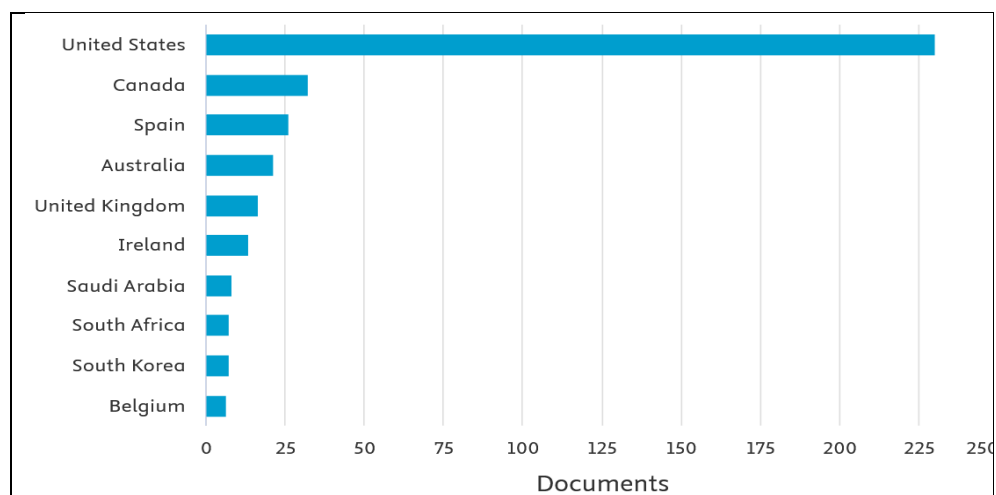


Figure 2. Documents by region or territory. Source Scopus

This asymmetry raises epistemological and political questions: who can define “inclusion”? Furthermore, who evaluates so-called “universal” pedagogical models? The risk of global standardisation of educational approaches developed in specific cultural and historical contexts, without adequate local mediation, is concrete and problematises the epistemic neutrality often attributed to UDL.

Bibliometric data thus become an opportunity to critically interrogate the geography of pedagogical knowledge, claiming an orientation towards cognitive justice. Promoting effective inclusiveness requires scientific production to be open to alternative knowledge, locally located visions and perspectives from historically subaltern contexts. The democratisation of UDL, understood not only as a didactic

model but also as a field of research, has passed through a radical expansion of epistemic plurality.

3.3 Types of Scientific Contributions

The typological composition of the scientific production (Figure 3) shows a strong academic orientation, with an apparent prevalence of peer-reviewed articles, against a scarce presence of freer or more popular discursive genres.

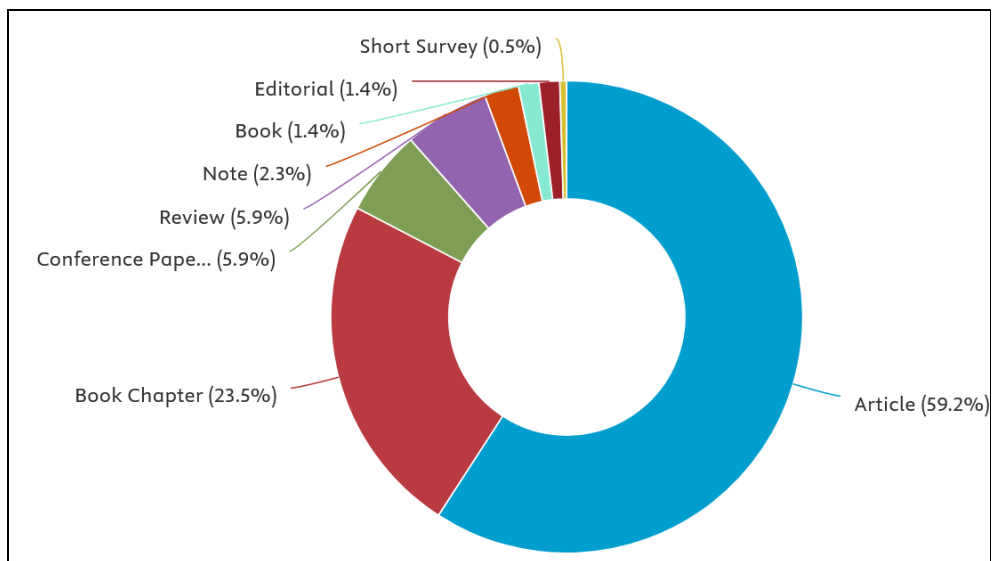


Figure 3. Documents by type. Source Scopus

This arrangement reflects a form of epistemic consolidation which, while guaranteeing rigour and validation, can limit the circulation of knowledge in concrete educational contexts. The figure, if read in parallel with the geographical distribution of production, reinforces this impression: the most productive countries — particularly the United States, the United Kingdom and Canada — are also confirmed as most aligned with Anglo-Saxon academic editorial logic, often oriented towards publication in indexed journals. The absence of a plurality of expressive and textual tools oriented towards transferring knowledge suggests the urgency of rethinking pedagogical dissemination formats to realise UDL's inclusive vocation through more accessible, dialogic and contextualised discursive mediations.

