



PREDICTORS OF INCLUSIVE TEACHING PRACTICES: THE ROLE OF TEACHERS' PERCEPTIONS, PROFESSIONAL PREPARATION, AND INSTITUTIONAL SUPPORT

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ABSTRACT

Universal Design for Learning (UDL) has emerged as an important framework for promoting inclusive education by addressing learner variability, accessibility, participation, and academic outcomes. This review synthesizes recent theoretical and empirical literature on UDL-based pedagogical practices across school, higher education, professional education, and online learning contexts. Using a narrative-integrative review approach, the study examines evidence related to multiple means of engagement, representation, and action and expression, together with technology-supported practices, accessibility, learner participation, and implementation conditions. The findings show that UDL can create more flexible and inclusive learning environments by providing diverse pathways for accessing information, participating in learning activities, and demonstrating knowledge. Reported benefits include improved motivation, engagement, academic achievement, learner autonomy, belonging, and social participation, particularly among students with disabilities and other diverse learning needs. Technology-supported approaches, including digital tools, multimedia resources, learning analytics, augmented reality, and artificial intelligence, further enhance opportunities for accessible, adaptive, and personalized learning. However, the effectiveness of UDL implementation is shaped by several contextual factors, including teacher preparedness, professional development, workload, technological infrastructure, institutional support, and assessment flexibility. The review concludes that UDL provides a strong foundation for inclusive educational practice, but successful implementation requires coordinated pedagogical and institutional support. Further longitudinal, multi-context, and implementation-focused research is needed to evaluate fidelity, scalability, sustainability, and the long-term effects of UDL on diverse student populations and learning outcomes. Such evidence is essential for guiding educators, institutions, and policymakers in developing equitable and sustainable learning environments.

1. Introduction

1.1 Background: Inclusive Education and Learner Diversity

Diversity in students' learning abilities, languages, cultures, thinking patterns, learning styles and learning experiences is a growing feature of the contemporary classroom. This means that inclusive education needs to be delivered in settings that are flexible in meeting learners' needs, while not excluding learners whose needs deviate from the mainstream teaching. The one-size-fits-all approach to teaching and learning with traditional models can be a barrier for students who may have an alternative mode of access, participation or expression. Inclusive classroom practice has thus focused on how to develop classroom design that takes into account variability in learners, rather than differences as an exception that needs to be addressed at a later stage (Almumen, 2020; Carrington et al., 2020).

The change is especially significant for students with disabilities, students who are neurodiverse, multilingual students and students from culturally diverse backgrounds who might face barriers that may be built into the curriculum, the way the curriculum is delivered, how the curriculum is evaluated, or within the digital environment. Research on inclusive instruction suggests that if the focus is on planning in advance, reliance on individual accommodations that are only implemented when problems arise can be avoided (Griful-Freixenet et al., 2021b; Kelly et al., 2022). Equitable participation is thus more than a matter of access to classrooms; it's a matter of access to learning opportunities, meaning in content, access to displaying knowledge, and opportunities to be in learning communities.

1.2 Universal Design for Learning as an Inclusive Educational Framework

Universal Design for Learning (UDL) offers an organized approach to designing learning experiences for learners that takes into consideration all learners at the beginning. It's rooted in the understanding that variation is a natural characteristic of young people, and therefore curriculum should have flexible engagement, representation and expression pathways. Empirical research has demonstrated the support that UDL provides for teachers to create lessons that address the needs of all types of learners in a way that remains equal for all with the same learning goal (Bedir, 2022; Barahona et al., 2023).

There are three principles which are generally used to structure the framework. Multiple means of engagement involve different ways to engage, interest, persist and are considered as learner participation. Multiple means of representation are the ways in which content is presented in different ways to allow students to access and comprehend content in multiple ways. Multiple means of action and expression provide students many ways to respond, such as the way they demonstrate their understanding, in tasks and in assessment style. Research has demonstrated that these principles can be applied when designing lessons, training teachers, and in their classrooms both in educational and professional settings (Lowrey et al., 2023; Thoma et al., 2023).

UDL is related to inclusive education in that they both try to prevent barriers which limit participation. UDL-based course redesign in higher education has shown to be correlated with more flexible learning experiences and have improved access to instructional materials (Espada-Chavarria et al., 2023; Redstone & Luo, 2024). Likewise, research in VLEs reveals that pupils appreciate flexibility, ease of access and autonomy in the way learning and work are delivered (Beck Wells, 2022; Seymour, 2024).

1.3 Pedagogical, Accessibility, and Learning Challenges

Despite the potential, the implementation of UDL is not easy. A large number of educational systems have stuck to the old style of teaching and learning, of single assessment systems and of teaching the same thing to everyone. The methods used can be detrimental to students who needs alternative means for representation, response, and/or expression. Research on teacher practice shows that for effective implementation of UDL, teachers' knowledge, confidence, planning skills and access to appropriate professional development are critical (Craig et al., 2022a; Craig et al., 2022b).

Accessibility barriers are not limited to physical barriers as well. Digital inaccessibility, cognitive overload, as well as the lack of or inflexibility in assistive technologies and instruction, and inflexibility in assessment practices can limit participation. The findings presented in faculty perspectives demonstrate that institutional support, training, time, and practical resources have a strong influence on whether the principles of UDL are consistently taught. The results of the faculty perspectives indicate that institutional support, training, time and practical resources are key factors

determining whether principles of UDL are taught consistently or not. Some of these barriers may be overcome with the help of emerging technologies. For instance, augmented-reality learning and artificial-intelligence based learning can offer alternative formats, interactive learning opportunities, as well as adaptive support, however, the effectiveness of these in practice depends upon the pedagogical integration (Gill et al., 2024; Hyatt & Owenz, 2026).

Importantly, there are many growing links between improved student outcomes and increased UDL implementation. Research has indicated links with academic achievement and motivation, engagement and belonging, implying that UDL can have an impact on accessibility and learning performance (Craig et al., 2024; Guo & Wang, 2025). The flexible teaching approach has also been found to be effective in the context of other subjects, such as science education (Dempsey et al., 2023) and anatomy education (Javed et al., 2024) in the field of science education, where it has been shown to facilitate achievement and motivation in students. But these benefits can be different, depending on how faithful to the model they are implemented, their educational level, the institutional context, and their characteristics as learners.

