

Mind Mapping and Universal Design For Learning in Education: A Systematized Narrative Review

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Abstract

Background: Mind and concept mapping support the organization of conceptual relationships and active knowledge processing, while Universal Design for Learning (UDL) addresses learner variability through flexible representation, action and expression, and engagement. However, evidence remains fragmented across educational contexts, with limited direct research examining the integration of these approaches within educational practice.

Objective: To synthesize evidence on Mind Mapping and UDL across educational contexts, examine convergent and divergent findings, and clarify the potential relevance of their integration for teaching and learning.

Method: A systematized narrative review synthesized selected empirical studies, systematic reviews, meta-analyses, and conceptual studies. Evidence was thematically synthesized across knowledge organization and learning outcomes, active map construction and learning processes, UDL and learner variability, educational applications across contexts, and contextual variation in implementation.

Results: Mind and concept mapping were associated with improved knowledge organization, comprehension, retention, and higher-order learning, although their effects varied according to map construction, scaffolding, learner preferences, and instructional conditions. UDL evidence supported flexible access and participation for diverse learners, but improved learner perceptions did not consistently translate into measurable performance gains. Evidence across educational contexts was favorable overall but remained heterogeneous in implementation, learner characteristics, and measured outcomes.

Contribution: The review identifies a specific evidence gap concerning the integration of Mind Mapping and UDL within educational practice. It provides a conceptual basis for investigating whether embedding Mind Mapping within UDL principles can support accessible, engaging, and cognitively structured learning while avoiding overstatement of the current evidence for their combined effectiveness.

Keywords: Mind Mapping; Universal Design for Learning; Educational Design; Inclusive Learning; Learning Outcomes; Knowledge Organization; Learner Variability.

Introduction

Effective education, including adolescent learning, requires learners to acquire, organize, interpret, and apply interconnected information while accommodating substantial variation in prior knowledge, motivation, and learning needs (Sansom-Daly et al., 2016). These demands highlight two complementary instructional challenges: how complex knowledge is organized for meaningful learning and how learning environments can accommodate learner variability. Mind Mapping and Universal Design for Learning (UDL) address these dimensions through visual knowledge organization and flexible instructional design, respectively.

Concept maps make relationships among concepts visually explicit and support meaningful knowledge organization (Novak & Gowin, 1984; Novak & Cañas, 2008) and can support the integration of new information with existing knowledge structures (Novak & Cañas, 2008). By contrast, Mind Maps typically organize ideas around a central concept and represent a related but distinct form of visual mapping; they should not be treated as interchangeable with concept maps (Eppler, 2006; Davies, 2011). Mapping approaches differ in structure and instructional purpose, and their reported effects vary according to implementation. A meta-analysis demonstrated positive effects of concept and knowledge maps on learning, including retention and transfer (Nesbit & Adesope, 2006). Subsequent meta-analytic evidence indicated stronger effects when learners constructed maps rather than

studied completed maps, highlighting the importance of active cognitive engagement (Schroeder et al., 2018). Among pre-adolescent learners, mind mapping has also been associated with changes in text-learning strategies, although outcomes varied with mapping format and instructional support (Merchie & Van Keer, 2016). More recent evidence also indicates that computer-based Mind Mapping can support scientific creativity and knowledge construction in educational settings (Sun et al., 2022).

UDL addresses learner variability through flexible instructional design, a pattern reflected across multiple reviews of UDL-based educational models (Rao et al., 2014; Al-Azawei et al., 2016). Its framework emphasizes multiple means of representation, action and expression, and engagement to provide flexible pathways for accessing and demonstrating learning. Research synthesizing UDL applications has reported generally favorable outcomes but substantial variation in implementation and research contexts (Al-Azawei et al., 2016). UDL-based literacy instruction has demonstrated its applicability to learners with significant intellectual disabilities (Coyne et al., 2012), while flexible digital learning environments have been identified as contexts for addressing differences in reading and learning (Rose & Dalton, 2009). However, this evidence establishes the relevance of UDL to inclusive instructional design rather than demonstrating the effectiveness of a combined UDL–Mind Mapping intervention. Meta-analytic evidence further indicates that UDL consistently improves the learning process across diverse educational settings, although improvements in academic outcomes remain more heterogeneous (Capp, 2017). Related work combining UDL principles with visual mapping strategies has also shown potential for supporting reading comprehension among diverse learners (Narkon & Wells, 2013).