4. Bibliometric mappings

4.1 The most cited sources

The visual map generated with VOSviewer (Figure 4) shows the 426 most cited documents from 2007 to 2024, distinguishing them by size (number of citations) and colour (year of publication): dark blue represents studies prior to 2016, green those published in subsequent years, while yellow and light blue indicate the most recent research.

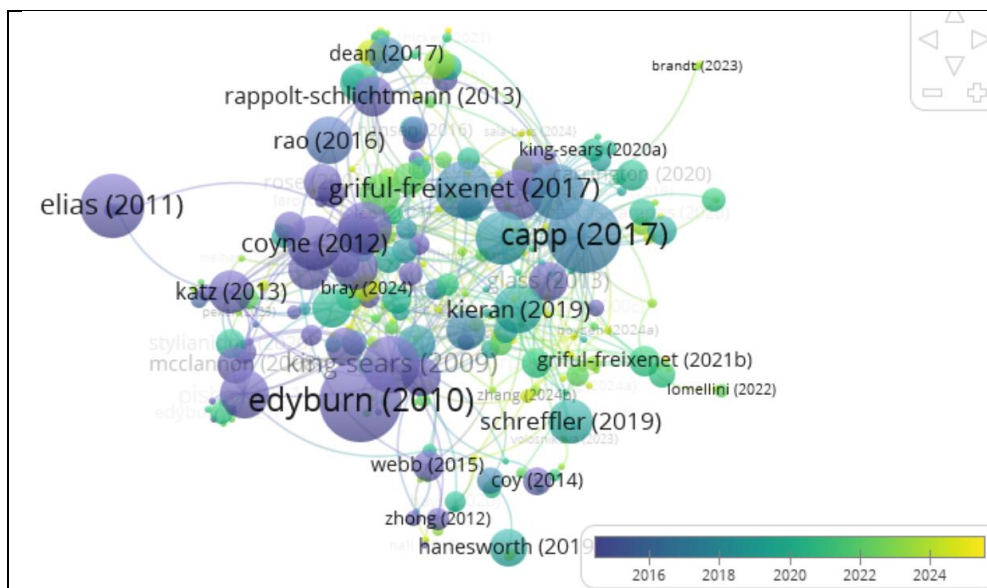


Figure 4. Most cited documents. Processed by Vosviewer

From a visual point of view, the map highlights central poles around which conceptual and citational networks are structured, with authors acting as epistemic nodes. Edyburn (2010), Capp (2017), and Griful-Freixenet (2017) stand out as wide spheres and dense connections characterise them, indicators of significant theoretical influence, and wide resonance. The density of connections signals the centrality of some contributions and their ability to generate dialogue between studies, favouring a shared language on educational inclusion. Alongside these, isolated but strongly cited figures emerge, such as Waitoller (2016), whose relevance derives from theoretical solidity rather than interconnection.

The cross-analysis with Table 1, relating to the ten most cited documents, confirms and deepens this evidence.

Id	Document	Citations	Links
1	Edyburn (2010)	245	1
2	Capp (2017)	200	44
3	Waitoller (2016)	163	0
4	Elias (2011)	146	1
5	King-Sears (2009)	119	28
6	Griful-Freixenet (2017)	117	14
7	Ok (2017)	114	36
8	Coyne (2012)	108	19
9	Rogers-Shaw (2018)	104	13
10	Spooner (2007)	102	33

Table 1. The ten most cited documents

The analysis reveals that Edyburn (2010), although the most cited author, is positioned at the periphery of the conceptual network, thereby confirming his role as a seminal contribution: a foundational reference often taken as a starting point but rarely integrated into the most recent theoretical paradigms. On the contrary, Capp (2017) emerges as a central hub, combining many citations and numerous connections: this configures him as a mediator between different lines of research, capable of updating and declining the UDL model in a current key. The case of Waitoller (2016) signals a relevant but isolated theoretical contribution, perhaps because it is critical or not yet assimilated into the dominant network. The presence of highly cited and strongly connected authors – such as Ok, Spooner and King-Sears – reflects a cohesive epistemic community around the UDL model. However, the absence of post-2019 contributions among the primary references (except for Bray, 2024) suggests a theoretical crystallisation that requires a renewed reflective impetus and a greater appreciation of the emerging literature.

4.2 Analysis and mapping of the 917 keywords

The VOSviewer concept map (Figure 5) returns the semantic structure of the search, showing the most frequent keywords and the strength of their connections. The size of the nodes indicates the frequency, while lines and intensities visualise the strength of the link strength.