1.4 Educational Leadership and Organizational Conditions for UDL

The universal design for learning should not be considered as a purely pedagogical approach at the classroom level as it relies significantly on the leadership and conditions of an educational organisation in order to be implemented for a long period. School leaders have an impact on the implementation of inclusive principles in curriculum, training, assessment, resource allocation, technology choices and collaborative structures. Leadership is especially crucial when the school wants to transition from individual or small group teacher-led implementation of UDL to school-wide efforts for accessibility and inclusion. In terms of organization, any successful UDL implementation needs to have support from the leadership priorities, teachers, curriculum, technology, accessibility codes and systems of professional collaboration. Principals and instructional leaders can support implementation by allocating teacher planning time, offering opportunities for professional learning, coaching, using available educational technologies, and offering organizational support.

Distributed leadership is another point to consider as it may require multiple school administrators to implement, but also involve classroom teachers, special educators, instructional designers, technology staff, accessibility staff, and families. This is a way to situate UDL in broader conversations about inclusive school leadership, organizational growth, and school equity. Accessibility may be an individual accommodation or it could be integrated into the normal curriculum planning and instructional processes, and this is a leadership decision that could make the difference. A UDL approach, therefore, might be viewed from an educational leadership perspective to help understand the conditions and structure of the school to foster or limit sustainable inclusive practice.

1.5 Rationale and Objectives of the Review

As UDL grows wider in scope and use in school, online learning, higher education, professional education, and technology-supported settings, there is a significant but fragmented evidence base. Recent research has shifted the paradigm of UDL from an accessibility approach to that of a pedagogical practice that offers the potential to enhance participation, belonging and learner agency (Chick et al., 2025). A synthesis that is focused on bringing together pedagogical practices, accessibility mechanisms and student outcomes, and that uncovers barriers to effective pedagogical practices is thus required. This review can help to shed light on the UDL process in a variety of contexts and offer practical guidance to teachers and schools for creating a more inclusive school environment.

The objectives of this review are to:

- 1.Examine major UDL-based pedagogical practices and their application within inclusive educational settings
- 2.Evaluate the contribution of UDL to accessibility, participation, engagement, achievement, autonomy, and inclusion among diverse learners
- 3.Identify key implementation barriers and derive implications for teaching practice, institutional support, and future research
- 4.Examine how educational leadership, organizational conditions, institutional support, and policy influence the implementation and sustainability of UDL, particularly within K–12

2. Methods

The research used in this study is narrative-integrative type of research to synthesize the existing knowledge on Universal Design for Learning (UDL) in inclusive education. The choice of the approach was made because it enabled a theoretical perspective and empirical data from various educational contexts to be studied together. The review was limited to pedagogical practices related to UDL, accessibility, participation of the learners, student outcomes, and implementation conditions, in school, higher education, online learning, and professional education.

Journal articles that were peer reviewed and focused on the topic of UDL implementation, inclusive pedagogy, educational accessibility, or learner outcomes were given priority. The emphasis was placed on contemporary research (published in the last 5 years) and some earlier research was included to give background and continuity of conceptual focus. Where they could be considered to have a direct contribution to the aims of the review studies in both school and higher education settings were included. Articles were not included if UDL was cited only as a tangential topic, or the main subject of the article had little or nothing to do with instructional accessibility and/or inclusive learning, pedagogical design or student participation.

Due to the conceptual focus of the target, there is a special focus on evidence from elementary and secondary education, as it is evident that educational leadership and organizational implementation is part of this conceptual focus. Studies from higher education and professional education were retained if the evidence presented was transferable to the teacher preparation environment and/or institution, professional development, organizational support, technology implementation, and/or policy conditions that could have implications for the K–12 environment. Based on the UDL principle and the learner's outcome, findings were thus taken into account in thematic synthesis, while also taking educational level and organization into account.

The selected literature was then analysed comparatively and themes were identified which were common to the different texts. These included: UDL-based pedagogical practices, accessibility and participation, technology-enables UDL, student learning and developmental outcomes, and barriers and enabling conditions of implementation. Results in each category were analyzed by level of education to determine if there were patterns, variations across the education levels and implications for inclusive teaching. This thematic organization was the foundation for weaving in evidence of how UDL is implemented, the educational outcomes that have been linked to the use of UDL, and the institutional and pedagogical conditions that impact successful implementation. The UDL literature was organized into the review process and themes shown in Figure 1.

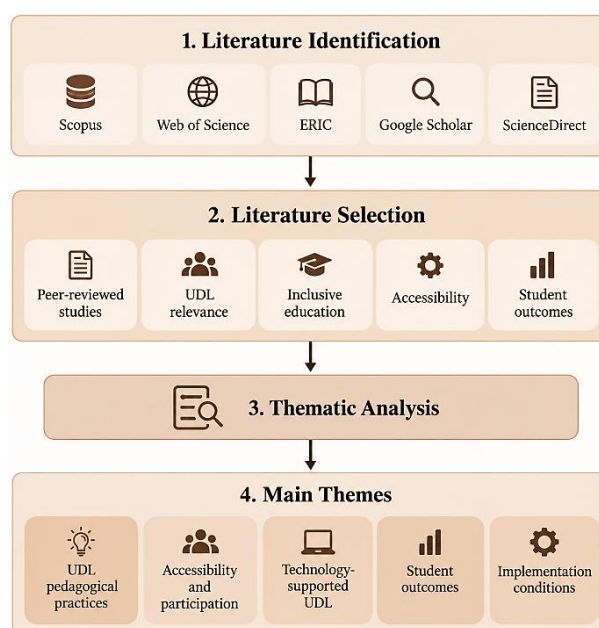


Figure 1. Review Process and Thematic Organization of UDL Literature

3. Results: UDL Pedagogical Practices in Inclusive Education

The literature reviewed shows that the key components of the implementation of Universal Design for Learning (UDL) include: flexible pedagogical strategies designed to enhance student engagement, access to information, expression of information and to lower obstacles in educational settings. In all learning environments (school, higher education, professional education, and online learning), the top three most cited practices identified were related to the 3 main UDL principles: multiple means of engagement, representation, and action and expression. Digital and adaptive technologies are also becoming a part of these practices, with an increasing number of applications.