The educational relevance of these approaches extends across disciplinary and instructional contexts, including health-professional education, where learners must integrate interconnected information and apply knowledge to practical situations. In medical and nursing education, mapping has been associated with factual recall, comprehension, academic performance, and higher-order learning (Farrand et al., 2002; Sajadi et al., 2024; Aljamal et al., 2026). Evidence from pediatric nursing education further indicates applications of mapping-based strategies to knowledge, critical thinking, clinical reasoning, self-efficacy, and clinical performance (Sawalha et al., 2026).

Despite these advances, important contextual differences remain across educational populations and settings. Much of the mapping literature in health-related contexts concerns undergraduate medical and nursing students or health professionals, while other evidence addresses school and general educational settings. Differences in prior knowledge, educational level, learning environment, instructional demands, and implementation conditions limit direct extrapolation across contexts. The broader evidence therefore needs to be interpreted according to the educational population, instructional setting, and outcome being examined.

The resulting gap is therefore specific and integrative. Evidence exists on mapping and knowledge construction, UDL and learner variability, and educational applications across different instructional contexts. What remains insufficiently established is whether Mind Mapping embedded within UDL principles can jointly support learning, engagement, inclusion, and cognitive outcomes. The literature also provides limited evidence concerning which mapping formats, levels of scaffolding, and UDL components are most appropriate under different educational conditions.

This evidence base is heterogeneous in population, educational level, mapping approach, intervention design, outcome measurement, and implementation conditions. A systematized narrative approach is therefore appropriate for integrating these related but methodologically diverse strands without assuming that they provide directly comparable estimates of effectiveness.

Accordingly, this review aims to synthesize evidence on Mind Mapping and UDL across educational contexts, identify convergent and divergent findings, and clarify the evidence supporting their potential integration within educational practice. The review seeks to establish an evidence-based foundation for future empirical research rather than presupposing the effectiveness of a combined Mind Mapping–UDL intervention.

Methodology

Review Design

A systematized narrative review was conducted to identify and synthesize evidence on Mind Mapping and Universal Design for Learning (UDL) across educational contexts. This approach was selected because the available literature encompasses diverse study designs, populations, educational settings, interventions, and outcome measures. Previous evidence syntheses on concept mapping and UDL similarly demonstrate substantial methodological and contextual heterogeneity across studies (Nesbit & Adesope, 2006; Al-Azawei et al., 2016). Accordingly, the present review used structured study identification and selection followed by narrative and thematic synthesis rather than statistical pooling.

Information Sources and Search Strategy

Literature was searched in Scopus, Web of Science, PubMed, and Google Scholar for publications dated 2000–2026. Scopus and Web of Science served as the principal bibliographic sources, while PubMed and Google Scholar were used to identify additional relevant literature across educational and health-professional learning domains. The 2000–2026 period was selected to capture contemporary research on Mind Mapping, concept mapping, UDL, inclusive learning, and educational applications while retaining relevant foundational literature within the defined period.

The search strategy was structured around the principal concepts of the review. Core terms included “mind mapping,” “mind maps,” “concept mapping,” “concept maps,” “Universal Design for Learning,” “UDL,” “education,” “secondary education,” “school students,” “higher education,” “medical education,” “nursing education,” and “health-professional education.” These terms were combined using Boolean operators, with additional searches incorporating learning outcomes, engagement, comprehension, critical thinking, inclusion, accessibility, and multimodal learning. Component-based searches were also conducted because requiring all major concepts within a single search string could exclude relevant evidence addressing individual components of the review. This strategy was consistent with the heterogeneous evidence identified in previous mapping and UDL research (Schroeder et al., 2018).

Eligibility Criteria

Studies were considered eligible when they were published between 2000 and 2026, appeared in peer-reviewed scholarly sources, and addressed at least one of the principal domains of the review: Mind Mapping or concept mapping, UDL, educational applications, inclusive learning, or relevant learning outcomes. Empirical, experimental, quasi-experimental, observational, mixed-method, systematic-review, and meta-analytic studies were considered. Foundational conceptual studies were retained selectively when they provided directly relevant conceptual foundations for Mind Mapping or UDL, such as the framework provided by Novak and Cañas (2008).

Studies were excluded when they were duplicate records, outside the specified publication period, unrelated to the review domains, non-scholarly or unverifiable, or lacked sufficient information for reliable extraction. Importantly, studies were not required to address Mind Mapping, UDL, adolescent education, and health simultaneously. Studies addressing individual components were retained when their findings contributed directly to the corresponding thematic synthesis. This criterion prevented potentially relevant evidence from being excluded merely because the integrated research question remains underdeveloped.