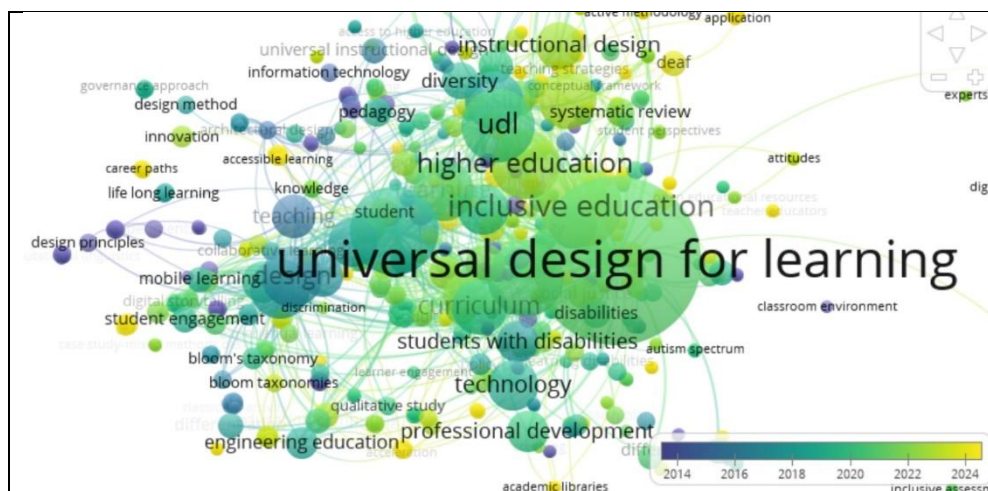


Figure 5. Keyword Map

The concept map highlights the centrality of Universal Design for Learning (UDL), around which a cohesive semantic ecosystem develops, indicative of a consolidated scientific community. The most interconnected terms —inclusive education, students with disabilities, higher education and instructional design — outline a shared orientation towards inclusion and instructional design in the academic field. The presence of peripheral keywords linked to digitisation (e.g. mobile learning, innovation) highlights the expansion of the model towards experimental technological scenarios. The recent emergence of accessibility, engineering education and student engagement signals a methodological evolution, especially in STEM contexts and teacher training. Overall, the field is theoretically solid but in transformation, with dominant conceptual cores well highlighted in Table 2 based on the frequency and strength of connections.

Id	Keyword	Occurrences	TLS
1	Universal design for learning	165	887
2	Universal design	46	488
3	Inclusive education	39	205
4	Inclusion	33	173
5	Udl	31	192
6	Higher education	28	126
7	Design	22	313
8	Learning	22	199

9	Students	21	283
10	Accessibility	20	123
11	Universal design for learning (UDL)	20	94
12	Curriculum	18	171
13	Disability	15	93
14	Technology	15	102
15	Education	14	156
16	Instructional design	13	70
17	Special education	13	57
18	Human	11	142
19	Teaching	11	119
20	Curricula	10	126
21	E-learning	10	145
22	Professional development	10	56
23	Students with disabilities	10	52

Table 2. Keywords by frequency and link strength

The keyword *universal design for learning* (165 occurrences, 887 link strength) signals the canonisation of the UDL paradigm as a theoretical reference for inclusion, flanked by terminological variants that reflect its adaptability to different educational contexts. Inclusion emerges as a thematic core, focusing on personalisation and removing barriers. Terms such as *higher education*, *curriculum* and *professional development* indicate a growing institutionalisation of UDL in education and university environments. The technological component, highlighted by keywords such as *technology*, *e-learning* and *accessibility*, suggests inclusion mediated by digital tools. Finally, the presence of the word *human* recalls the centrality of the relational dimension in an education-oriented towards humanisation.

Bibliometric analysis confirms UDL as a theoretical-operational paradigm for dealing with school heterogeneity. The recurring keywords highlight the urgency of accessible, personalised teaching that is attentive to the integration of technologies and the human dimension. Terms such as teacher training, curriculum, and disability outline UDL as a flexible but structured model oriented towards students' concrete needs. The dialogue with empirical data, a point of convergence between theory and inclusive practice, will verify these theoretical hypotheses.

5. Description of the tools and theoretical context

5.1. The Study Approach Questionnaire

The Study Approach Questionnaire (SAQ), part of the AMOS battery, is a standardised psychometric instrument consisting of 50 items on a 5-point Likert scale, aimed at investigating learning strategies, study organisation, metacognition and self-regulation, in line with the principles of UDL. SAQ allows the analysis of the three pillars of the UDL model: engagement (motivation), representation (cognitive processes) and action/expression (regulation and monitoring of strategies). The results show a good metacognitive awareness among students: the highest percentages focus on items related to the verification of comprehension, selective attention to key contents and self-assessment (Table 3).

