

Towards an Integrated Perspective on Inclusive Pedagogy through a Bibliometric and Conceptual Synthesis of Culturally Sustaining Pedagogy and Universal Design for Learning

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ABSTRACT

Inclusive education requires pedagogical approaches that address both the cultural diversity of learners and structural barriers to participation. This study examines the development and emerging convergence of Culturally Sustaining Pedagogy (CSP) and Universal Design for Learning (UDL), two influential frameworks that have largely evolved through distinct scholarly traditions. A bibliometric analysis of Scopus-indexed literature was conducted using performance analysis and science mapping, including publication trends, source distributions, country co-authorship, keyword co-occurrence, and co-citation analysis. The findings reveal contrasting but complementary trajectories: CSP has expanded rapidly through scholarship centred on cultural identity, equity, and social justice, whereas UDL has developed more cumulatively through accessibility, learner variability, and inclusive instructional design. Keyword and co-citation networks further indicate increasing intellectual connections between the two traditions while retaining their distinct theoretical foundations. The study argues that this convergence represents an emerging integrated perspective on inclusive pedagogy in which CSP contributes cultural legitimacy and epistemic justice, while UDL contributes structural accessibility and proactive barrier reduction. Future research should empirically examine this integration across diverse educational contexts, particularly technology-enhanced and AI-mediated learning environments.

Keywords: Culturally Sustaining Pedagogy; Universal Design for Learning; inclusive pedagogy; bibliometric analysis

INTRODUCTION

The global impact of the COVID-19 pandemic necessitated a rapid transition among educators to online pedagogical frameworks, posing significant challenges for courses that relied on classroom-based practical applications (Jones et al., 2021). Consequently, Culturally Sustaining Pedagogy (CSP) and Universal Design for Learning (UDL) have gained increasing attention as complementary approaches for supporting inclusive teaching and learning. Together, these frameworks seek to address educational equity by recognising learner diversity across cultural, linguistic, cognitive, and functional dimensions (Paris, 2012). As educational institutions continue to serve increasingly diverse student populations in both face-to-face and digitally mediated environments, questions surrounding equity, accessibility, participation, and belonging have become central to contemporary educational research and practice.

Previous scholars have highlighted the complementary strengths of CSP and UDL and advocated greater integration between the two frameworks (Hanesworth et al., 2018; Waitoller & Thorius, 2016). CSP provides a

critical perspective for recognising and sustaining learners' cultural identities, languages, and ways of knowing, whereas UDL offers a systematic design framework that proactively removes barriers to learning through multiple means of engagement, representation, and expression (Hanesworth et al., 2018). Despite this conceptual complementarity, the two frameworks have largely evolved as parallel traditions within educational research. Consequently, scholarship has tended to emphasise either cultural responsiveness or accessibility rather than examining how both dimensions can be intentionally integrated, particularly within higher education and technology-enhanced learning environments (Garrað & Nolan, 2022). This separation has limited the development of pedagogical approaches capable of addressing the multidimensional nature of learner diversity.

Addressing this gap has become increasingly important as institutions pursue inclusive education agendas aligned with global equity and sustainability goals. Rather than viewing CSP and UDL as independent pedagogical approaches, this review argues that their growing convergence reflects an emerging direction for inclusive education in which culturally sustaining practices and accessible instructional design should be understood as complementary dimensions of educational equity. Using bibliometric analysis, this study moves beyond describing publication trends to interpret how the intellectual development of both traditions has evolved, where they intersect, and how their convergence provides a foundation for a more integrated understanding of inclusive pedagogy.

LITERATURE REVIEW

Culturally Sustaining Pedagogy

Culturally Sustaining Pedagogy (CSP) constitutes an extension of prior conceptualisations of culturally responsive and relevant pedagogy, positing education as a critical locus for the perpetuation, rather than the displacement, of the cultural and linguistic practices inherent to historically marginalised student populations (Paris, 2012). Paris (2012) contends that prevailing educational systems frequently normalise monocultural and monolingual norms, thereby potentially framing alternative cultural practices as deficits. CSP contested this position through the assertion that students' linguistic repertoires, identities, and communal practices represent dynamic assets warranting legitimisation and perpetuation within formal educational contexts (Paris, 2012).

Further scholarship has reinforced CSP as both a pedagogical and ideological shift. CSP has been conceptualised as a critical framework that focuses on communities and resists assimilationist education structures, particularly under conditions of increasing standardisation and accountability pressures (Budnyk, 2023). Empirical studies have suggested the operationalisation of CSP in practice through the integration of students' funds of knowledge, culturally grounded discourse practices, and identity-affirming learning activities (Esteban-Guitart et al., 2019). In early childhood and multilingual contexts, CSP has been shown the disruption of deficit-oriented language policies and the reframing of linguistic diversity as pedagogical capital rather than a barrier to achievement (Dunham et al., 2024). Recent work appears to have expanded CSP into disciplinary contexts, including mathematics, technology, and digital learning environments, highlighting its relevance beyond humanities-oriented curricula (Marshall, 2023), emphasizing that sustaining students' identities in technical and STEM-related fields necessitates a reconsideration of both content exemplars and the epistemic norms governing legitimate knowledge and competence; collectively, this body of literature positions CSP as a justice-oriented pedagogical stance that foregrounds cultural legitimacy, identity affirmation, and community continuity as a focus for meaningful learning.

Universal Design for Learning

Universal Design for Learning (UDL) emerged from cognitive neuroscience and architectural principles of universal design and appears to aim at the proactive reduction of barriers to learning through flexible instructional planning (Dalton et al., 2019). Rather than being designed for specific groups, UDL advances the conceptualisation of learning environments that furnish multiple avenues for engagement, representation, and action or expression, thereby addressing learner variability from the beginning.

Studies in higher education have consistently highlighted UDL's potential to enhance access, participation, and belonging, particularly for students with disabilities (Griful-Freixenet et al., 2017). Studies link UDL implementation fidelity to measurable gains in student engagement, achievement, and sense of belonging (Canter et al., 2017), suggesting that superficial or symbolic adoption of UDL principles may result in limited impact (Fovet, 2021).

At the institutional level, several studies delineated faculty beliefs, professional development, workload, and policy alignment as critical determinants of UDL adoption. A systematic review by Wahyuni et al. (2025) suggests that, while UDL awareness demonstrates an increment, sustained implementation is frequently impeded by limited institutional support and insufficient pedagogical training. Similar findings are reported in professional and discipline-specific programs, such as nursing education, where audits of inclusive practice reveal discrepancies between UDL principles and the implementation of teaching strategies (Gilmore & Browne, 2025). Digital technologies are frequently positioned as facilitators of UDL. However, evidence suggests that technology alone does not guarantee inclusivity unless it is intentionally aligned with pedagogical flexibility and learners' choice (Bucheli et al., 2024). The incorporation of culturally responsive pedagogy in early childhood education, demonstrated through Ghanaian ethno-cultural practices such as storytelling and traditional songs and rhymes, may foster the development of children's comprehension of cognitive concepts, language, literacy, and moral development (Thompson, 2019). Extending inclusivity into the digital domain, intelligent agents powered by large language models are being explored for their potential to support students with disabilities by integrating personalised chatbots that enhance participation, while emphasising human-centred design principles such as accessibility, learner agency, and sensitivity to sociocultural contexts (Ballantyne et al., 2025; Zhang et al., 2025).