Study Selection Process

Study selection followed a PRISMA-informed sequence of identification, screening, eligibility assessment, and inclusion. Retrieved records were first screened by title, followed by abstract assessment of potentially relevant records. Studies that remained potentially eligible were examined at the full-text stage against the predefined inclusion and exclusion criteria. Duplicate records and studies failing the eligibility criteria were excluded at the appropriate stage. This process enabled evidence from mapping and UDL across different educational contexts to

be considered as related evidence streams without incorrectly treating component-specific studies as direct evidence of a combined Mind Mapping–UDL intervention.

Data Extraction and Synthesis

A standardized extraction framework was applied to the included studies, recording author and year, study design, context and sample, core areas addressed, and key findings relevant to the review. The final evidence base comprised 32 studies, including 20 core studies and 12 supporting studies. Core studies provided direct or substantial evidence relevant to the principal review domains, whereas supporting studies contributed component-specific, conceptual, or contextual evidence.

Because the included studies differed in research design, population, educational level, intervention characteristics, and outcome measures, the evidence was synthesized through narrative and thematic analysis rather than quantitative meta-analysis. The synthesis examined five principal themes: knowledge organization and learning outcomes; active map construction and learning processes; UDL, learner variability, and inclusive participation; educational applications across contexts; and contextual variation in implementation. The synthesis also considered convergence and divergence across studies, differences across educational populations and settings, and the extent to which existing evidence directly addresses the integration of Mind Mapping and UDL. The final synthesis identified this integration as a specific evidence gap within the broader literature. The synthesis examined five principal themes: knowledge organization and learning outcomes; active map construction and learning processes; UDL, learner variability, and inclusive participation; educational applications across contexts; and contextual variation in implementation. The synthesis also considered convergence and divergence across studies, differences across educational populations and settings, and the extent to which existing evidence directly addresses the integration of Mind Mapping and UDL. The final synthesis identified this integration as a specific evidence gap within the broader literature.

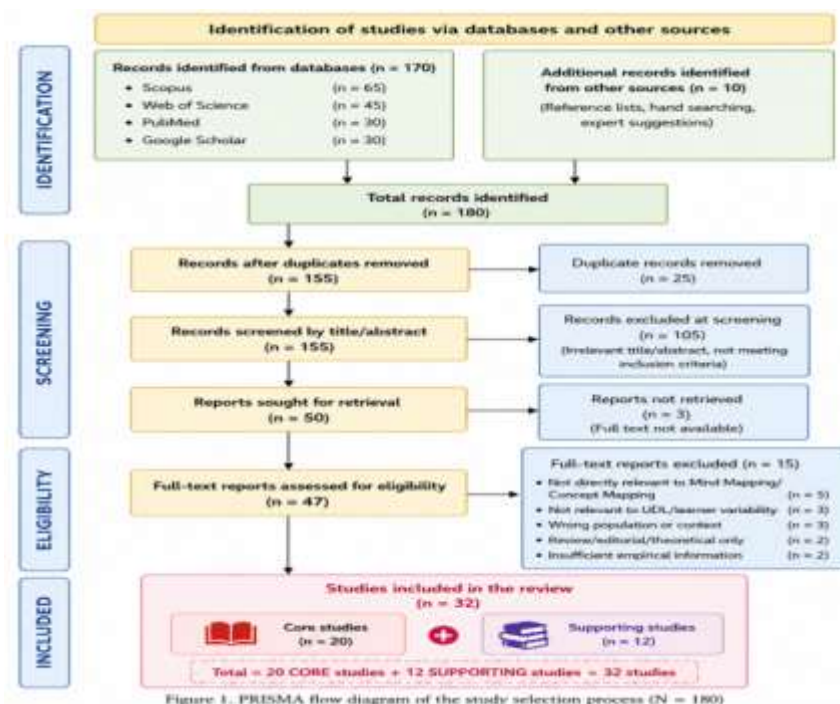


Figure 1. PRISMA flow diagram of the study selection process

Results: Thematic Synthesis

Table 1. Summary of Representative CORE Studies Contributing to the Thematic Synthesis

Author (Year)	Study Type	Sample / Context	Core Focus / Variables	Main Findings
Budd (2004)	Classroom-based pedagogical study	Undergraduate economics classroom	Mind Mapping; active/collaborative learning	Mind Mapping was used as an active, collaborative classroom exercise to support student participation.
Nesbit & Adesope (2006)	Meta-analysis	55 studies; education contexts	Concept Mapping; retention; transfer; learning outcomes	Concept/knowledge maps showed positive effects on learning, including retention and transfer.
Eppler (2006)	Comparative review	Undergraduate/graduate teaching contexts	Mind Mapping; Concept Mapping; visual learning	Different mapping formats served complementary functions for motivation, attention, understanding, and recall.
Merchie & Van Keer (2016)	Empirical study	Pre-adolescent learners; Belgium	Mind Mapping; meta-learning; text learning	Mind Mapping influenced learners' text-learning strategies and performance, with outcomes varying by mapping format and instructional support.