3.1 Multiple Means of Engagement

Multiple means of engagement are about enhancing learner motivation, engagement, persistence and personal involvement in learning. Literature suggests that key elements in UDL instructional strategies include opportunities for learners to make choices, collaborative learning, goal setting, peer interaction, and the opportunity for self-regulation. Giving pupils sensible options over the tasks, materials and learning sequences that they use can help to make their learning more autonomous, and less passive. Dempsey et al. (2023) showed the importance of applying UDL principles to understand student motivation and Beck Wells (2022) revealed that flexibility and choice were appreciated by students in virtual higher education settings.

Cooperative and participatory learning helps to keep students engaged as well. Students can engage in activities and tasks with peers and in a structured fashion, thus engaging in various social and cognitive ways. Thoma et al. (2023) illustrated a way in which UDL-informed STEAM activities could merge engaging with learning through collaboration and technology. Similarly, Kelly et al. (2022) pointed out the importance of the strategies for participation during outdoor learning. In general, the fidelity of the implementation seems to be important with higher fidelity related to student engagement and sense of belonging (Guo & Wang, 2025).

3.2 Multiple Means of Representation

Multiple means of representation is about the way children perceive, process and understand information. The literature reviewed included descriptions of the use of visual, auditory, textual, digital and multimodal resources to enhance accessibility. UDL teaching approaches do not just teach content in one way, but include multiple ways of representing the information with scaffolding, clear instructions, examples, and explanations.

Barahona et al. (2023) discovered that preservice teachers were able to adapt the use of UDL to the context of remote learning with diverse learners, such as by choosing flexible presentations of content. Likewise, Espada-Chavarria et al. (2023) highlighted the importance of diversity in teaching and learning in inclusive HE. Multimodal representation can be beneficial for students with linguistic, sensory, and/or cognitive barriers as it provides multiple ways to gain access to academic content. Flexible content presentation has also been integrated into classroom practice that will be UDL-oriented in science-related contexts (Kirsch et al., 2024). Based on the literature, the following pedagogical practices were identified as the main ones: Table 1 summarizes these practices.

Table 1. Major UDL Pedagogical Practices and Their Applications in Inclusive Education

UDL principle	Major pedagogical practices	Application in inclusive education	Expected educational contribution	Citation
Multiple means of engagement	Choice, goal setting, collaboration, peer interaction	Enables learners to participate according to motivation, interests, and preferred forms of involvement	Motivation, persistence, autonomy, participation	Dempsey et al. (2023); Guo and Wang (2025)

Multiple means of representation	Visual, auditory, textual, and multimodal resources	Provides alternative routes for accessing and processing information	Comprehension, accessibility, cognitive support	Barahona et al. (2023); Espada-Chavarria et al. (2023)
Multiple means of action and expression	Flexible assignments, presentations, projects, alternative assessments	Allows students to demonstrate learning through varied formats	Learner agency, equitable assessment, participation	Adom et al. (2023); Lowrey et al. (2023)
Flexible instructional design	Scaffolding, differentiated activities, adjustable pacing	Responds to variation in learner readiness and support needs	Inclusion, participation, reduced learning barriers	Bedir (2022); Carrington et al. (2020)
Technology-supported UDL	Multimedia, adaptive tools, AR, AI, online platforms	Extends access through digital and personalized learning pathways	Accessibility, interaction, personalization	Gill et al. (2024); Hyatt and Owenz (2026)

3.3 Multiple Means of Action and Expression

Multiple Means of Action and Expression offer students more ways to express their knowledge and be involved in the assessment process. Responding to the literature, flexible formats for assignments, project-based activities, presentations, performance tasks, and electronic submission, and other options for non-standard written evaluation have been noted. Inclusive pedagogy can be flexible and include flexible learning and expression in culturally diverse educational settings, as Adom et al. (2023) demonstrated. In a similar vein, preservice teacher research demonstrates UDL helps teachers to use different types of learner response in their design of lessons (Lowrey et al., 2023).

The following strategies are particularly pertinent for students who have a solid grasp of the course material, but are constrained in being able to share this information in one mode of assessment. Certainly, UDL shifts the perspective of flexibility in assessment to consider it a part of instruction, not an exceptional accommodation. Previous classroom study also showed UDL teaching is a viable approach for students with learning disabilities and without learning disabilities (King-Sears & Johnson, 2020). The three core UDL dimensions have associated pedagogical practices that are summarized in a conceptual way in Figure 2.