In summation, investigations into CSP and UDL delineate a critical requirement for effective contemporary education: a balanced integration of cultural relevance, inclusivity, and responsible technological application, which collectively ensure equitable learning outcomes for all learners. These studies underscore the imperative of designing inclusive, culturally responsive, and equitable learning environments through the integration of CSP, UDL, contextual relevance, and advanced technologies. This holistic methodology consequently ensures that educational practices not only acknowledge but also actively leverage the diverse backgrounds and cognitive profiles inherent among all students, thereby fostering the development of a more robust and equitable learning ecosystem. Table 1 provides a comparative analysis of the distinct characteristics and complementary functions of CSP and UDL.

Table 1 Comparison of Culturally Sustaining Pedagogy and Universal Design for Learning

Characteristic	Culturally Sustaining Pedagogy	Universal Design for Learning
Focus	Sustenance of cultural and linguistic practices	Reduction of barriers to learning
Approach	Critical framework; an equity-centered orientation	Proactive instructional planning
Key Principles	Legitimation and sustenance of student cultures	Multiple means of representation, engagement, and action
Application	Integration of funds of knowledge and identity	Enhancement of access, participation, and belonging
Challenges	Standardisation limits, curriculum rigidity	Uneven implementation and symbolic adoption
Technology	Digital cultural tools and heritage platforms	Enabler of pedagogical flexibility and learner choice

Collectively, the reviewed literature suggests that CSP and UDL have developed from different theoretical traditions but increasingly address complementary educational concerns. CSP contributes a critical perspective by foregrounding cultural identity, linguistic diversity, and epistemic justice, whereas UDL contributes a design-oriented framework that seeks to remove barriers to learning through flexible instructional planning. Neither framework alone fully addresses the multidimensional nature of learner diversity. Considered together, they provide a broader understanding of inclusive education that recognises both the legitimacy of learners'

identities and the accessibility of learning environments. The present bibliometric review therefore examines how these two traditions have evolved, where they intersect, and what their convergence implies for the future development of inclusive pedagogical theory and practice.

METHODOLOGY

This study conducts a bibliometric analysis to delineate the trends of CSP and UDL, which may provide a longitudinal, citation-based proxy for the evolution and thematic convergence of these pedagogical paradigms. This study strategically leveraged Scopus as the primary data reservoir, a prioritisation stemming from its superior metadata granularity and standardised citation metrics within the social sciences, ensuring high-fidelity cross-referencing and data integrity. The search parameters encompassed a temporal window of 1999 to the present, restricting document types to peer-reviewed journal articles, conference proceedings, and reviews in English to maintain academic rigor. This structured acquisition phase establishes the raw corpus required for meticulous data cleaning, a process in which the precision of metadata refinement directly dictates the validity of subsequent algorithmic clustering. To understand how CSP and UDL grow and connect with each other, this study used one main method which is bibliometric analysis. The bibliometric method allowed us to measure publication patterns, citation networks, and common themes across both areas. The conceptual synthesis then helped explain these patterns within the larger discussion on inclusive teaching. The data extracted from the Scopus database, which was chosen because it covers peer-reviewed education research thoroughly and provides detailed document data. The study searched for publications using the query string TITLE-ABS-KEY("Culturally Sustaining Pedagogy" OR "Universal Design for Learning" OR "inclusive pedagogy" OR "bibliometric analysis"). The search timeframe was set from 2012 to 2026 to track the growth of CSP alongside recent developments in UDL. This initial search returned 474 total records.

Next, the study applied specific rules to narrow down the documents. The study included only English-language publications from the teaching and learning subject area across all document types. During the screening process, we removed 145 records that did not meet these rules, mainly because they were not written in English. This left a final set of 329 documents for our analysis. The data analysis took place in two steps. First, performance analysis measured basic indicators such as publication growth over time, main journal sources, and international co-authorship networks to show how both frameworks have expanded globally. Second, science mapping used keyword co-occurrence and co-citation methods. Keyword co-occurrence revealed shared topics and connecting terms, while co-citation analysis tracked the original theories behind each approach. Together, these steps provided clear evidence of how CSP's focus on cultural identity connects with UDL's focus on accessibility and removing learning barriers. Establishing methodological precision necessitates a structured screening workflow to transmute raw bibliographic metadata into a validated dataset suitable for algorithmic synthesis and scholarly replication. Post-retrieval, the records underwent a multi-stage refinement protocol involving deduplication, manual relevance filtering of titles and abstracts, and exhaustive verification of bibliographic completeness. This curation is imperative for neutralising bias within the dataset and which may preclude the artificial inflation of bibliometric indicators by redundant entries or tangential metadata. By adhering to these standardised verification techniques, the study mitigates selection bias and strengthens the structural integrity of the refined metadata, which serves as the essential technical precursor for deploying sophisticated science mapping computational tools.

The analytical architecture employs a bifurcated approach of performance analysis and science mapping to elucidate the historical trajectory and thematic consolidation of the CSP and UDL frameworks. Performance analysis quantifies annual publication trajectories and source distributions, while science mapping is operationalised with VOSviewer to conduct multi-dimensional cluster analyses. Specifically, co-citation analysis is used to map the intellectual genealogy and seminal foundations shared by these frameworks, while keyword co-occurrence identifies the emerging conceptual frontiers and interdisciplinary linkages. The resulting network maps and cluster structures provide a high-resolution visualisation of the rapid expansion of CSP scholarship alongside the steady maturation of UDL, transforming disparate citation data into a coherent roadmap of the field's intellectual structure. This data-driven foundation facilitates a sophisticated interpretation of the literature's evolution, ultimately the identification of future directions for inclusive and equitable educational research. Figure 1 shows the infographic of the methodology employed.

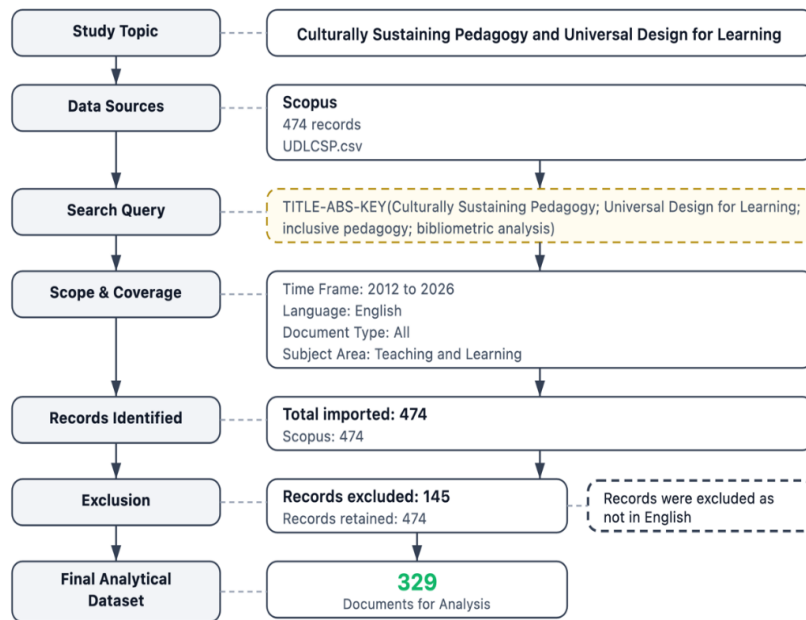


Figure 1 Bibliometric Study Flow Diagram

FINDINGS

The annual distribution of publications on CSP shown in Figure 2 reveals a distinct surge followed by a period of stabilisation. Output remained modest in the early part of the observed period, with moderate publication counts between 2020 and 2022. A marked increase is evident in 2025, where the number of indexed documents more than doubled compared to preceding years. This sharp rise may indicate heightened scholarly engagement and potentially reflect broader educational debates surrounding equity, cultural identity, and post-pandemic pedagogical reform. After this peak, publication numbers appeared to taper slightly, yet its quantity persisted at a substantially elevated level compared to pre-2025 figures. This observed pattern suggests a transition of CSP from an emergent topic toward a more established field of inquiry. Rather than manifesting a sharp decline subsequent to its peak, the field appears to demonstrate indications of consolidation, wherein research output stabilised while theoretical refinement and empirical diversification likely persist. Overall, the observed trajectory might suggest CSP's increasing centrality within contemporary educational discourse. The sustained attention in recent years may indicate that scholars are not only responding to sociocultural shifts but are also integrating CSP within broader frameworks, such as those pertaining to curriculum design, teacher preparation, and policy reform.