Author (Year)	Study Type	Sample / Context	Core Focus / Variables	Main Findings
Farrand et al. (2002)	Experimental study	Medical students; UK	Mind Mapping; recall; memory; motivation	Mind Mapping produced significantly higher adjusted recall, with the advantage remaining evident after one week; motivation effects were not uniformly positive.
Al-Azawei et al. (2016)	Content analysis/review	12 peer-reviewed UDL studies; multiple educational levels	UDL; accessibility; learner variability; learning outcomes	“Most of the reviewed studies reported positive UDL outcomes, although the evidence was concentrated in particular countries and learning contexts..
Coyne et al. (2012)	Intervention study	16 students with significant intellectual disabilities; Grades K–2	UDL; inclusive/multimodal learning; comprehension	UDL-based Literacy by Design produced significantly greater gains in passage comprehension after controlling for initial achievement.
Soellner et al. (2017)	Concept-mapping/model-building study	Health-literacy experts and respondents	Concept Mapping; health literacy; health-learning constructs	Concept mapping supported development of a multidimensional health-literacy model, subsequently validated through quantitative analyses.
Kinchin (2001)	Critical/research report	UK secondary-school biology context	Concept Mapping; secondary education; curriculum implementation	Adoption of concept mapping was constrained by teachers’ epistemological beliefs and curriculum philosophy despite its reported instructional value.

Author (Year)	Study Type	Sample / Context	Core Focus / Variables	Main Findings
Schroeder et al. (2018)	Meta-analysis	142 independent effect sizes across educational contexts	Concept Mapping; map construction; learning outcomes	Map construction showed stronger effects than studying completed maps, emphasizing active learner involvement in mapping.
Sajadi et al. (2024)	Systematic review	10 medical-education studies; 2000–2023 literature	Mind Mapping; memory; comprehension; cognitive outcomes	Evidence indicated benefits for memory, comprehension, participation, problem-solving, and learning processes, alongside implementation challenges.
Azmi, Smyth, & Keith (2026)	Systematic review of qualitative evidence	10 studies; undergraduate nursing education	Concept Mapping; engagement; metacognition; implementation	Mapping supported engagement and metacognitive learning, while unfamiliarity, limited guidance, and implementation demands remained challenges.
Sawalha et al. (2026)	Systematic review	Nurses and nursing students; pediatric nursing education	Mind/Concept Mapping; health education; critical thinking; clinical outcomes	Mapping-based strategies showed favorable outcomes across knowledge, critical thinking, clinical reasoning, self-efficacy, and clinical performance, although evidence remained heterogeneous.
Aljamal et al. (2026)	Systematic review of RCTs	503 undergraduate preclinical medical students	Mind/Concept Mapping; comprehension; retention; academic performance	Four of six RCTs reported significantly better assessment outcomes; overall evidence favored mapping, particularly for retention and comprehension, although two studies found no significant differences.

Source: Compiled from the 20 pre-selected CORE studies and their extracted synthesis. The selected studies represent the principal evidence streams relevant to the review.

Synthesis Note: Overall, the CORE evidence shows the most consistent support for Mind/Concept Mapping in knowledge organization, comprehension, retention, and active learning, while UDL provides evidence for flexible and inclusive learning. Evidence across educational contexts remains heterogeneous, and direct evidence integrating Mind Mapping with UDL is limited.

Synthesis of the 32 included studies (20 core and 12 supporting studies) identified five themes: (1) knowledge organization and learning outcomes, (2) active map construction and learning processes, (3) UDL and learner variability, (4) educational applications across contexts, and (5) contextual variation and implementation. Overall, findings were most consistent for the contribution of mapping to knowledge organization and learning, whereas UDL outcomes were more heterogeneous. Evidence across educational contexts was generally favorable but varied according to population, instructional setting, implementation conditions, and outcome measures.

Theme 1: Knowledge Organization and Learning Outcomes

The majority of mapping studies reported positive associations with knowledge organization, identification of conceptual relationships, comprehension, retention, and knowledge integration. Concept and mind maps differ in structure and instructional purpose, indicating that findings should not be generalized across all mapping formats (Eppler, 2006; Davies, 2011).