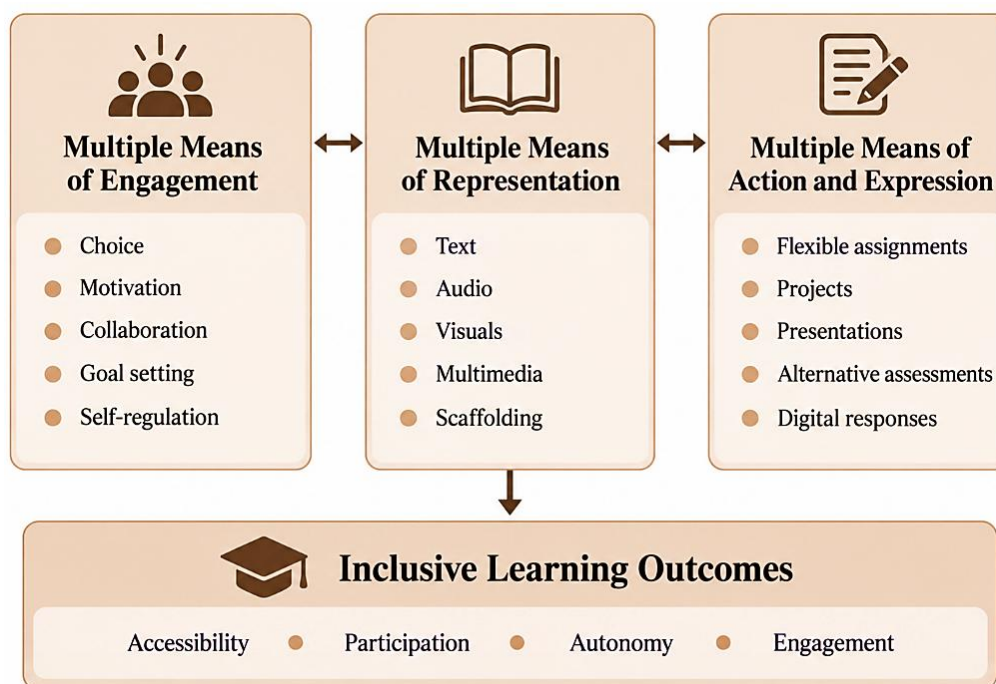


Figure 2. Core UDL Pedagogical Practices in Inclusive Education

3.4 Technology-Supported UDL Practices

The use of technology has grown in importance as it has broadened the usefulness of UDL in real world situations. Technology has played a greater role in making UDL more useful in real world applications. LMS, multimedia, AT, digital accessibility, learning analytics and adaptive platforms can offer several options to access content and learning tasks. Redstone and Luo (2024) showed, for instance, how to redesign an online computer science course using UDL, and Seymour (2024) shared examples of UDL's use in enhancing the online student experience.

Augmented reality, learning analytics and artificial intelligence are more advanced techniques. Gill et al. (2024) combined augmented-reality game based learning and UDL, while Roski et al. (2024) showed the possibilities of relating learning analytics with UDL to detect learning patterns of the learner. Artificial Intelligence (AI) technologies can continue to aid those with disabilities in terms of personalization and accessibility for learners (Hyatt & Owenz, 2026). This table (Table 2) summarizes the main technology-supported practices that were found in the studies reviewed and their applicability to inclusive learning.

Table 2. Technology-Supported UDL Practices and Their Inclusive Educational Functions

Technology-supported practice	UDL-related function	Inclusive application	Potential student benefit	Citation
Learning management systems	Flexible access to content and activities	Supports asynchronous and differentiated participation	Accessibility and learner autonomy	Beck Wells (2022); Seymour (2024)
Multimedia resources	Multiple means of representation	Combines text, audio, video, and interactive resources	Improved content accessibility	Espada-Chavarria et al. (2023)

Augmented-reality learning	Engagement and interactive representation	Provides experiential and multimodal learning opportunities	Motivation and active participation	Gill et al. (2024)
Learning analytics	Monitoring learner interaction and variability	Helps identify differing participation and learning patterns	Personalized instructional support	Roski et al. (2024)
Artificial intelligence tools	Adaptive support and alternative access	Can support students with disabilities through flexible assistance	Personalization and independence	Hyatt and Owenz (2026)
Accessible online course design	Flexible representation and expression	Enables students to access materials and complete tasks in multiple formats	Participation and equitable access	Redstone and Luo (2024)

The interaction between digital technologies and UDL-based inclusive learning practices is presented in Figure 3.

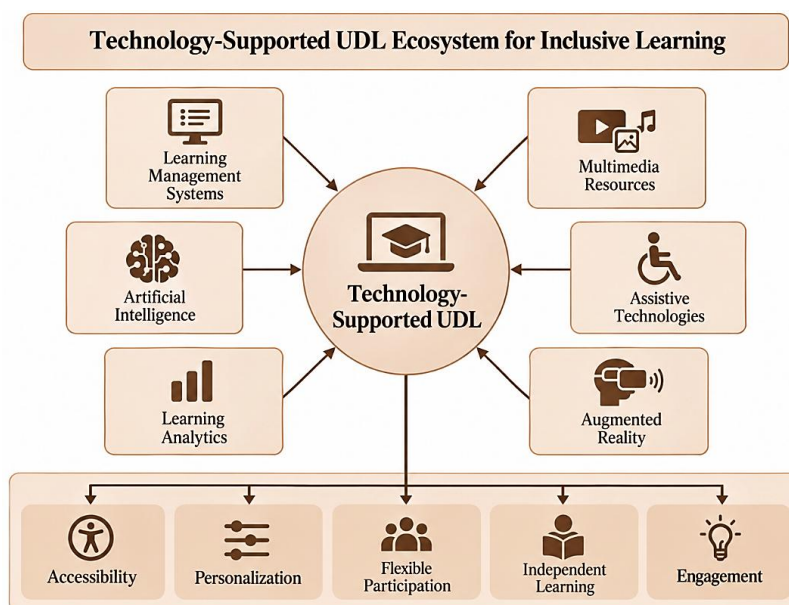


Figure 3. Technology-Supported UDL Ecosystem for Inclusive Learning

4. Results: Accessibility, Participation, and Inclusive Learning

Literature reviewed suggests that the implementation of the Universal Design for Learning (UDL) factors can help to achieve inclusive education by minimizing barriers to access, participation and engagement. UDL's accessibility is not limited to physical accessibility, but encompass sensory, digital, cognitive, instructional, linguistic and social aspects. In various forms of education inclusive learning is enhanced where access is planned from first principles in the design of the course and not as a once-off extra.

4.1 Physical, Sensory, and Digital Accessibility

Mobility, visual, auditory and other functional impairments are the reasons why physical and sensory accessibility are still key principles of inclusive education. UDL Inspired Environments strive to provide classroom, materials, and digital environments that are accessible via multiple means. This means that electronic documents can be read, multimedia can be captioned, they can be read by a

screen reader, they can be read aloud to the user, they have alternative text for images, and they have navigation structures that can be accessed by a person using a screen reader. Carrington et al. (2020) emphasized in their research the need to plan for the specific needs of students with autism in the learning context, and Kelly et al. (2022) showed that the UDL principles are adaptable to inclusion outside of the classroom. With the changing nature of learning – both online and blended – digital accessibility becomes a growing priority. Flexible access to learning and the use of multiple formats has been valued by students (Beck Wells, 2022) and an online course that integrates a UDL approach has the potential to provide an accessible and inclusive learning experience (Seymour, 2024). A research study by Redstone and Luo (2024) also showed that planned redevelopment of an online computer science course resulted in greater flexibility in access to content and in engaging with learning activities.