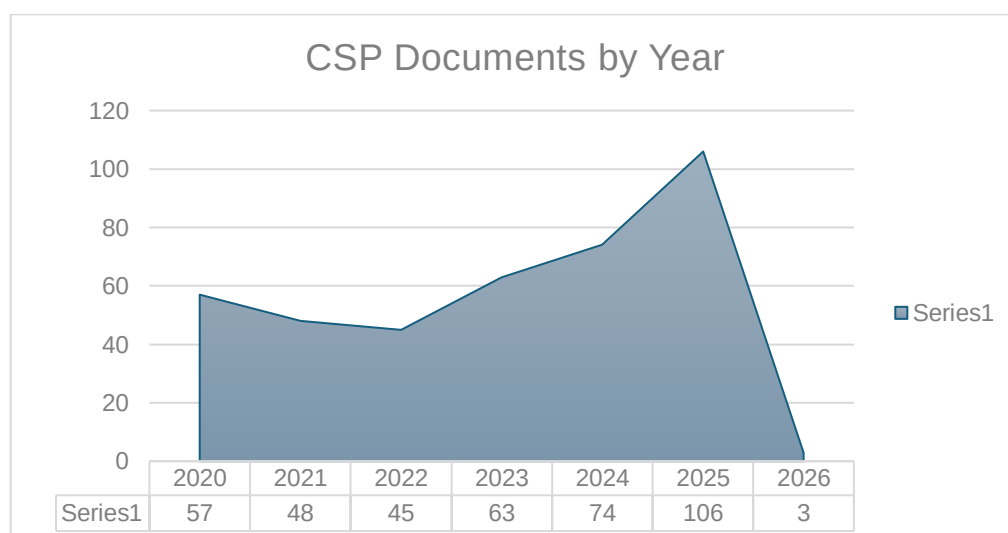


Figure 2 CSP Documents by Year

Beyond illustrating publication growth, the observed trajectory suggests the progressive institutionalisation of CSP within educational research. The rapid increase in publications reflects more than heightened academic interest; it indicates that issues of cultural identity, linguistic diversity, and educational justice have become central concerns in contemporary pedagogical discourse. The subsequent stabilisation of publication output further suggests that CSP is transitioning from an emerging area of scholarship towards a mature research domain characterised by continued theoretical refinement and broader application across educational contexts.

In contrast to CSP, UDL demonstrates a more protracted and incremental developmental trajectory. Publication output shown in Figure 3 steadily increased, reaching its highest point in 2025 based on data available up to April 2026. This pattern reflects cumulative scholarly momentum rather than a sudden spike, highlighting UDL's sustained presence in discussions of accessibility, inclusion, and differentiated instruction. This pattern does not signify a diminution of its relevance but rather may reflect a maturation phase in which foundational frameworks are well-established and subsequent studies focus on application, contextual adaptation, and integration with other pedagogical models. The broader trend, therefore, indicates UDL's transition from a nascent innovation to a broadly recognised instructional framework. Its sustained output over several years underscores its institutional adoption across educational sectors, particularly in inclusive education and technology-enhanced learning environments.

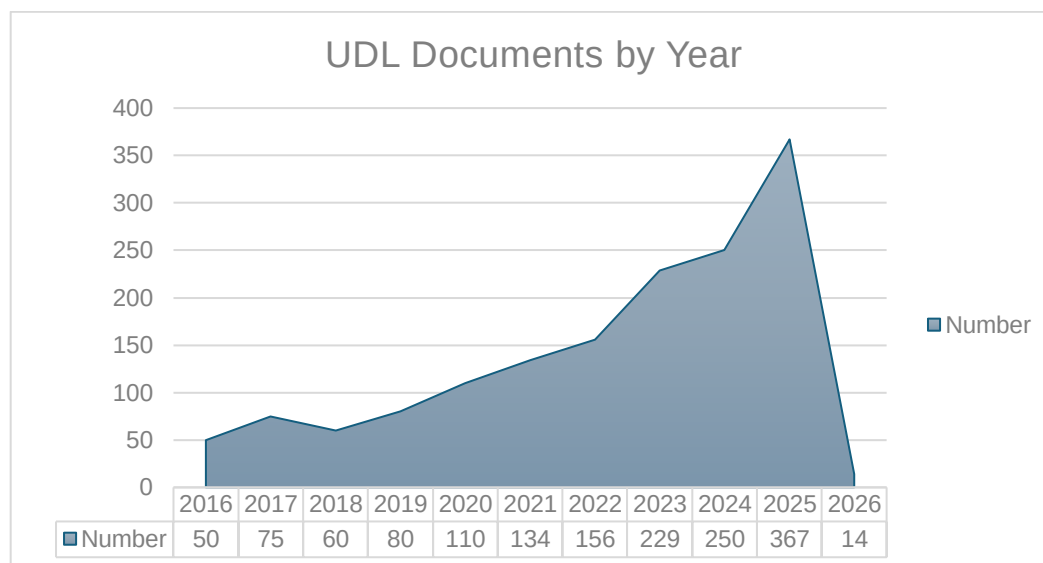


Figure 3 UDL Documents by Year

The sustained growth of UDL publications reflects the gradual consolidation of inclusive instructional design within mainstream educational research. Rather than responding to short-term educational trends, the steady increase suggests that UDL has become increasingly embedded within institutional practices and scholarly discourse. This pattern indicates a shift from establishing the theoretical foundations of UDL towards investigating its implementation, contextual adaptation, and effectiveness across diverse educational settings, highlighting its enduring relevance as a framework for inclusive learning.

When examined together, CSP and UDL manifest discernible divergences in their publication trajectories. Both frameworks culminated in a conspicuous peak in 2025, which may suggest a concomitant intensification of scholarly attention during that period. However, CSP's pattern reflects a sharper surge, while UDL demonstrated steady cumulative growth. These distinctions may, in turn, reflect the conceptual positioning inherent to each framework. UDL, grounded in accessibility and design principles, has experienced a gradual institutional embedding, characteristic of its foundational principles. CSP, rooted in sociocultural critique and equity discourse, appears to exhibit a more dynamic responsiveness to contemporary social movements and policy debates. Consequently, the findings may suggest a complementary yet distinct scholarly trajectory: UDL as a progressively institutionalised model of inclusive design, and CSP as a rapidly expanding field driven by cultural and social imperatives. Taken together, the data indicate that both CSP and UDL remain highly relevant within current educational research, with 2025 representing a significant year of peak academic engagement for both domains.