	Value 1 (%)	Value 2 (%)	Value 3 (%)	Value 4 (%)	Value 5 (%)
Comprehension check	3.4	6.9	25.9	39.7	24.1
Self-assessment	1.7	12.1	22.4	48.3	15.5
Procrastination	37.9	27.6	15.5	17.2	1.7
Lack of planning	41.4	37.9	12.1	6.9	1.7
Organizational difficulties	39.7	34.5	12.1	8.6	5.2
Active comprehension	1.7	0.0	12.1	27.6	58.6
Selective attention	0.0	6.9	8.6	39.7	44.8

Table 3. The most representative answers

However, significant challenges emerge in procrastination, planning, and study organisation. Statistical analysis shows a polarisation: functional practices are widespread, while dysfunctional behaviours, although a minority, appear well outlined. The profile is favourable but points to organisational and motivational vulnerabilities that can compromise learning effectiveness without structured contexts. In terms of UDL, this evidence reinforces the need for flexible and personalised teaching strategies to enhance the current metacognitive resources and intervene in critical areas to strengthen autonomy and involvement. The following table summarises the percentage distribution of responses to a selected set of significant items.

5.2 The Questionnaire on Beliefs (motivational and self-efficacy)

The Questionnaire on Beliefs (QB) explored the motivational, cognitive and value dimensions of the school experience, involving 82 students out of 224 (36.6% adherence), with good spontaneous participation. Structured in six sections — conception of intelligence, vision of personality, confidence in one's abilities, perception of abilities and learning objectives — QB uses Likert scales, dichotomous choices and qualitative assessments to return an articulated motivational profile. The framework of UDL mainly allows us to investigate the engagement domain and offers ideas for representation and action/expression (Fig. 6).

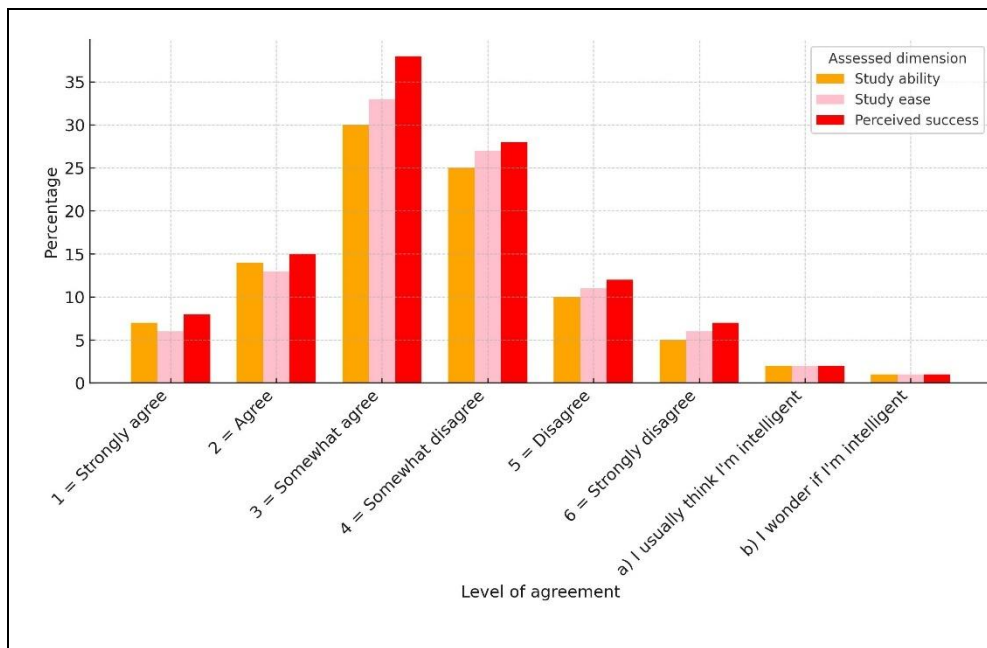


Figure 6. Self-assessment of academic abilities

The data indicate a prevalent adherence to an incremental vision of intelligence (64%), consistent with the growth mindset, and an overall prudent but positive self-perception: 68% rate themselves between sufficient and reasonable, while only 41% express complete confidence in their cognitive abilities. The orientation towards learning objectives reveals a marked trend towards confident performance: over 70% prefer easy or already known tasks, limiting cognitive exploration and using metacognitive strategies. This inclination towards safety suggests the influence of a school culture focused on the immediate outcome at the expense of developing skills such as resilience, critical thinking and adaptation. From a UDL perspective, this evidence reinforces the need for environments that

support self-efficacy, legitimise error and value learning as a process. The emerging convictions are configured as educational markers useful for orienting educational design towards challenging but accessible activities and can foster involvement, awareness, and a sense of evolutionary effectiveness.

5.3. The Anxiety and Resilience Questionnaire (ARQ)

The Anxiety and Resilience Questionnaire, consisting of 14 items on a 5-point Likert scale, explores two key dimensions of the school experience: on the one hand, dysfunctional emotions related to studying (anxiety, tension, fear of error); on the other, the personal resources to cope with them (resilience, self-esteem, self-confidence). In line with the theoretical framework of UDL, the tool allows for investigating the domains of engagement and action/expression, highlighting how emotions condition access to learning and implementing cognitive and behavioural strategies. Out of a sample of 82 students, the data show widespread performance anxiety: 31% report high levels of panic at the idea of a test, 45% say that anxiety compromises concentration, and over half report discomfort even at the thought of some subjects, indicating generalised emotional hyperactivation. However, on the positive side, good resilience emerges: 45% say they can cope with failure, more than 50% say they can recover after difficult moments, and about 60% show a medium-high ability to adapt (Fig. 7).