4.2 Cognitive and Instructional Accessibility

UDL also seeks to overcome cognitive and instructional challenges that can occur when a learner is required to access higher-order information in just one way. Clearly giving instructions, structuring learning sequences, scaffolding, flexible pacing, chunking, and multimodal explanations can be strategies to eliminate unnecessary cognitive load. Bedir (2022) found that teachers saw the importance of flexible and differentiated teaching in UDL and Barahona et al. (2023) demonstrated that preservice teachers could accommodate for the diversity in learners in a remote teaching context. The multimodal explanations are especially relevant as they offer alternative ways of understanding. Espada-Chavarria et al. (2023) called for the adoption of diverse instructional approaches to facilitate inclusive higher education and Kirsch et al. (2024) showed how UDL principles can be applied to science education. This practice enables all students to interact with the learning content at a different level, depending on their prior experience, processing speed and cognitive readiness. Table 3 provides an overview of the major dimensions of accessibility that are addressed by UDL.

Table 3. Dimensions of Accessibility Addressed Through Universal Design for Learning

Accessibility dimension	UDL-related practices	Inclusive function	Expected learner benefit	Citation
Physical accessibility	Flexible classroom arrangements and accessible learning spaces	Reduces environmental barriers to participation	Greater physical access and inclusion	Kelly et al. (2022)
Sensory accessibility	Captioning, alternative text, screen-reader support, text-to-speech	Provides multiple sensory pathways to information	Improved access for learners with sensory needs	Carrington et al. (2020); Hyatt and Owenz (2026)
Digital accessibility	Accessible documents, multimedia, navigation, online platforms	Enables equitable participation in digital learning	Flexible and independent access	Beck Wells (2022); Redstone and Luo (2024)

Cognitive accessibility	Chunking, scaffolding, structured instruction, flexible pacing	Reduces unnecessary cognitive load	Improved comprehension and persistence	Bedir (2022); Barahona et al. (2023)
Instructional accessibility	Multimodal explanations and differentiated presentation	Provides alternative routes to learning	Better understanding across learner profiles	Espada-Chavarria et al. (2023); Kirsch et al. (2024)
Social and participatory accessibility	Choice, collaboration, peer interaction, flexible participation	Supports belonging and classroom involvement	Increased engagement and learner agency	Craig et al. (2024); Guo and Wang (2025)

4.3 Supporting Students with Diverse Learning Needs

The research shows that UDL is particularly important for students with learning needs likely not to be met through the traditional models of instruction. This is for students with disabilities, neurodiversity, multilingual students, students with uneven backgrounds and students from the socially or educationally disadvantaged backgrounds. It is evident that UDL could be adapted across cultural contexts, as demonstrated by Almumen (2020) that it can be used effectively with different groups of students. Gujarat et al. (2023) also demonstrated the need for culturally diverse learners by presenting the concepts of inclusive pedagogy and how it can be addressed through flexible pedagogical design. Adom et al. (2023) also used flexible pedagogical design to demonstrate the need for culturally varied learners and how inclusive pedagogy can address them.

Additionally, with UDL, there may be a decrease in the need to identify students in a deficit-focussed way since support is provided to all learners. In an inclusive education context, Griful-Freixenet et al. (2021b) showed that designing learning experiences in the light of the learner variability that is expected is one way to strengthen inclusive education practice. This has been further developed by more recent research in the areas of non-traditional learners, and wider equity issues (Chick et al., 2025).

4.4 Equity, Participation, and Learner Agency

The focus on participation, choice and learner agency is a key element of UDL. Equal access is only meaningful if pupils can also contribute and make decisions, and demonstrate competence. Flexible learning pathways can support independence and self-advocacy by providing options for students to choose which means of learning and/or representation to use. Craig et al. (2024) found that UDL implementation was correlated with student outcomes, and that Guo and Wang (2025) found that there were correlations between the level of fidelity in the implementation and student achievement, engagement, and belonging. The results indicate that UDL may be used to decrease exclusion and stigmatization by providing flexibility in the context of the normal educational design process—rather than only selected learners. This means that access and equity are part of the fabric of teaching which underpins more extensive participation, robust academic belonging and increased learner independence. UDL is a multi-dimensional concept that is seen as a relationship between accessibility, participation and learner agency in Figure 4.