The strongest quantitative evidence came from Nesbit and Adesope (2006), whose meta-analysis demonstrated positive effects of concept and knowledge maps on learning, including retention and transfer. Evidence among pre-adolescent learners also supported mind mapping for text-learning strategies and performance (Merchie & Van Keer, 2016). Thus, evidence was predominantly consistent for mapping as a knowledge-organization strategy, although outcomes varied with instructional context and mapping format.

Theme 2: Active Map Construction and Learning Processes

The evidence indicated that how learners use maps influences their effectiveness. Schroeder et al. (2018) reported a larger effect for map construction ($g = .72$) than for studying completed maps ($g = .43$), providing relatively strong evidence for active map construction as an important learning condition.

Findings for affective and social outcomes were less consistent. Farrand et al. (2002) found improved factual recall among medical students using mind mapping but lower motivation in the intervention group. Evidence concerning collaborative versus individual mapping was also mixed. Thus, evidence was stronger for active construction than for specific motivational or collaborative conditions.

Theme 3: UDL, Learner Variability, and Inclusive Participation

UDL studies consistently emphasized flexible representation, action and expression, engagement, and accommodation of learner variability (Al-Azawei et al., 2016). Evidence from UDL-based literacy instruction further demonstrated applicability among students with significant intellectual disabilities (Coyne et al., 2012).

However, findings for objective academic performance were mixed. Some studies reported improved learning outcomes, whereas others showed improvements in learner perceptions or participation without comparable gains in measured achievement. Differences in implementation, learner characteristics, educational settings, and outcome measures contributed to this variation.

The evidence therefore provides stronger support for UDL as an inclusive instructional-design framework than for a uniform effect on academic achievement. The core studies did not directly test whether combining UDL with Mind Mapping produces superior outcomes.

Theme 4: Educational Applications Across Contexts

Educational applications of mapping were evident across general, secondary, medical, and nursing contexts. Concept mapping has been associated with critical-thinking development in nursing education and applied to health literacy and other multidimensional learning constructs (Wheeler & Collins, 2003; Soellner et al., 2017). Systematic evidence from medical education associated Mind and Concept Mapping with academic performance, knowledge retention, comprehension, and higher-order learning (Sajadi et al., 2024; Aljamal et al., 2026). Pediatric nursing evidence similarly reported favorable outcomes in knowledge, reasoning, self-efficacy, and clinical learning (Sawalha et al., 2026). Taken together, these studies demonstrate that mapping can be applied across substantially different educational settings, although outcomes remain dependent on instructional context and implementation.

Theme 5: Contextual Variation and Implementation

Comparable evidence also indicates variations were evident. Mapping outcomes differed according to whether learners constructed or studied maps, with construction producing stronger effects (Schroeder et al., 2018). Objective learning outcomes also did not always correspond with learner motivation (Farrand et al., 2002). UDL findings varied according to whether outcomes were assessed through learner perceptions, participation, or academic performance (Al-Azawei et al., 2016).

Evidence strength also differed by study design, with meta-analyses and controlled empirical studies providing stronger evidence for learning effects than conceptual sources. Accordingly, conceptual studies were used to contextualize the approaches, while empirical and synthesis-level studies informed conclusions regarding outcomes.

The principal evidence gap concerns the integration of Mind Mapping and UDL within educational practice. Existing research provides evidence for these approaches separately, but direct empirical evidence evaluating their combined implementation was not demonstrated consistently in the synthesized evidence. The available literature therefore supports their individual educational relevance more strongly than claims concerning their combined effectiveness.

Overall Synthesis

Overall, the evidence showed a predominantly positive pattern for mapping, particularly in knowledge organization, retention, comprehension, and active learning. Evidence for active map construction was relatively strong, while findings concerning motivation, collaboration, and implementation conditions were mixed. UDL evidence consistently addressed learner variability and flexible participation but showed greater variation in objective academic outcomes. Educational applications across contexts were generally favorable but varied according to population, instructional setting, and implementation.

Thus, the evidence supports the individual educational relevance of Mind Mapping and UDL but does not establish their combined effectiveness. The principal unresolved question is whether, and under what conditions, Mind Mapping embedded within UDL can jointly support learning, engagement, inclusion, and cognitive outcomes across educational contexts.