The distribution of CSP publications across sources evinces a relatively dispersed, yet markedly education-centred, pattern of scholarly dissemination, as delineated in Figure 4. It appears that no single journal exerts an overwhelming dominance within the field. However, the dissemination of publications is observed across a prominent consortium of scholarly venues, encompassing literacy, multicultural education, teacher education, and applied linguistics. The Journal of Adolescent and Adult Literacy is identified as the most prominent source; it is succeeded closely by publications within such esteemed journals as Reading Teacher, Advances in Research on Teaching, and the Journal for Multicultural Education. These venues suggest that CSP scholarship suggest a profound integration of CSP scholarship into the discourse surrounding literacy education and teacher preparation. The strong presence of practitioner-oriented journals also appears to indicate a close connection between CSP research and classroom application, rather than its remaining purely theoretical. The cumulative distribution curve ostensibly demonstrates a gradual concentration effect: approximately half of the total publications are accounted for by a relatively small subset of core journals, whereupon the remaining publications are disseminated across a long tail of diverse outlets. This protracted distribution encompasses journals focusing on early childhood education, bilingual education, higher education, sustainability education, and arts education. Such dispersion arguably reflects the conceptual flexibility of CSP and its broad applicability across various educational levels and disciplinary contexts. Overall, the observed source pattern suggests that CSP may function as a cross-cutting framework within education research, with a particularly robust anchoring in literacy, equity, and culturally responsive teaching conversations.

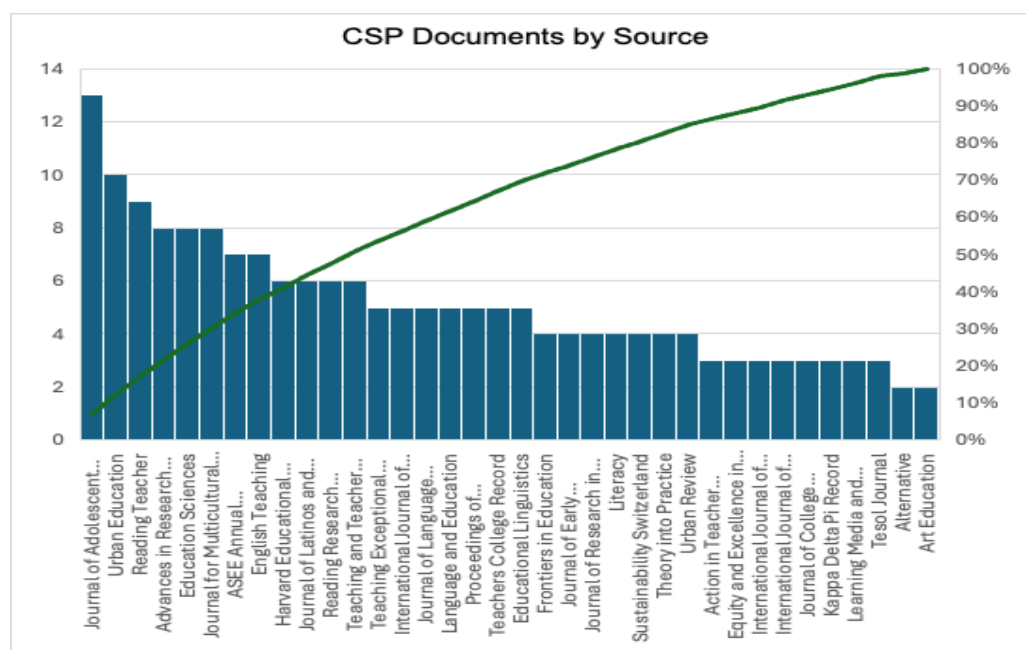


Figure 4 CSP Documents by Source

The broad distribution of CSP publications across multiple educational journals demonstrates that the framework has extended beyond a specialised area of multicultural education to become relevant across diverse pedagogical disciplines. Rather than remaining confined to equity-focused scholarship, CSP increasingly informs discussions surrounding literacy, teacher education, curriculum development, and educational policy. This disciplinary diffusion suggests that cultural sustainability is becoming recognised as a fundamental consideration in educational practice rather than a topic limited to particular learner populations or educational contexts.

In contrast, the distribution of UDL publications exhibited a greater degree of concentration in high-output journals, as shown in Figure 5. Education Sciences contributed the most substantial volume of publications, followed by the Journal of Special Education Technology and the International Journal of Inclusive Education. This appears to delineate UDL's robust alignment with inclusive education, assistive technology, and accessibility research. A salient characteristic of the distribution of publications pertaining to UDL involved journals focused upon disability studies, educational technology, and instructional design. This pattern may underscore UDL's conceptual roots in accessibility and Universal Design principles. Compared to CSP, UDL

appeared more tightly clustered within journals that specialise in inclusion and technological mediation of learning. The cumulative curve exhibits a steeper ascent in the early portion of the distribution, indicating that a more circumscribed cohort of journals contributes a substantial proportion of the total publications. Subsequent to this foundational grouping, publication venues diversified into conference proceedings, interdisciplinary journals, and domain-specific outlets such as early childhood education, higher education, and subject-based education journals. This trend intimates that, although UDL maintains a robust institutional foundation within inclusive education research, its conceptual application is concurrently broadening into more expansive pedagogical contexts.

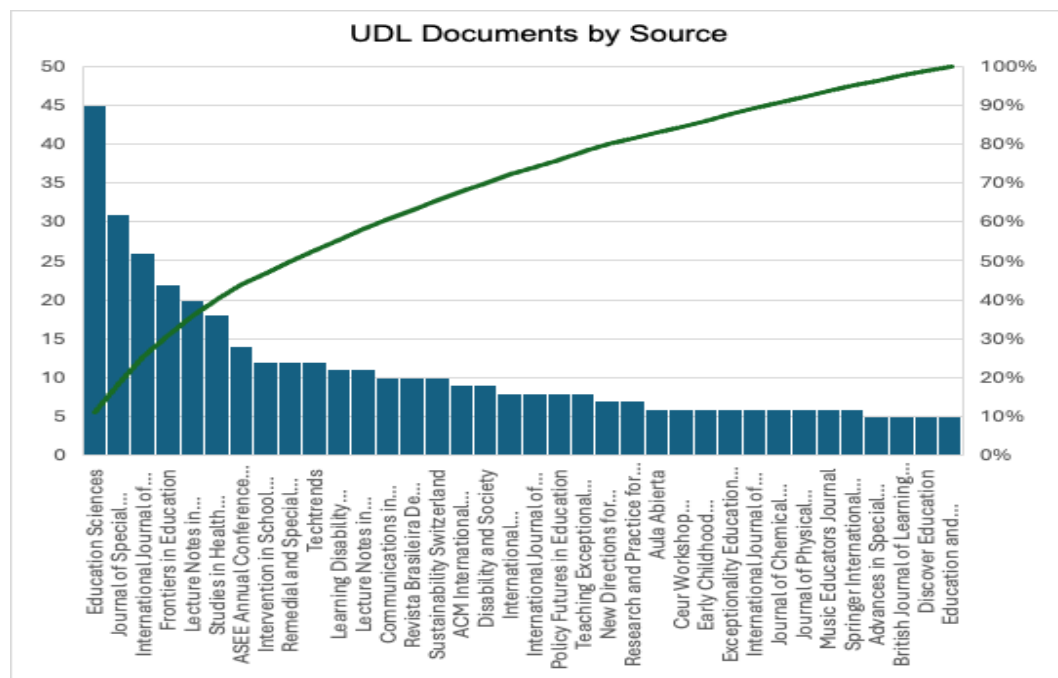


Figure 5 UDL Documents by Source

The concentration of UDL publications within journals specialising in inclusive education, accessibility, and educational technology reflects the framework's strong institutional foundation within evidence-based instructional practice. At the same time, its gradual expansion into broader educational journals suggests that UDL is increasingly being viewed not solely as a disability-focused framework but as a general pedagogical approach capable of supporting learner variability across educational contexts. This evolution reinforces the growing recognition that accessibility constitutes a core component of high-quality teaching rather than an accommodation implemented only for specific student groups.