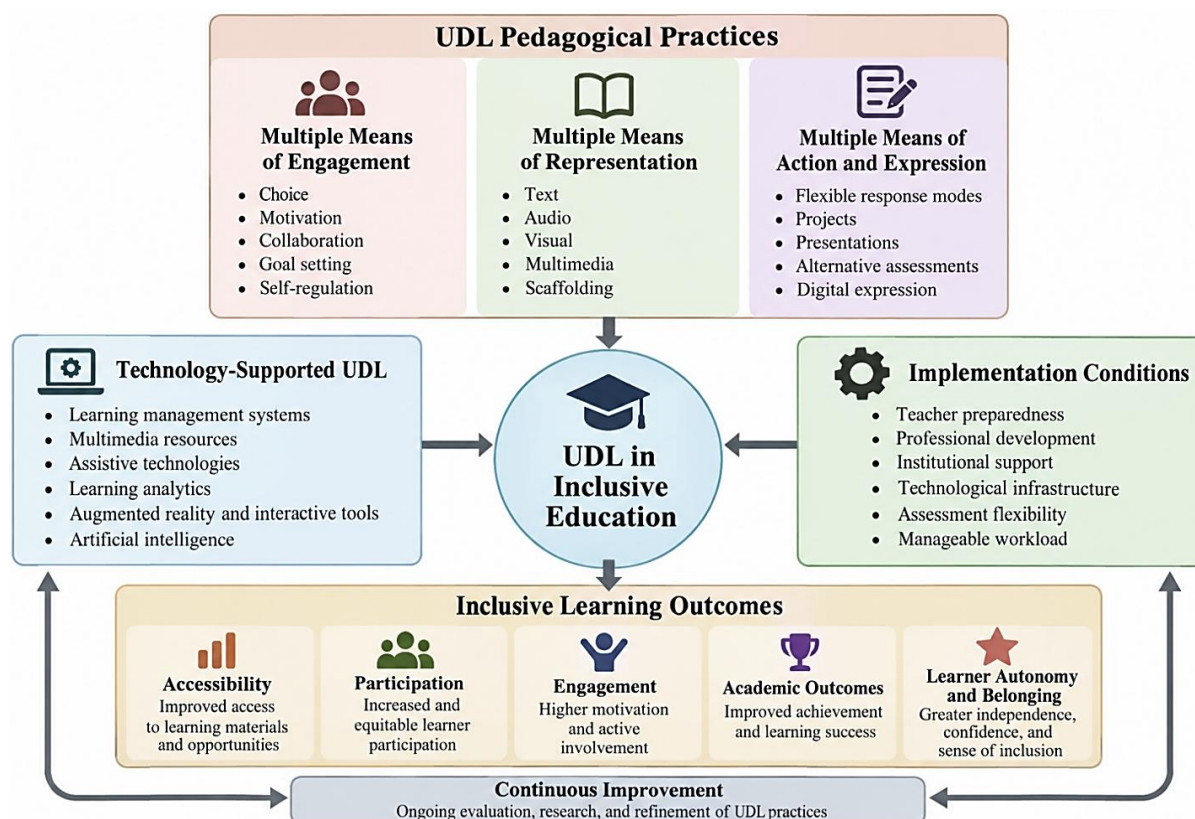


Figure 4. Dimensions of Accessibility and Participation Supported by UDL

5. Discussion

The results suggest that Universal Design for Learning (UDL) is not only applicable for accessibility, but also for motivation, achievement, autonomy, belonging and participation of students. The size of these benefits seems to be dependent on the consistency of implementation, preparedness of the teachers, institutional support and how UDL is integrated into curriculum, instruction, assessment and technology.

5.1 Student Engagement and Motivation

The evidence reviewed indicates that UDL can enhance behavioral, emotional and cognitive engagement by offering students multiple means of engaging and providing choices. Allow some flexibility in learning activities to boost interest and persistence as the students are not limited to just one way of engaging. Dempsey et al. (2023) illustrated why UDL is relevant to student motivation and Guo and Wang (2025) linked engagement and belonging with increased levels of fidelity with UDL implementation. Interactive and experiential learning can also enhance the participation, for instance through augmented reality learning, which offers opportunities for active and multimodal involvement (Gill et al., 2024). However, satisfaction in online learning seems to be greater if there is flexibility and ease of participation in the course design (Beck Wells, 2022).

5.2 Academic Achievement and Learning Performance

The evidence reviewed suggests that UDL can contribute to learning achievement through the use of a variety of approaches to access content, activities and evidence of learning. Being flexible in instructional design can minimize barriers that occur when everyone in the classroom is expected to learn and/or respond in the same format. The implementation of the principles of UDL in science instruction has been shown to improve academic achievement (Javed et al., 2024); other studies have found success with UDL in inclusive learning settings more broadly (Craig et al., 2024). UDL also includes the ability to provide learners with choices to interact with the content of the course and complete learning tasks. This will allow for greater flexibility and may promote goal setting, self-monitoring, metacognition, and independent learning. In addition to greater learner choice and flexible participation (Redstone & Luo, 2024), Seymour (2024) also found that an online learning experience was enhanced through accessible and adaptable learning processes when designing online courses

with UDL. These learning outcomes have close links to other learning outcomes. Engagement and motivation can be enhanced through choice and a range of learning activities (Dempsey et al., 2023; Guo & Wang, 2025) and belonging and social interaction can be supported by inclusive participation (Chick et al., 2025; Kelly et al., 2022; Gilleran Stephens et al., 2025). Accessible formats and flexible support may also serve to expand access for all kinds of learners (Dempsey et al., 2024; Hyatt & Owenz, 2026).

5.3 Learner Autonomy and Self-Regulated Learning

Another contribution to learning that UDL makes is the social aspects of learning. The difference between formal and informal support can be removed by flexible support, where flexible support is offered to students who receive formal support, it's also offered to the rest of the students. Chick et al. (2025) perceived UDL as a process to establish an equal playing field to reduce any obstacles that affect all non-traditional students. In a context of cultural diversity, with the use of UDL, there is also the potential to extend opportunities for meaningful participation (Almumen, 2020). Inclusive design can consequently increase the sense of belonging in the classroom, facilitate peer interactions, enhance independence and social participation and help to minimise stigmatisation.

5.4 Inclusion, Belonging, and Social Participation

UDL also contributes to the social dimensions of learning. Inclusive environments can reduce the distinction between students who receive formal accommodations and those who do not because flexible support becomes available to the wider learner population. Chick et al. (2025) conceptualized UDL as an equity-oriented framework for reducing barriers affecting diverse non-traditional learners. In culturally varied contexts, UDL has similarly demonstrated potential to broaden opportunities for meaningful participation (Almumen, 2020). Inclusive design may therefore strengthen classroom belonging, peer interaction, independence, and social participation while reducing stigmatization.

5.5 Challenges and Barriers to UDL Implementation

Although UDL has potential for widespread use, it is not being implemented evenly in educational settings. While teachers might be familiar with the basic principles of UDL, they may struggle with implementing the principles in the design of their lessons, instructional delivery, and/or assessment. Bedir (2022) highlighted the significance of teacher perspectives in the practical implementation and Duncan et al. (2025) raised institutional and operational issues impacting UDL implementation in higher education. Factors such as time constraints, workload, lack of resources, technological constraints, and institutional support are common obstacles. Awareness and implementation can also be different in different disciplines, such as health-professions education (Dempsey et al., 2024). The enabling factor of teacher preparation is thus an important one. Coaching may enhance teachers' implementation by boosting their UDL application in the classroom (Craig et al., 2022a); continuous professional development can enhance teachers' ability to apply UDL systematically in curriculum and instruction (Craig et al., 2022b). Preservice preparation is also critical, as future teachers must have experiences with inclusive design during their preservice experiences in order to make it a part of their lesson planning before entering the professional world (Lowrey et al., 2023). Access to technology, flexible curricular and assessment systems, leadership at the institutional level and implementation frameworks are also key to broader implementation (Espada-Chavarria et al., 2023; Kotcherlakota et al., 2024; Roski et al., 2024; Hyatt & Owenz, 2026; Griful-Freixenet et al., 2021b; Guo & Wang, 2025).