Discussion

The synthesis indicates that Mind Mapping and Universal Design for Learning (UDL) address distinct but potentially complementary dimensions of learning. Mind Mapping primarily facilitates the organization and representation of relationships among concepts, whereas UDL focuses on providing flexible pathways for learners to access, engage with, and demonstrate understanding. The combined evidence therefore supports a plausible basis for integrating the two approaches but does not establish that their combination produces superior outcomes compared with either approach used independently. The integrated pathway identified in this review should consequently be regarded as a synthesis-derived framework rather than an experimentally validated causal model.

Mapping as a Mechanism for Knowledge Organization and Active Processing

The predominantly favorable findings associated with mapping can be interpreted in terms of the cognitive activity required to organize relationships among concepts. Constructing a map requires learners to identify relevant information, determine relationships, and represent those relationships in an external structure. The educational value of mapping therefore appears to extend beyond visual presentation itself; it may arise from "...the process of selecting, organizing, connecting, and integrating information. Classroom-based evidence further suggests that collaborative Mind Mapping activities can support active participation and learner involvement during instruction (Budd, 2004). The cross-study synthesis consistently associates these processes with comprehension and retention, while meta-analytic evidence indicates stronger effects when learners construct maps rather than study completed maps (Nesbit & Adesope, 2006; Schroeder et al., 2018).

The stronger effects associated with map construction provide further support for this interpretation. Learners who construct maps actively determine relationships among concepts rather than simply receive a pre-organized representation. This interpretation is consistent with the meta-analytic finding that map construction produced stronger effects than studying completed maps (Schroeder et al., 2018). However, the evidence does not support the assumption that learner-generated maps are universally superior. Differences between learner-generated and researcher- or instructor-provided maps indicate that the effectiveness of mapping depends partly on how the activity is structured (Merchie & Van Keer, 2016).

Scaffolding as a Condition of Effective Map Use

The apparent contrast between stronger effects for active construction and evidence favoring provided maps can be interpreted as a possible issue of instructional scaffolding. Learners may benefit differently from map construction depending on their familiarity with mapping and the level of instructional support provided. Evidence from pre-adolescent learners indicates that researcher-provided maps may support stronger and more sustained gains than student-generated maps under some instructional conditions (Merchie & Van Keer, 2016). The synthesis identifies scaffolding, teacher practices, curriculum structure, and implementation demands as factors that may influence outcomes, while broader curriculum philosophy and teachers' epistemological beliefs may also influence classroom adoption (Kinchin, 2001).

This interpretation should nevertheless remain cautious because the available evidence does not establish a universally optimal level of scaffolding. Rather, it suggests that the relationship between learner autonomy and learning outcomes is conditional. For adolescent education, this has particular relevance because prior knowledge, familiarity with mapping, and instructional support may vary substantially between learners. Future research should therefore compare different levels of scaffolding rather than treating learner-generated and instructor-provided maps as inherently competing approaches. This interpretation is also consistent with broader evidence-synthesis work indicating that instructional effectiveness depends on how teaching strategies are implemented rather than on any single universal approach (Hattie, 2009).

Reconciling Learning Outcomes with Learner Experience

The synthesis also reveals a meaningful distinction between objective learning outcomes and learner perceptions. Some evidence indicates improved recall associated with mind mapping alongside lower motivation (Farrand et al., 2002), whereas other studies report positive learner preferences without corresponding significant performance differences (Aljamal et al., 2026). These findings suggest that academic achievement, cognitive engagement, motivation, and perceived usefulness should not be treated as interchangeable indicators of effectiveness. Qualitative evidence also indicates that learner engagement and metacognitive practices are shaped by familiarity with mapping and instructional support (Azmi et al., 2026).

UDL and the Extension from Knowledge Organization to Learner Access

The UDL evidence adds a distinct instructional dimension. Whereas mapping primarily concerns how knowledge is organized, UDL concerns how learning opportunities are designed to accommodate this interpretation aligning with broader reviews of UDL educational models (Rao et al., 2014). Multiple means of representation, action and expression, and engagement provide alternative pathways through which learners can access content, demonstrate understanding, and participate (CAST, 2011; Meyer et al., 2014; Al-Azawei et al., 2016). Practical applications of multimodal and accessible learning-resource design have also been demonstrated in UDL-based instructional materials (Webb & Hoover, 2015).

This distinction helps explain why UDL findings may be heterogeneous across outcome types. The available evidence includes studies assessing learner perceptions, learner performance, lesson planning, and curriculum alignment, making direct comparison of academic outcomes difficult (Al-Azawei et al., 2016). The evidence therefore provides stronger support for UDL as a framework and recent reviews similarly identify accessibility as one of the most consistent strengths of UDL implementation across educational settings (Cumming & Rose, 2022). Conceptual work on curriculum design further suggests that UDL can promote meaningful and engaging learning environments through flexible instructional planning (Glass et al., 2013).