A comparison of both distributions revealed structural differences in how each framework circulates throughout scholarly networks. CSP appears to demonstrate broader dispersion across culturally and pedagogically oriented journals. UDL, by contrast, exhibits stronger clustering within journals focused on disability inclusion, educational technology, and universal access. These patterns suggest a primary anchoring of CSP in sociocultural and literacy scholarship, while UDL is more firmly situated within accessibility-driven and design-oriented educational research. The difference in concentration levels may further suggest a benefit for UDL from established institutional platforms dedicated to inclusive education, whereas CSP exhibits operation across a wider spectrum of pedagogical debates. Considering both CSP and UDL, the source distributions substantiated the complementary yet distinct intellectual trajectories of CSP and UDL. CSP's spread across literacy and multicultural education outlets underscores its instrumental role in reshaping cultural discourse within pedagogical practice. UDL's concentration within inclusion and technology-focused journals reflects its systematic integration into accessibility and instructional design frameworks, thereby establishing its practical utility. Collectively, these patterns confirm the sustained academic engagement, albeit through different scholarly ecosystems.

The country-level co-authorship network shown in Figure 6 reveals a highly centralised yet globally interconnected structure. The United States is the dominant hub, as evinced by its substantial node size and extensive collaborative linkages. This entity maintains robust partnerships with Canada, the United Kingdom, Spain, China, Australia, and South Africa, thereby positioning itself as the primary connector across diverse regions. Secondary hubs are visible in the United Kingdom, Canada, and Spain; Spain demonstrates particularly strong ties with Portugal, Mexico, and Colombia, suggesting linguistic and regional collaboration patterns. A European cluster links Spain, Portugal, Italy, France, and Switzerland, while an Asia-Pacific cluster connects Australia, China, South Korea, Indonesia, and Hong Kong. China appears to fulfil an important bridging role between Western and Asian research communities, which may indicate increasing integration into global scholarly networks. Countries such as Brazil and South Africa contribute to cross-continental linkages, albeit with a comparatively diminished number of connections compared to the main hubs. Overall, the network appears to reflect a core-periphery structure; wherein a small contingent of highly interconnected nations anchors the field, whilst others participate primarily through regional or bilateral ties. Despite this concentration, the discernible presence of multiple cross-regional connections appears to indicate active international knowledge exchange and extensive global engagement.

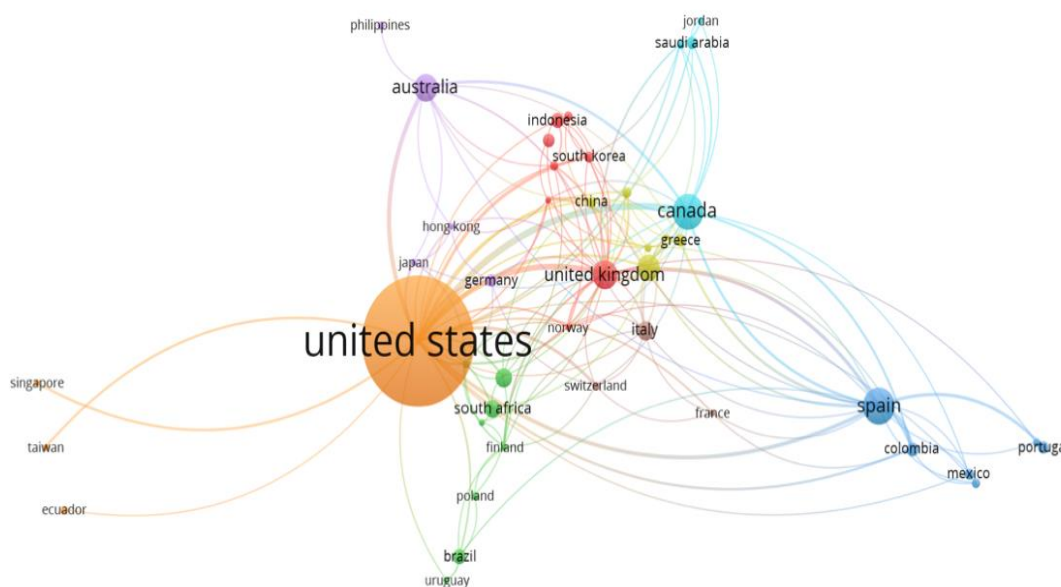


Figure 6 Co-authorship by Countries

The country-level bibliometric data reveals a geographical distribution dominated by the United States, which anchors the field across two distinct research clusters. In Cluster 5, the United States leads with the highest overall productivity of 833 documents, 32 international collaboration links, a Total Link Strength (TLS) of 104.00, and a normalized citation score of 1.11 (Avg. Pub. Year = 2020.0). It also leads Cluster 1 with 250 documents (TLS = 7.00, Avg. Pub. Year = 2022.2). Strong secondary contributions come from European and Commonwealth nations: Spain generates 123 documents in Cluster 1 with high network connectivity (15 links, TLS = 47.00) and an above-average normalized citation score of 1.30, while Canada (94 documents, Cluster 4), the United Kingdom (72 documents, Cluster 3; Avg. Norm. Citations = 1.46), and Ireland (70 documents, Cluster 2) represent major research hubs. Australia demonstrates high theoretical impact in Cluster 8 with 58 documents and the highest average raw citations (14.66) among major producers. Emerging international research fronts are highlighted by contributions from Asia and Africa, which feature noticeably more recent publication dates. India (38 documents, Avg. Pub. Year = 2023.7, TLS = 14.00) and South Africa (36 documents, Avg. Pub. Year = 2022.5, Avg. Norm. Citations = 1.04) anchor Cluster 9, while Indonesia (Cluster 7; 24 documents, Avg. Pub. Year = 2024.2) and China (Cluster 2; 5 documents, Avg. Pub. Year = 2024.6) represent the most recent temporal entries. Although these emerging nodes currently report lower normalized citation rates (ranging from 0.21 to 0.36), their recent inclusion reflects a growing global extension of inclusive pedagogy research beyond its traditional Western bases.