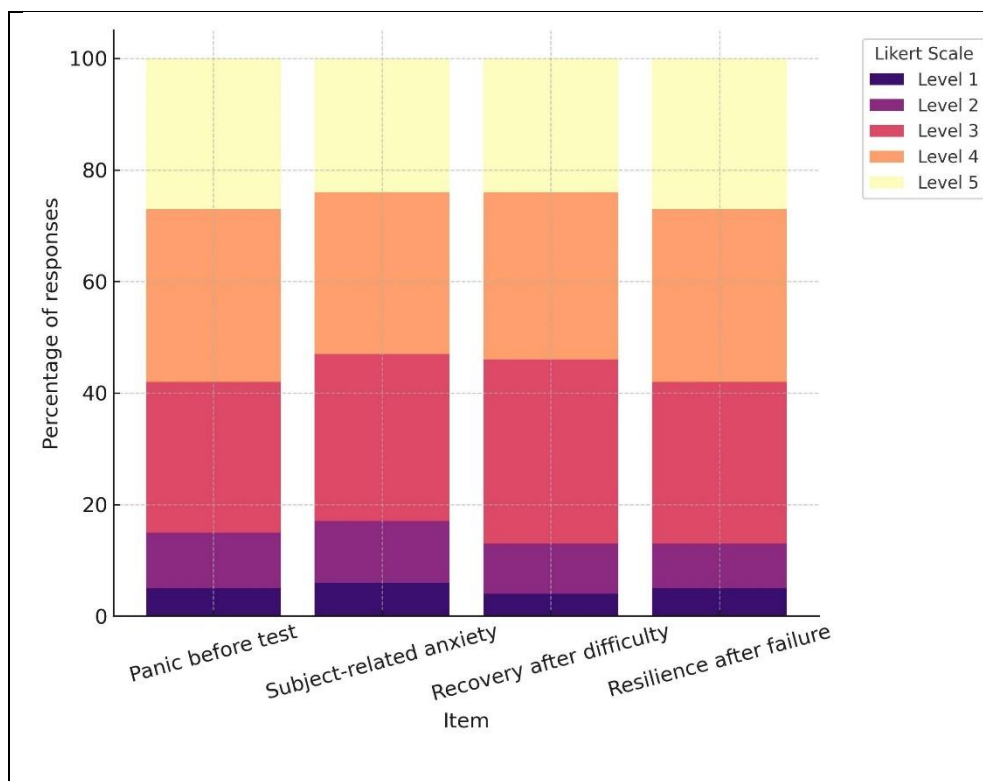


Figure 7. Anxiety and Resilience in Students

This balance between emotional fragility and adaptive resources suggests the need for school environments that reduce evaluation pressure, promote emotional regulation, and value error as a formative opportunity. From a UDL perspective, emotions are critical factors for inclusion: if neglected, they can become barriers to learning; if recognised and managed, they can turn into levers to build more welcoming, resilient and well-being-oriented educational environments.

6. From Diagnosis to Treatment: Integrating QB, SAQ, and ARQ for a Transformative UDL Intervention

The possibility of integrating three complementary psychometric tools - QB, SAQ and ARQ - to draw a complex, stratified and coherent profile of the students involved represents an added value. Each of these tools returns a distinct but interrelated lens.

The integrated analysis of the data (Fig. 8), combined with a critical reading of the literature through bibliometric analysis, provides a picture in which empirical data and scientific trends do not always overlap.