Importantly, the present synthesis does not demonstrate that UDL enhances the effectiveness of Mind Mapping. Rather, the two approaches appear to address different instructional functions: Mind Mapping can support knowledge structuring, while UDL can support flexible access to that learning process. This interpretation is consistent with broader educational discussions highlighting concept mapping as a tool for meaningful learning and knowledge organization (Daley & Torre, 2010). Their integration is therefore a theoretically and educationally plausible proposition but remains empirically unverified.

Educational Applications Across Contexts

The evidence across educational contexts indicates that mapping can be applied to the organization of complex knowledge, including disciplinary and health-professional learning. Evidence from health-literacy, medical education, and paediatric nursing contexts links mapping with knowledge organization and, in some settings, retention, comprehension, critical thinking, clinical reasoning, self-efficacy, and clinical performance (Soellner et al., 2017; Sajadi et al., 2024; Sawalha et al., 2026; Aljamal et al., 2026). Earlier work in health-professional education also identified concept mapping as a useful strategy for structuring complex clinical knowledge (Daley et al., 1999).

These findings illustrate the adaptability of mapping across educational levels and disciplinary settings, but they should not be interpreted as evidence that identical effects occur under all instructional conditions. Medical and nursing learners differ from students in other educational contexts in prior disciplinary knowledge, educational objectives, and learning environments. Consequently, health-professional studies provide useful evidence of educational applicability while also illustrating the importance of contextual adaptation.

This distinction represents an important feature of the existing evidence. The available literature spans general education, secondary education, medical education, and nursing education, with variation in learner characteristics, instructional objectives, and outcomes. The appropriate interpretation is therefore contextual applicability rather than universal transferability.

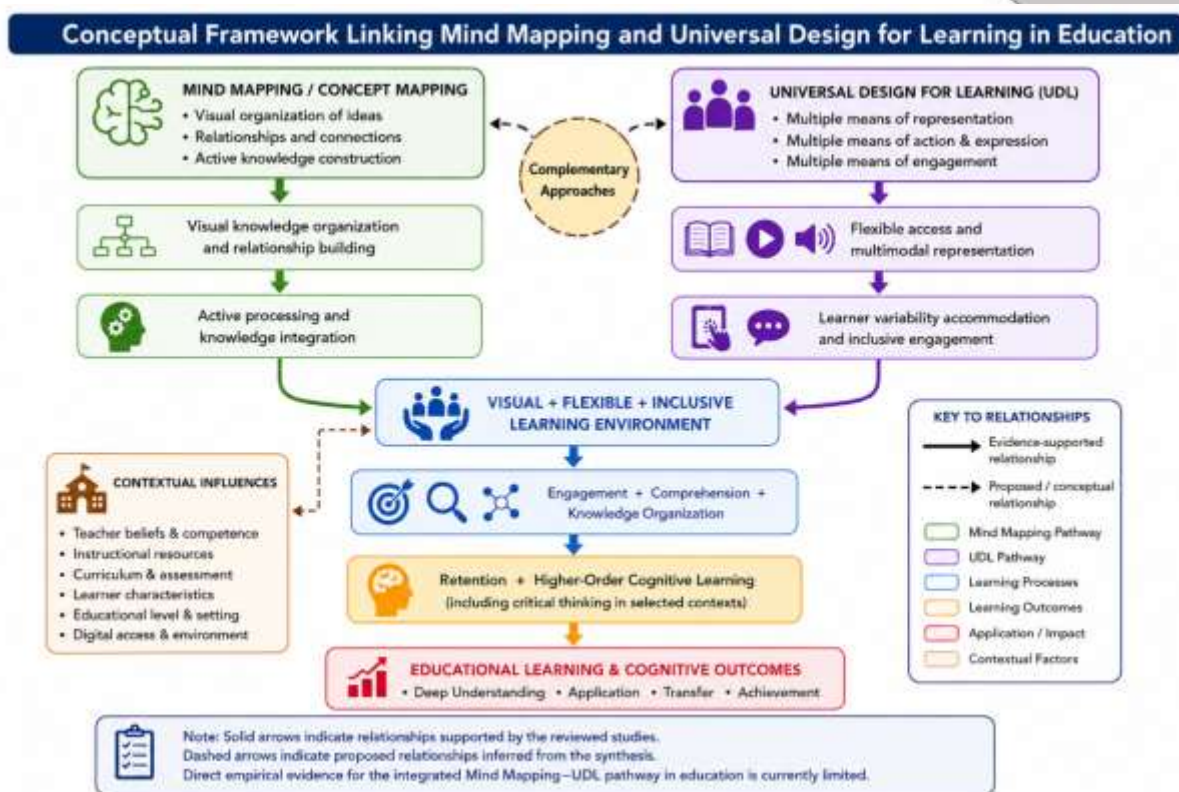


Figure 2. Conceptual Framework Linking Mind Mapping and Universal Design for Learning in Education