Table 2 Co-authorship matrix

N o	Country	Cluste r	Document s	Link s	Total Link Strengt h	Relevanc e	Avg. Pub. Year	Avg. Citation s	Avg. Norm. Citation s	X	Y
1	United States	1	250	3	7.00	250.000	2022.2	9.22	1.04	0.571	-0.012
2	New Zealand	3	13	0	0.00	13.000	2021.2	12.23	0.99	-0.321	0.173
3	Canada	1	11	1	4.00	11.000	2023.5	13.73	1.22	0.870	0.273
4	Spain	4	7	0	0.00	7.000	2022.0	13.43	1.58	-0.238	-0.078
5	United Kingdom	1	6	1	1.00	6.000	2023.3	11.50	1.16	0.878	-0.289
6	China	2	5	2	3.00	5.000	2024.6	1.00	0.28	-0.707	-0.031
7	Australia	2	5	1	1.00	5.000	2021.4	10.60	0.82	-1.054	-0.036
8	United States	5	833	32	104.00	833.000	2020.0	12.83	1.11	-0.010	-0.176
9	Spain	1	123	15	47.00	123.000	2022.4	9.85	1.30	1.002	-0.010
10	Canada	4	94	12	32.00	94.000	2021.6	7.30	0.73	-0.234	-0.453
11	United Kingdom	3	72	19	45.00	72.000	2022.0	9.13	1.46	-0.199	0.426
12	Ireland	2	70	12	19.00	70.000	2022.2	4.86	1.01	0.077	0.001
13	Australia	8	58	7	17.00	58.000	2020.4	14.66	1.18	-1.056	-0.082
14	India	9	38	8	14.00	38.000	2023.7	1.37	0.21	-0.487	0.018
15	South Africa	9	36	3	4.00	36.000	2022.5	7.83	1.04	-0.246	-0.080
16	Italy	6	35	9	12.00	35.000	2022.4	2.54	0.46	0.381	-0.024
17	Indonesia	7	24	4	5.00	24.000	2024.2	1.92	0.36	-1.078	0.619

The international collaboration network demonstrates that scholarship on CSP and UDL is increasingly shaped through cross-national knowledge exchange, although research leadership remains concentrated within a relatively small number of countries. This concentration highlights opportunities for expanding the

geographical diversity of future research and incorporating perspectives from educational systems that remain underrepresented in the literature. Broader international collaboration would contribute to a more comprehensive understanding of how inclusive pedagogical principles can be adapted to different cultural, linguistic, and institutional contexts.

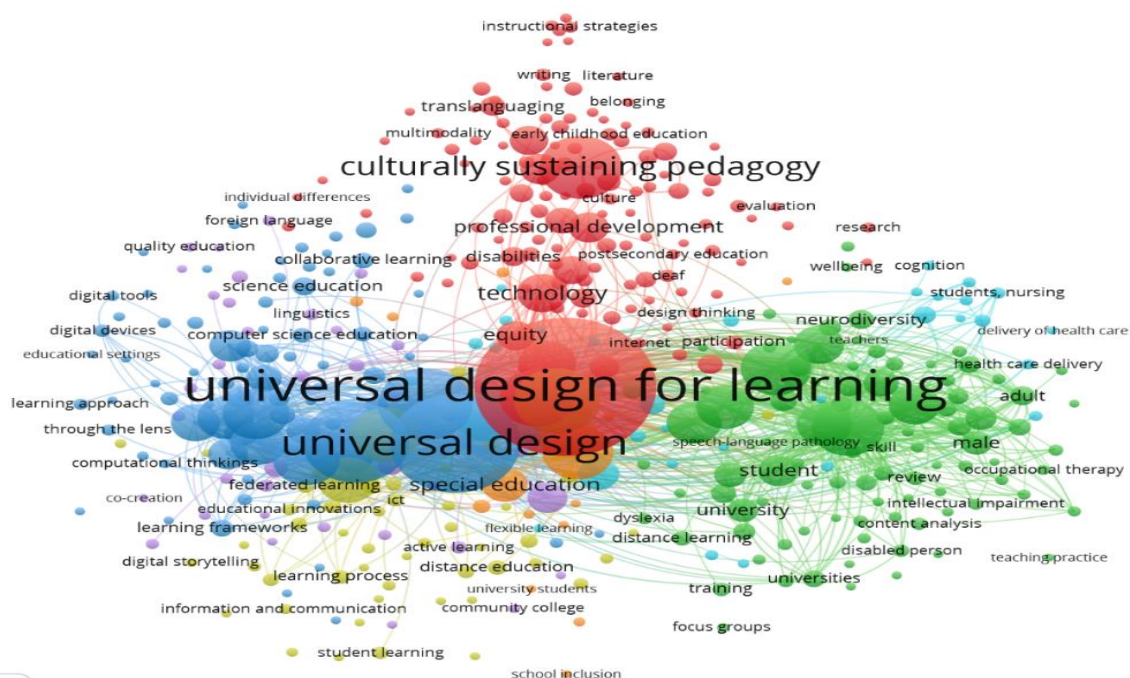


Figure 7 Co-occurrence by Keywords

The keyword co-occurrence network shown in Figure 7 indicates a closely interconnected conceptual structure anchored by UDL, and Universal Design, which function as the primary organisational nodes. Their central position and high connectivity suggest that they underpin multiple thematic strands within the field. One cluster associates UDL with student, adult, neurodiversity, intellectual impairment, and occupational therapy, reflecting sustained engagement with inclusive education and disability-related research. A second cluster centres on CSP and delineates linkages with equity, technology, professional development, and early childhood education, underscoring the integration of cultural responsiveness with digital and teacher development perspectives. A further cluster delineates technological dimensions, including computer science education, digital tools, and learning analytics, indicating increasing convergence between inclusive design principles and technology-enhanced learning. Collectively, the network may evince thematic integration around inclusion, equity, and digital innovation, suggesting a progressively interdisciplinary and consolidated research landscape.

Table 3 Co-occurrences matrix

No	Term	Cluster	Occurrences	Links	Total Link Strength	Relevance	Avg. Pub. Year	Avg. Citations	Avg. Norm. Citation	X	Y
1	universal design for learning	3	656	158	1269	656	2021	13.38	1.27	-0.073	0.148
2	inclusive education	4	158	91	346	158	2022.7	9.85	1.26	0.093	0.145
3	inclusion	3	145	105	385	145	2021	14.38	1.24	0.239	0.132
4	higher education	5	116	93	330	116	2021.8	11.51	1.6	0.118	0.012
5	accessibility	2	110	78	295	110	2020.8	10.6	0.86	-0.044	-0.588

6	universal design for learning	5	94	80	158	94	2022.4	9.21	1.29	- 0.313	- 0.048
7	UDL	6	92	75	214	92	2021.7	9.61	1.24	- 0.195	- 0.036
8	disability	6	69	60	187	69	2021.5	12.28	1.44	- 0.435	- 0.209
9	technology	2	63	82	186	63	2019.2	18.86	1.33	- 0.059	- 0.201
10	universal design	3	56	53	143	56	2019.8	16.84	1.63	0.134	- 0.256
11	culturally sustaining pedagogy	3	150	33	147	150	2022.2	7.92	0.89	- 0.349	- 0.105
12	culturally sustaining pedagogies	1	42	19	38	42	2022.9	6.76	1.2	0.013	0.515
13	translanguaging	1	21	14	41	21	2022.8	9.71	1.56	- 0.125	- 0.295
14	teacher education	1	21	18	37	21	2021.7	10.14	1.14	0.191	0.062
15	culturally relevant pedagogy	4	19	13	36	19	2021.9	8.21	0.98	- 0.169	- 0.427
16	social justice	5	14	13	26	14	2022	16.57	1.65	- 0.586	- 0.188
17	culturally responsive teaching	4	12	9	23	12	2021.8	7.17	0.81	- 0.287	- 0.292
18	professional development	1	10	13	21	10	2021.9	8.2	1.22	0.519	0.022
19	identity	2	10	15	21	10	2021.9	5.5	1.05	0.414	0.29
20	indigenous education	3	9	6	11	9	2021.1	15.33	1.2	- 0.562	- 0.385

To evaluate key structural and quantitative metrics within the co-occurrence network (as shown in Table 3), the analysis goes beyond visual spatial distance to incorporate exact measurements, including node occurrences, total link strength (TLS), average publication year, and normalized citation impact. The domain is anchored by universal design for learning (Cluster 3), which demonstrates the highest centrality across the corpus with 656 occurrences, 158 co-occurrence links, and a Total Link Strength of 1,269.00. While its average publication year (2021.0) reflects an established literature base, its average normalized citation score of 1.27 confirms above-average relative academic impact within the field. Close conceptual derivatives, such as UDL (Cluster 6; 92 occurrences, TLS = 214.00, Avg. Norm. Citations = 1.24) and universal design(Cluster 3; 56 occurrences, TLS = 143.00, Avg. Norm. Citations = 1.63), further demonstrate strong citation density and institutional integration across higher education settings (Cluster 5; 116 occurrences, TLS = 330.00, Avg. Norm. Citations = 1.60).