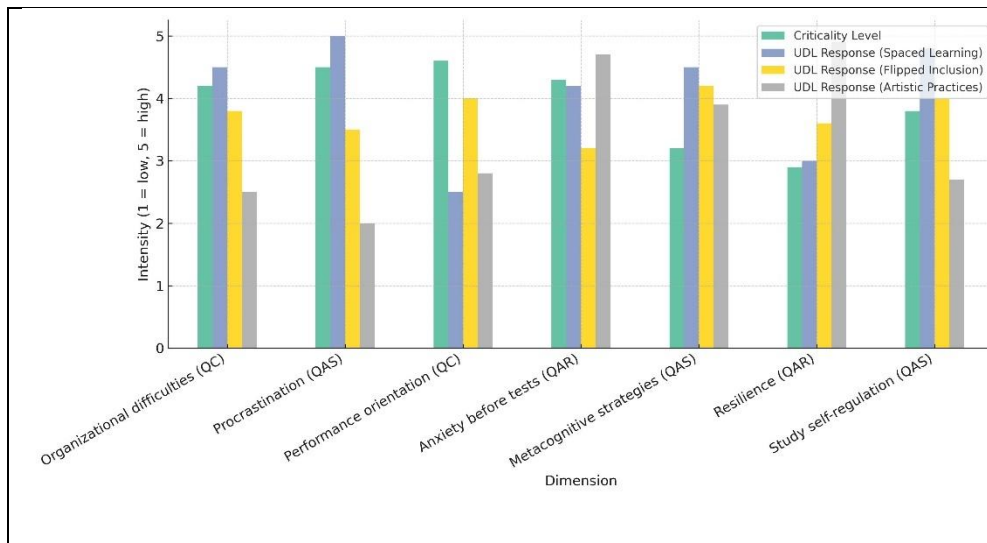


Figure 8. Criticalities vs UDL-Based interventions - QB, SAQ, ARQ

Bibliometrics confirms the growing centrality of UDL since 2020 but highlights its limitations related to geographical polarisation and formal standardisation, which risk excluding central experiential dimensions. Empirical data show transversal fragilities in students, including insecurity, procrastination and performance anxiety, in the face of a positive view of learning. In response, UDL proposes itself as an inclusive design paradigm capable of anticipating diversity and transforming vulnerabilities into educational resources. The three strategies – Spaced Learning, Flipped Inclusion and artistic practices – represent operational responses to the critical issues that have emerged, giving back to education the task of designing for all.

Thanks to its rhythmic and segmented structure, Spaced learning represents an effective strategy to intervene on the fragilities that emerged in the data in cases of disorganised learning, procrastination and difficulties in time management. The alternation between short, high-intensity sessions and active cognitive breaks promotes the sedimentation of content, improves attention and supports the acquisition of more conscious study strategies. Gradually introduced, this

methodology may be adapted to the educational level, disciplinary context, and specific characteristics of the class group, ultimately evolving into a routine practice of self-regulation.

A concrete example: in the presentation of the Industrial Revolution, the teacher can alternate synthetic exposure, recreational-mnemonic activities and moments of re-elaboration, reducing hoarding anxiety and promoting distributed and sustainable learning.

Flipped Inclusion, an inclusive evolution of the flipped classroom, on the other hand, addresses the dimensions of personalisation and relational care. Offering accessible and differentiated materials for self-study allows students to learn at their own pace and cognitive styles. This methodology entirely unfolds its potential in the educational field since transitioning from the traditional lesson allows for reconfiguring classroom time into a space for reflection, re-elaboration and active involvement.

In this context, the teacher assumes the role of an empathic facilitator, capable of orchestrating knowledge by enhancing the contribution of each one and promoting shared metacognitive processes.

Finally, artistic practices offer privileged access to the deepest and often neglected dimensions of school discomfort: the emotional ones. Activities such as theatre, music (Coppi, 2017; 2020), visual arts, and storytelling reduce anxiety and promote self-construction, intersubjective sharing, and reworking mistakes as opportunities for growth. Included in the curriculum or proposed as transversal laboratories, they represent spaces for decompression and identity regeneration for students who struggle to find a place of belonging in school. An emblematic example: after a lesson on the theme of migration, students can create an artistic collage on the journey and the encounter between cultures, transforming the experience into a personal and collective narrative. These practices, well rooted in the UDL approach, support authentic engagement and restore value to diversity as an expressive and pedagogical resource.

These strategies reflect a generative design that values subjective complexity. The teacher becomes a curator of possibilities and a promoter of inclusive environments. Research must also go beyond standardised logic, moving towards a universality that recognises and values difference. Only in this way can education truly include and emancipate.

7. Conclusions

The results that emerged from the triangulation between psychometric tools (SAQ, QB, ARQ), bibliometric analysis and educational practices outline an articulated picture in which the transformative potential of UDL assumes not only methodological but epistemic relevance. The fragilities highlighted — anxiety, insecurity, discontinuous self-regulation, orientation towards safe performance — are not exceptions to be corrected but signs of an educational system that struggles to accommodate the complexity of the subjects. UDL appears as a systemic response to this challenge: not an ex-post adaptation but an intentional design of inclusion, capable of anticipating needs, removing barriers and valorising resources. Integrating Spaced Learning, Flipped Inclusion, and artistic practices does not represent a mere summation of approaches but a synergistic vision recognising the interdependence between cognition, emotion and relationship. From this perspective, the learning environment is no longer the neutral container of knowledge but the first pedagogical device the educator must design with care, intentionality and awareness. At the centre of this process, the teacher does not act as an executor of protocols but as a transformative mediator, promoter of agency, and architect of contexts where each student can experience belonging, recognition and growth. The evidence collected asks the research to go beyond the rhetoric of abstract universality to move towards a universality embodied in difference. Only in this way can education become truly inclusive: not as a normative device, but as a practice of daily justice, capable of generating possibilities where there were previously obstacles. An education that does not limit itself to instructing but that heals, accompanies, transforms, and, ultimately, liberates.

Author contributions

This article is the result of the joint work of the two authors. However, it is possible to attribute the paragraphs ‘Introduction,’ ‘Theoretical Framework and Literature Review,’ and ‘Conclusions’ to *Antonella Coppi*, as she provided the fundamental indications of the research and developed the final reflections. *Sabrina Lucilla Barone* outlined the methodology and carried out bibliometric and bibliographic research. The other paragraphs are, therefore, to be attributed to her.