5.6 Educational Leadership and Organizational Support for UDL Implementation

The evidence reviewed suggests that the success of the implementation of Universal Design for Learning (UDL) is not only dependent on the teacher's knowledge of instructional practices for UDL but is also influenced by the conditions that are set for UDL by the educational leadership. The decisions made by school leaders can affect whether UDL is used in isolated classrooms or is an integrated school-wide approach: professional development, collaborative planning, curriculum flexibility, technological support, accessibility support, assessment, and more. However, coaching and ongoing professional development have been found to support teachers' capacity to apply UDL to classroom practices and so implementation capacity should be considered more as an organizational responsibility than an individual responsibility (Craig et al., 2022a; Craig et al., 2022b). A distributed leadership approach is relevant in particular as the responsibility for inclusive education lies with

principals, classroom teachers, special educators, curriculum coordinators, instructional coaches, technology, accessibility specialists, students and families.

Collaborative accountability allows schools to leverage collaborative expertise in curriculum, assessment, technology, accessibility and professional development. Preservice preparation also is an important consideration as teachers need opportunities to apply inclusive principles prior to starting practice (Lowrey et al., 2023). Leadership also influences implementation through its approach to resource distribution and its norms and values. The staffing, planning time, available technology, technical support, and instructional resources can facilitate or hinder UDL implementation. Faculty views also point to the need for institutional support for continued implementation (Kotcherlakota et al., 2024). However, UDL should not be viewed just as a pedagogical approach, but as a strategy for organization and continuous institutional support that must be led by teachers and supported by other teachers and service providers.

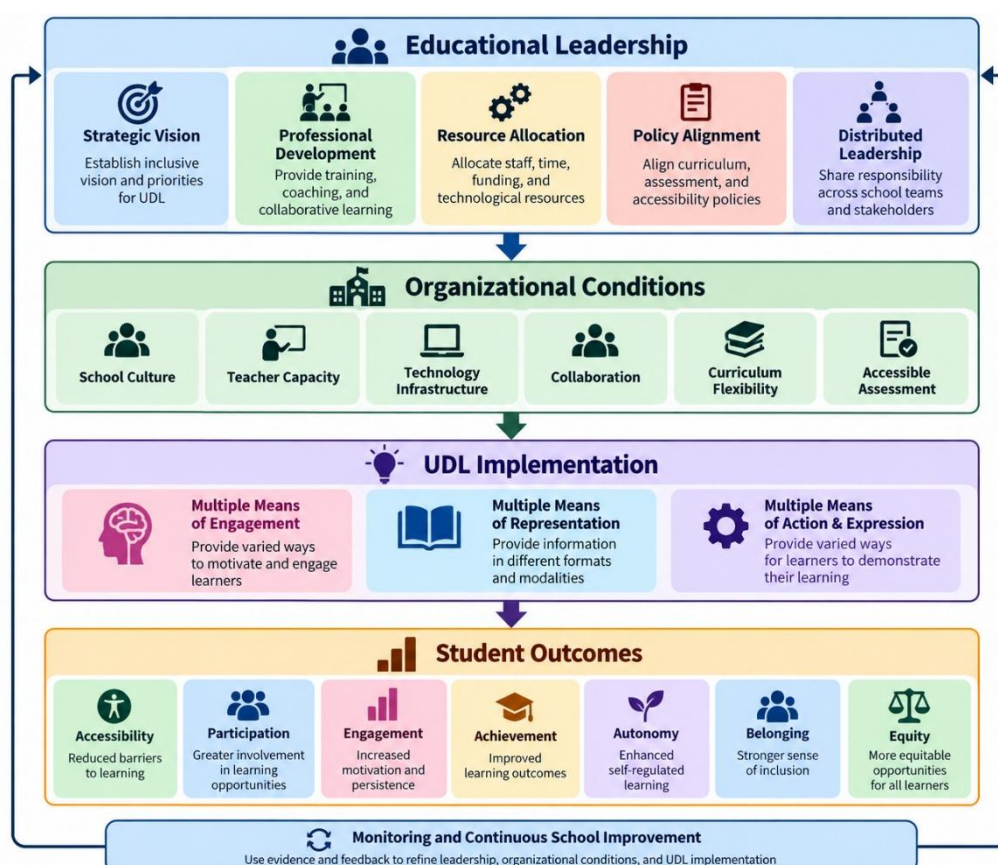


Figure 5. Educational Leadership Framework for School-Wide UDL Implementation

Within K–12 settings, leadership is particularly important because UDL implementation often requires coordination across classrooms, grade levels, special education services, curriculum teams, and school-wide support systems. Principals and instructional leaders can strengthen implementation by embedding inclusive design within school improvement priorities, allocating collaborative planning time, supporting sustained professional development and coaching, and ensuring access to appropriate instructional and technological resources. Evidence from school-based studies indicates that teacher preparation, coaching, and consistent application of UDL principles can strengthen classroom implementation and contribute to more inclusive learning experiences (Craig et al., 2022a; Craig et al., 2022b). Primary-school applications further demonstrate that UDL can be integrated into collaborative and technology-supported learning activities, illustrating its relevance beyond individual classroom accommodation toward broader inclusive school practice (Thoma et al., 2023).