Conversely, scholarship centred on cultural frameworks forms distinct clusters characterized by high relevance, recent temporal emergence, and focused co-occurrence links. Culturally sustaining pedagogy (Cluster 3) registers 150 occurrences with a TLS of 147.00 across 33 links, accompanied by an average publication year of 2022.2. A related node, culturally sustaining pedagogies (Cluster 1), displays an even more recent temporal signature (Avg. Pub. Year = 2022.9) with 42 occurrences and 19 links (TLS = 38.00). These nodes interlock with specialized equity-focused terms within Cluster 1, including translanguaging (21 occurrences, TLS = 41.00, Avg. Norm. Citations = 1.56) and teacher education (21 occurrences, TLS = 37.00, Avg. Norm. Citations = 1.14), as well as Cluster 4 terms such

as culturally relevant pedagogy (19 occurrences, TLS = 36.00) and culturally responsive teaching (12 occurrences, TLS = 23.00). Although these cultural framework terms exhibit lower overall connectivity (TLS) compared to UDL, their high relevance scores (e.g., 150.000 for CSP) and elevated normalized citations among specific nodes reflect an active, rapidly expanding research front that complements structural access models within contemporary inclusive education literature.

The keyword network illustrates an important shift in the intellectual development of the field. Rather than functioning as isolated areas of inquiry, concepts relating to inclusion, equity, accessibility, technology, and cultural responsiveness are becoming increasingly interconnected. This pattern suggests that contemporary educational research is moving towards a more holistic understanding of learner diversity, in which pedagogical design, cultural relevance, and technological innovation are recognised as complementary rather than competing priorities. Such convergence provides further evidence that inclusive education is evolving into an interdisciplinary field integrating multiple theoretical perspectives.

The co-citation network of cited references shown in Figure 8 elucidates two closely connected but conceptually distinct intellectual foundations. One cluster is delineated by the UDL framework, with foundational works on UDL and the learning brain forming the core references. The dense interconnection of these sources suggests the establishment of a robust theoretical foundation rooted in cognitive neuroscience, principles of accessibility, and instructional design. A second cluster delineates scholarship concerning CSP, with a particular emphasis on equity, cultural identity, and sociocultural theory. Although smaller relative to the UDL cluster, it forms a coherent body of literature with strong internal linkages. The two clusters are connected through bridging references, suggesting increasing conceptual dialogue between inclusive design frameworks and culturally responsive pedagogies. The structural arrangement suggests that while UDL and CSP have developed along partially independent trajectories, recent scholarship is drawing these traditions into closer alignment. Overall, the co-citation pattern evinces a dual theoretical underpinning in the field, supported by established canonical works and emerging integrative scholarship.



Figure 8 Co-citation by Cited References

The co-citation structure provides evidence that CSP and UDL continue to maintain distinct theoretical foundations while simultaneously exhibiting increasing intellectual convergence. Although each framework remains anchored within its respective scholarly tradition, the emergence of bridging references indicates growing dialogue between research on cultural equity and inclusive instructional design. This evolving citation pattern suggests that future scholarship is likely to move beyond treating CSP and UDL as independent approaches towards developing integrated pedagogical perspectives capable of addressing both cultural and structural dimensions of educational equity.

Collectively, the bibliometric evidence suggests that CSP and UDL are evolving through distinct yet increasingly interconnected scholarly trajectories. While CSP has expanded primarily through research centred on cultural identity, equity, and social justice, UDL has matured through sustained developments in accessibility, instructional design, and inclusive education. The observed convergence across publication trends, source distributions, collaboration networks, keyword relationships, and co-citation patterns indicates that these frameworks are no longer developing in isolation. Instead, the findings suggest the emergence of a broader scholarly movement towards inclusive pedagogy that recognises both cultural legitimacy and

accessible learning design as complementary dimensions of educational equity. This interpretation provides the foundation for the conceptual synthesis presented in the following discussion.

DISCUSSION

The bibliometric evidence suggests that the relationship between CSP and UDL extends beyond the parallel growth of two influential educational frameworks. Instead, their evolving relationship points towards a broader movement in inclusive pedagogy that recognises educational equity as encompassing both cultural and structural dimensions. Although CSP and UDL originate from different theoretical foundations and have developed through distinct scholarly communities, patterns across publication trajectories, disciplinary outlets, keyword networks, and citation structures reveal increasing intellectual alignment. This review therefore positions CSP and UDL as addressing distinct but mutually reinforcing dimensions of inclusive education.

The publication trajectories illustrate the different pathways through which the two frameworks have developed. CSP experienced rapid growth around 2025 followed by relative stabilisation, suggesting a transition from a predominantly critical discourse towards a more established pedagogical approach with applications across curriculum, policy, STEM, and digital learning. This development is consistent with CSP's justice-oriented foundations, which foreground the legitimacy of students' cultural identities while challenging dominant educational norms (Alim et al., 2020; Paris, 2012), as well as its increasing application across disciplinary contexts (Terrell & Silva Pimentel, 2026). UDL, by comparison, demonstrates a more gradual and cumulative trajectory, reflecting its sustained institutionalisation as a framework for inclusive instructional design. Its emphasis on proactively addressing learner variability through multiple means of engagement, representation, and expression provides an established design logic for inclusive practice (Canter et al., 2017). The recent moderation in publication growth may therefore reflect maturation and a shift towards implementation, contextual adaptation, and integration with other pedagogical approaches rather than declining relevance. Such a transition is consistent with evidence that effective UDL implementation depends on institutional support, faculty readiness, and pedagogical alignment (Gilmore & Browne, 2025; Muzdalifah et al., 2025).

The distribution of publications across scholarly sources reinforces these contrasting developmental pathways. CSP is broadly dispersed across literacy, multicultural education, and teacher education journals, demonstrating its cross-disciplinary relevance and close relationship with culturally responsive and identity-affirming practices (Esteban-Guitart et al., 2019). UDL is more concentrated within journals concerned with inclusive education, assistive technology, and instructional design, reflecting its established position within accessibility-oriented research and educational technology (Griful-Freixenet et al., 2017). These patterns indicate that the two frameworks have approached the broader challenge of educational inclusion from different intellectual directions: CSP primarily through questions of cultural legitimacy, identity, and knowledge, and UDL through accessibility, learner variability, and instructional design.

The geographical structure of the literature introduces a further dimension to this development. The co-authorship network is internationally connected but remains strongly centered on the United States, with secondary regional clusters across Europe and the Asia-Pacific (Bulut, 2025). Such concentration raises questions concerning epistemic representation, particularly given CSP's critique of dominant knowledge systems and emphasis on culturally situated educational practices (Alim et al., 2020). The underrepresentation of perspectives from the Global South may constrain understanding of how CSP, UDL, and their potential integration operate across different cultural, linguistic, and institutional environments. Greater cross-regional participation would therefore contribute not merely to geographical diversity but also to the contextual development of inclusive pedagogical knowledge.