References

- Almeqdad, Q., Al Khateeb, J., Al-Sabbah, S., & Khatib, A. (2023). Universal design for learning: A systematic review and meta-analysis. *Journal of Education and Learning*, 12(2), 112-130.
- Ayyal Awwad, A. M. (2023). A universal design for an adaptive context-aware mobile cloud learning framework using machine learning. *Journal of Mobile Multimedia*, 19(3), 707–738. <https://doi.org/10.13052/jmm1550-4646.1934>
- Banwari, A. R., Dambisya, P., Khumalo, B., & van Tonder, K. (2023). A design justice approach to Universal Design for Learning: Perspectives from the Global South. In A. P. Mooney, J. A. Reiss, & P. Wake (Eds.), *Higher education for good: Teaching and learning futures* (pp. 373–395). Open Book Publishers. <https://doi.org/10.11647/OBP.0363.16>
- Basham, J. D., Israel, M., Graden, J., Poth, R., & Winston, M. (2010). A comprehensive approach to RTI: Embedding Universal Design for Learning and technology. *Learning Disability Quarterly*, 33(4), 243–255. <https://doi.org/10.1177/073194871003300403>
- Biesta, G. (2013). *The Beautiful Risk of Education*. Routledge.
- Boysen, G. A. (2024). A critical analysis of the research evidence behind CAST's universal design for learning guidelines. *Policy Futures in Education*, 22(7), 1219–1238. <https://doi.org/10.1177/14782103241255428>
- Bray, A., Devitt, A., Banks, J., Sanchez Fuentes, S., Sandoval, M., Riviou, K., Byrne, D., Flood, M., Reale, J., & Terrenzio, S. (2024). What next for Universal Design for Learning? A systematic literature review of technology in UDL implementations at second level. *British Journal of Educational Technology*, 55(1), 113–138. <https://doi.org/10.1111/bjet.13328>
- Bronfenbrenner, U. (2002). *Ecologia dello sviluppo umano*. Il Mulino.
- Capp, M. J. (2017). The effectiveness of Universal Design for Learning: A meta-analysis of literature between 2013 and 2016. *International Journal of Inclusive Education*, 21(8), 791–807.
- CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. CAST
- Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., & Vanderheiden, G. (1997). *The principles of universal design*. Center for Universal Design, North Carolina State University.

- Coppi, A. (2017). *Community Music. Nuovi orientamenti pedagogici*. FrancoAngeli.
- Coppi, A. (2020). L'arte come strumento ponte per apprendere nelle piccole scuole. *Formazione & Insegnamento*, 18(1s), 182–191.
- Coyne, P., Pisha, B., Dalton, B., Zeph, L. A., & Smith, N. C. (2012). Literacy by Design: A Universal Design for Learning Approach for Students With Significant Intellectual Disabilities. *Remedial and Special Education*, 33(3), 162–172.
- Craig, S. L., Smith, S. J., & Frey, B. B. (2022). Professional development with Universal Design for Learning: Supporting teachers as learners to increase the implementation of UDL. *Professional Development in Education*, 48(1), 22–37. <https://doi.org/10.1080/19415257.2019.1685563>
- De Beni, R., Moè, A., Cornoldi, C., Meneghetti, C., Fabris, M., Zamperlin, C., & De Min Tona, G. (2014). *AMOS: Abilità e motivazione allo studio. Prove di valutazione e orientamento per la scuola secondaria di secondo grado e l'università* (Nuova ed.). Erickson.
- De Giuseppe, T., & Corona, F. (2017a). Flipped Inclusion, Between Theoretical and Experimental Didactics: For an Existential Model of Inclusive Personality. *International Journal of Digital Literacy and Digital Competence*, 8(1), 50–59. <https://doi.org/10.4018/IJDLDC.2017010104>
- De Giuseppe, T., & Corona, F. (2017b). *La classe capovolta: Innovare la didattica con la flipped classroom*. FrancoAngeli.
- Dipace, A. (2014). Formare i docenti alla didattica inclusiva attraverso le ICT. In D. Dato (a cura di), *La sfida dell'inclusione. Competenze e formazione nella scuola dell'infanzia* (pp. 157–172). Progedit.
- Edyburn, D. L. (2010). Would you recognise Universal Design for Learning if you saw it? Ten propositions for new directions for the second decade of UDL. *Learning Disability Quarterly*, 33(1), 33–41.
- Elias, T. (2011). Universal Instructional Design Principles for Mobile Learning. *International Review of Research in Open and Distance Learning*, 12(2), 143–156.
- Espinoza-Ramos, G. R. (2024). Making education for sustainable development (ESD) more inclusive and engaging through universal design for learning (UDL): A case study at the Westminster Business School. In W. Leal Filho, A. M. Azul, L. Brandli, P. G. Özuyar, & T. Wall (Eds.), *An agenda for sustainable development research* (pp. 651–669). Springer. https://doi.org/10.1007/978-3-031-65909-6_36

Fovet, F. (2024). *Cases on effective Universal Design for Learning implementation across schools*. IGI Global. <https://doi.org/10.4018/978-1-6684-4750-5>

Glass, D., Meyer, A., & Rose, D. H. (2013). Universal Design for Learning and the arts. *Harvard Educational Review*, 83(1), 98–119. <https://doi.org/10.17763/haer.83.1.33102p26478p54pw>

Griful-Freixenet, J., Struyven, K., Vantieghem, W., & Gheysens, E. (2021). Teacher beliefs about UDL and inclusive practices: A cross-national study. *European Journal of Special Needs Education*, 36(3), 456–472.