5.7 Educational Policy and System-Level Implications

Importantly, UDL implications for educational policy are that curriculum standards, assessment requirements, accessibility regulations, and technology policies can hinder or facilitate flexible instructional design, as can professional development structures. Policies acknowledging learner

variability can contribute to ensuring multiple means of engagement, representation and action and expression are in place at the school and district level, not solely reliant on individual teacher initiative. On the other hand, the rigidity of curriculum and assessment can interfere with flexibility for the teacher to offer myriad learning pathways, even if they have knowledge of UDL (Espada-Chavarria et al., 2023). A policy-oriented perspective of UDL also promotes educational units to look for potential barriers prior to limiting student participation.

The accessibility guidelines for digital materials, AT, flexible assessment arrangements, professional learning and inclusive curriculum design can move schools from reactive, accommodative to proactive, planning for education. This is in line with UDL foundation principles to account for the variability of learners in the design of learning environments, instead of using accessibility as a special intervention. Policy coherence plays a key role in this regard for sustainable implementation. If all of the above areas are separate, UDL implementation could be disjointed. This can be achieved by alignment of the school-wide implementation across these areas that can be provided by support from leadership. Additional studies also indicate that fidelity to UDL implementation is related to student achievement, engagement and belonging (Guo & Wang, 2025). Therefore, in addition to investigating the use of UDL in schools, policy should also explore the organizational structure, resources, and accountability system that will allow for the consistent and equitable use of UDL.

5.8 Implications for Teachers and Educational Institutions

The results show that the implementation of UDL involves coordinated effort and involvement of teachers, educational leaders and the support systems within the institution. This means there is need for teachers to expect some variation in learners' performance when planning lessons and not only when difficulties in learning arise. Representations, participatory opportunities, resources, and assessment should thus be regularly integrated into the design of instruction to be flexible, accessible, and varied. Teachers' beliefs and understanding are also relevant as inclusive frameworks are more likely to impact classroom practice when teachers understand how their principles play out in classroom practices (Griful-Freixenet et al., 2021a). But for educational leaders, it is not only about the individual teacher's responsibility to implement UDL.

Leadership can help by setting expectations that are inclusive in the school, offering continuous professional development, allowing for time to plan together, making resources for access available, and incorporating UDL into curriculum and assessment. This is a change in the focus of leadership on finding problems in the learners' individuality and moving to enhancement of the environment. It is also critical that schools foster relationships between general and special educators, instructional coaches, curriculum specialists, accessibility and technology teams. However, the collaboration is crucial as there can be a combination of pedagogical, curricular, assessment-related, technological, and organization-related barriers that can arise. There is evidence that suggests sustained professional development and coaching is more effective at strengthening implementation of UDL than a single exposure to UDL principles (Craig et al., 2022a; Craig et al., 2022b). These supports can be institutionalized to help create a system for school improvement that is inclusive and equitable.

5.9 Research Gaps and Future Directions

Future research needs to shift from short-term studies, single classroom, single institution studies to study how leadership, organizational structures and policy environments affect the sustainability of implementing UDL. It is especially important to carry out longitudinal and multi-site studies to establish the sustainability of improved levels of accessibility, participation, engagement and achievement in different school contexts and over time. There is also a need to find a stronger voice for elementary and secondary education where the interaction between leadership, capacity, the curriculum policy, and inclusive practice are still vital in system implementation. Another priority is to establish universal acceptance of a UDL implementation fidelity measure. Anything that is more consistent would allow researchers to compare schools, education levels and social and cultural context and investigate if there is a relationship between the level of engagement and the equity of the outcomes. Existing evidence of the relationship between implementation fidelity and achievement, engagement and belonging highlights its significance (Guo & Wang, 2025).

Future research needs to also explore the relationship between principal, distributed leadership teams, professional development, and school organizational culture, and how they impact implementation

quality. Another area of research of great importance is the studies of emerging technologies. Learning analytics can support schools to detect participation patterns and learner variability, as well as AI can provide adaptive and accessible types of instructional support (Roski et al., 2024; Hyatt & Owenz, 2026). Further research is needed to explore the relationship of these technologies with issues of accessibility, equity, governance, cost-effectiveness and implementation capacity, however. Comparative studies at the school, district, and national levels to better understand the role of leadership and policy influencing scalability and sustainability of UDL would also be useful.

6. Conclusion

As a practical approach to inclusive education, the framework of Universal Design for Learning (UDL) has risen to the forefront of efforts to deal with learner variability, thereby minimizing barriers to student success in the curriculum, the classroom, the assessment process, and in the Digital Learning Environment. The evidence reviewed suggests that UDL is most effective when the three principles of engagement, representation, and action and expression are systematically included as multiple means of engagement in the design of education, rather than being used as individual accommodations. In all three contexts (school, higher ed, professional ed, and online), UDL-based practices correlated with increased flexibility, better accessibility, more engagement of learners, and greater opportunities for learners to show knowledge. There are also positive links to motivation, engagement, academic success, autonomy, belonging and social participation in the literature. Students with disabilities, neurodiverse learners, multilingual students and culturally/educationally diverse learners can benefit from these opportunities to the greatest degree. Willingness of the teacher is not enough for successful implementation. The problems that continue to persist are: inadequate professional preparation, time demands, lack of resources, uneven technological infrastructure, lack of consistency in assessment, and lack of consistency in institutional supports. To be effective, then, UDL must be actioned in a coordinated way by teachers, instructional designers, accessibility experts, technology personnel, and leaders. Going forward, there are opportunities to build on their continued professional development, improve access to the curriculum and assessment policies, enhance implementation guidelines, and expand the role of technology to support. Importantly, the synthesis indicates that sustainable UDL implementation is not solely an instructional responsibility. Educational leaders play a central role in establishing inclusive organizational cultures, coordinating professional development, providing technological and accessibility resources, supporting collaborative planning, and aligning curriculum and assessment policies with learner variability. Accordingly, UDL should be understood as both a pedagogical framework and an organizational strategy for equitable school improvement. School-wide implementation is most likely when leadership, policy, teacher capacity, and instructional design operate coherently rather than as separate initiatives. Additionally, long-term impacts, fidelity of implementation, scalability, cost-effectiveness, and the importance of adaptive systems and artificial intelligence needs to be explored further. In general, UDL provides a solid basis to help develop learning spaces that are more participatory, flexible, and inclusive for a variety of learners.

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