More importantly, the keyword co-occurrence and co-citation networks indicate that the intellectual boundaries separating CSP and UDL are becoming increasingly permeable. Connections among UDL, equity, technology, CSP, and related concepts suggest movement towards interdisciplinary research agendas that address multiple dimensions of learner diversity simultaneously. The emergence of technology-related clusters further extends this convergence into digital and generative AI environments, where accessibility, learner agency, and sociocultural responsiveness become increasingly interconnected considerations (Ballantyne et al., 2025). The

co-citation structure reinforces this interpretation by revealing two distinguishable theoretical foundations: UDL's cognitive and design-oriented tradition and CSP's sociocultural and equity-oriented tradition. Bridging references between these foundations indicate emerging intellectual dialogue rather than complete theoretical integration.

This distinction is central to interpreting the findings. Convergence does not imply that CSP and UDL are interchangeable or that their theoretical differences should be dissolved. Their potential lies precisely in their complementarity. CSP foregrounds whose cultures, identities, languages, and ways of knowing are legitimised within education, whereas UDL addresses how learning environments can be designed to reduce barriers to engagement, participation, and expression. Viewed together, they broaden the meaning of inclusion beyond either cultural responsiveness or accessibility alone. The bibliometric evidence therefore provides a basis for conceptualising their convergence as an emerging integrated perspective on inclusive pedagogy in which cultural legitimacy and structural accessibility operate as complementary dimensions of educational equity. Figure 9 presents the conceptual proposition underpinning this review, illustrating how CSP and UDL represent complementary dimensions of educational equity that together support an integrated approach to inclusive pedagogy.

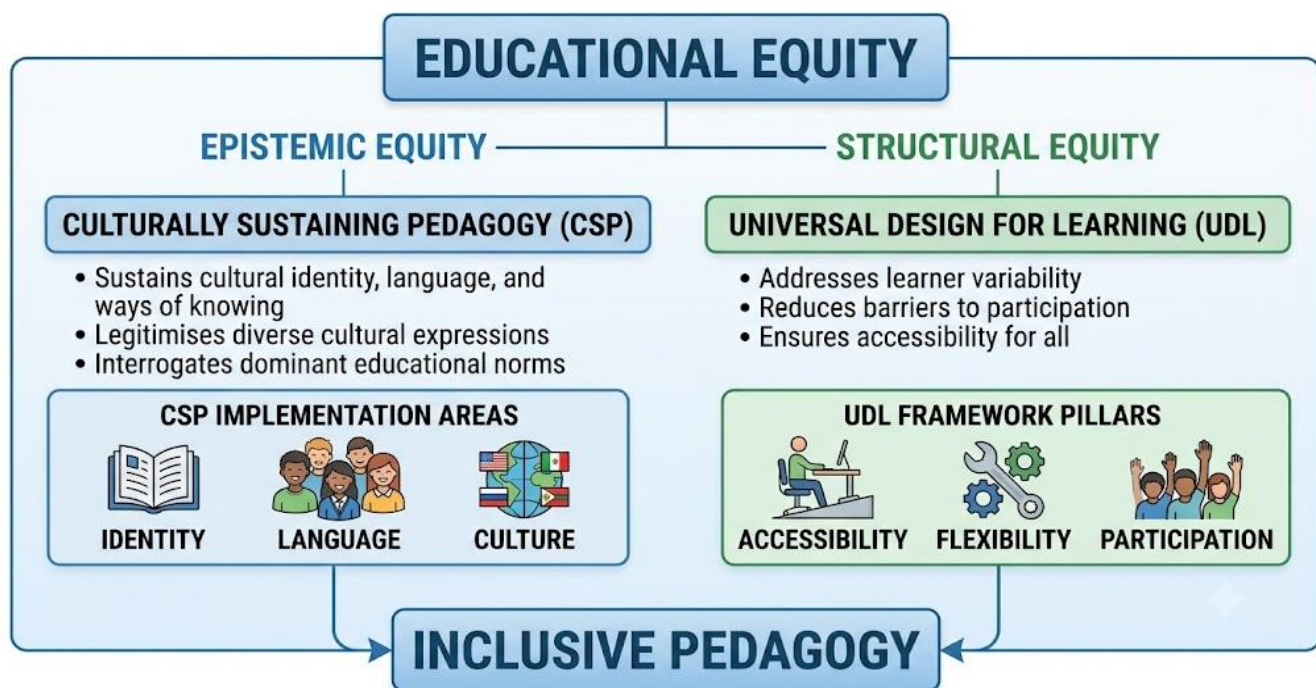


Figure 9 Educational Equity Conceptual Framework

The conceptual synthesis arising from these findings shifts the research question from whether CSP and UDL can coexist towards how their complementary principles can be integrated without diminishing the theoretical distinctiveness of either framework. This requires empirical investigation across diverse educational contexts, particularly higher education and technology-enhanced and AI-mediated learning environments. Future studies should examine how such integration can be operationalised and whether it strengthens participation, cultural affirmation, accessibility, and learning outcomes. In this way, subsequent research can move beyond evidence of intellectual convergence towards the development and evaluation of pedagogical models that are simultaneously culturally meaningful and structurally accessible.

CONCLUSION

This study examined the development and emerging convergence of CSP and UDL through bibliometric analysis. The findings reveal two distinct scholarly trajectories: CSP has expanded rapidly through research concerned with cultural identity, equity, and social justice, whereas UDL has developed more cumulatively through accessibility, instructional design, and inclusive education. Despite these different intellectual foundations, evidence from publication patterns, disciplinary distribution, keyword relationships, and co-

citation structures indicates increasing interaction between the two traditions. The principal contribution of this study is therefore not simply the identification of growth in CSP and UDL scholarship, but the interpretation of their convergence as a potential basis for a more integrated perspective on inclusive pedagogy. CSP contributes attention to cultural legitimacy, identity, language, and ways of knowing, while UDL contributes a proactive design orientation towards accessibility, learner variability, participation, and expression. Considered together, these perspectives suggest that educational equity requires learning environments that are both culturally sustaining and structurally accessible.

At the same time, the bibliometric evidence indicates that this integration remains emergent rather than fully established. Empirical studies examining the simultaneous application of CSP and UDL remain limited, and the geographical concentration of scholarship constrains the extent to which current understandings can be generalised across diverse educational contexts. Relying exclusively on Scopus introduces structural indexing biases, as it may omit specialized or regional peer-reviewed publications indexed in alternative repositories, thereby constraining the full conceptual mapping of Culturally Sustaining Pedagogy (CSP) and Universal Design for Learning (UDL). Incorporating Web of Science (WoS) particularly its highly selective Social Sciences Citation Index (SSCI) would significantly alter the global co-authorship landscape by amplifying the node centrality, total link strength, and citation metrics of established Western and Anglophone research hubs. While WoS would elevate the recorded impact of legacy institutions, combining both databases through systematic deduplication would balance Scopus's broader regional coverage with WoS's citation depth, yielding a more geographically representative model of international collaboration in inclusive pedagogy scholarship.

Future research should therefore test and refine integrated approaches in authentic teaching and learning environments, including higher education and digital and AI-enhanced settings. Such work would provide the empirical foundation necessary to determine whether the conceptual convergence identified in this review can be translated into pedagogical practices that more comprehensively address learner diversity.

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