Haeghele, J. A., Holland, S. K., Wilson, W. J., Maher, A. J., Kirk, T. N., & Mason, A. (2024). Universal design for learning in physical education: Overview and critical reflection. *European Physical Education Review*, 30(2), 250–264. <https://doi.org/10.1177/1356336X231202658>

Han, J., & Lei, Y. (2024). Teachers' inclusive beliefs and UDL practices. *Educational Studies*, 50(1), 88–102.

Horna-Saldaña, C., & Canaleta, X. (2024). Application of Universal Design for Learning and digital fabrication in the creation of a tool for inclusive teaching of the ordering of chemical elements. *Journal of Chemical Education*, 101(12), 5261–5271. <https://doi.org/10.1021/acs.jchemed.4c00679>

Johnstone, C. J., & Niad, T. (2022). UDL as a travelling concept: A global analysis. *International Review of Education*, 68(2), 155–174.

King-Sears, M. (2009). Universal Design for Learning: Technology and pedagogy. *Learning Disability Quarterly*, 32(4), 199–201.

Loiodice, I. (a cura di). (2018). *Pedagogie. Sguardi plurali sul sapere dell'educazione*. Progedit.

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal Design for Learning: Theory and Practice*. CAST Professional Publishing.

Molbæk, M., & Hedegaard-Sørensen, L. (2023). Teachers' agency in inclusive education through the lens of UDL. *Scandinavian Journal of Educational Research*, 67(4), 579–594.

Morin, E. (1999). *La testa ben fatta: Riforma dell'insegnamento e riforma del pensiero*. Cortina Editore.

Mortari, L. (2015). *Filosofia della cura*. Raffaello Cortina Editore.

Ok, M. W., Rao, K., Bryant, B. R., & McDougall, D. (2017). Universal Design for Learning in Postsecondary Education: A Systematic Review of Empirical Research. *Journal of Postsecondary Education and Disability*, 30(3), 209–223.

Perianes-Rodríguez, A., Waltman, L., & van Eck, N. J. (2016). Constructing bibliometric networks: A comparison between full and fractional counting. *Journal of Informetrics*, 10(4), 1178–1195. <https://doi.org/10.1016/j.joi.2016.10.006>

Redstone, A. E., & Luo, T. (2024). Empowering learners in higher education: Redesigning an online computer science course through Universal Design for Learning implementation. *TechTrends*, 68(5), 869–881. <https://doi.org/10.1007/s11528-024-00980-z>

Rivoltella P. C. (2014a). Episodes of Situated Learning. A New Way to Teaching and Learning. *Research On Education And Media*, 6(2), 79–88.

Rivoltella, P. C. (2024b). *Neurodidattica. Insegnare al cervello che apprende* (2^a ed.). Raffaello Cortina.

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal Design for Learning: Guidelines for Accessible Online Instruction. *Adult Learning*, 29(4), 155–166.

Roski, M., Sebastian, R., Ewerth, R., Hoppe, A., & Nehring, A. (2024). Learning analytics and the Universal Design for Learning (UDL): A clustering approach. *Computers & Education*, 214, Article 105028. <https://doi.org/10.1016/j.compedu.2024.105028>

Salgarayeva, G., & Makhanova, A. (2024). Making computer science accessible through Universal Design for Learning in inclusive education. *International Journal of Engineering Pedagogy*, 14(5), 109–122. <https://doi.org/10.3991/ijep.v14i5.48811>

Sibilio M. (2013). *La didattica semplessa*. Liguori.

Spooner, F., Baker, J. N., Harris, A. A., Delzell, L. A., & Browder, D. M. (2007). Effects of Training in Universal Design for Learning on Lesson Plan Development. *Remedial and Special Education*, 28(2), 108–116.

Trinchero, R. (2024) *Lo studio di caso*. In <https://pedagogiasperimentaleonlinefe.wordpress.com/lo-studio-di-caso/> (ultimo accesso 29/04/2025).

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538.

Waitoller, F. R., & Thorius, K. A. (2016). Cross-pollinating Culturally Sustaining Pedagogy and Universal Design for Learning. *Review of Research in Education*, 40(1), 311–336.

Zhang, Y., Choi, Y., & Lee, M. (2022). Personalised learning environments based on UDL principles: Effects on self-regulation and motivation. *Educational Technology Research and Development*, 70(2), 775–794.