Implications for an Integrated Educational Learning Framework

The findings provide a coherent basis for considering how the two approaches might operate together. Mind Mapping may facilitate visual organization → relationship building → active processing → comprehension and retention, while UDL may facilitate multiple pathways for representation, expression, and engagement → accommodation of learner variability.

This potential integration is relevant across educational contexts in which learners must understand relationships among concepts, organize complex information, and demonstrate understanding through different modes. A relational visual representation may support organization of these connections, while UDL principles may provide alternative ways of accessing content and demonstrating understanding..

Nevertheless, the complete pathway has not been empirically established. The evidence supports the individual components and their conceptual compatibility but does not demonstrate that their integration will necessarily improve learning, engagement, inclusion, or cognitive outcomes.

Curriculum Implications and Research Priorities

The context-dependent nature of the evidence suggests that Mind Mapping and UDL should not be implemented as isolated instructional techniques. Teacher practices, curriculum structure, scaffolding, learner preferences, accessibility, technological modality, educational level, and implementation demands may influence their effectiveness. Across educational settings, this supports an instructional model in which mapping is progressively scaffolded while learners are provided with flexible opportunities to access information and demonstrate

understanding.

Future research should therefore move beyond examining the two approaches independently and directly test their integration. Comparative studies should examine UDL-supported Mind Mapping against conventional instruction and, where feasible, against Mind Mapping or UDL implemented independently. Outcomes should include comprehension, retention, engagement, critical thinking, and learner experience, with attention to educational level, prior knowledge, mapping format, and scaffolding level.

Overall, the evidence supports Mind Mapping as a potential mechanism for relational knowledge organization and active processing, while UDL provides a framework for flexible access and responsiveness to learner variability. Their integration is educationally plausible but remains insufficiently tested across educational contexts. The principal contribution of this synthesis is therefore to identify a specific, empirically testable intersection among visual knowledge organization, inclusive instructional design, and educational learning, rather than to claim an established combined effect.

Conclusion

This systematized narrative review indicates that Mind Mapping and Universal Design for Learning (UDL) address complementary dimensions of educational practice. Mind Mapping is most consistently associated with visual knowledge organization, active processing, comprehension, and retention, while UDL emphasizes flexible representation, engagement, and expression to accommodate learner variability. Their effectiveness, however, varies with instructional design, scaffolding, learner characteristics, and implementation context.

The principal contribution of this review is the integration and critical comparison of these previously separated evidence domains across educational contexts. The synthesis provides substantially more evidence for the individual educational functions of Mind Mapping and UDL than for their combined application. It also identifies a specific evidence gap: although individual evidence supports both approaches, empirical evaluation of Mind Mapping embedded within a UDL framework remains limited.

Future research should directly examine UDL-informed Mind Mapping interventions across educational levels while also evaluating accessibility and learner variability across implementation contexts (Cumming & Rose, 2022). Studies should examine comprehension, retention, engagement, and critical thinking while evaluating the effects of mapping format, scaffolding, learner characteristics, and implementation conditions.

Declarations

Use of Artificial Intelligence

Artificial intelligence (AI)-assisted tools were used to support language refinement, editing, structural organization, and drafting assistance during manuscript preparation. These tools were used solely to improve clarity, coherence, and presentation. All literature selection, evidence synthesis, interpretation of findings, critical analysis, and final editorial decisions were undertaken and verified by the authors. The authors accept full responsibility for the accuracy, originality, and integrity of the final manuscript.

Conflict of Interest

The authors declare that they have no known financial, professional, or personal competing interests that could have influenced the work reported in this study.

Ethical Approval

Ethical approval was not required for this study because it is a systematized narrative review based exclusively on published literature. The review did not involve human participants, animal subjects, primary data collection, or confidential personal information.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgement

The authors gratefully acknowledge the researchers whose published studies formed the evidence base for this review and contributed to the synthesis of current knowledge on Mind Mapping and Universal Design for Learning in education.

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