

UNIVERSAL DESIGN FOR LEARNING (UDL) FOR FUTURE EDUCATION: PREPARING LEARNERS WITH 21st-CENTURY SKILLS

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Abstrak

Pendidikan abad ke-21 menghadapi tantangan besar berupa ketidaksesuaian antara kebutuhan pengembangan keterampilan masa depan peserta didik dan praktik pembelajaran yang masih cenderung seragam, kurang fleksibel, serta belum sepenuhnya mengakomodasi keberagaman belajar. Kondisi ini menuntut kerangka pedagogis yang mampu menjembatani pendidikan inklusif dengan penguatan kompetensi abad ke-21. Penelitian ini bertujuan menganalisis Universal Design for Learning (UDL) sebagai kerangka strategis dalam menyiapkan peserta didik menghadapi tuntutan pendidikan masa depan. Penelitian menggunakan pendekatan kualitatif deskriptif melalui studi dokumentasi terhadap berbagai sumber primer dan sekunder, termasuk pedoman UDL, kebijakan pendidikan global, serta artikel ilmiah relevan yang dianalisis menggunakan analisis isi kualitatif. Hasil penelitian menunjukkan bahwa prinsip utama UDL—multiple means of engagement, representation, serta action and expression—memiliki keterkaitan kuat dengan pengembangan keterampilan berpikir kritis, kreativitas, kolaborasi, komunikasi, dan adaptabilitas. UDL terbukti tidak hanya mendukung aksesibilitas dan inklusi, tetapi juga berperan sebagai fondasi transformasi pembelajaran yang adaptif dan berorientasi masa depan. Temuan signifikan penelitian ini menegaskan bahwa UDL perlu direkonstruksi dari sekadar model pedagogi inklusif menjadi paradigma strategis pendidikan masa depan untuk membangun sistem pembelajaran yang adil, fleksibel, dan berkelanjutan.

Kata kunci: *Universal Design for Learning*; keterampilan abad ke-21; pendidikan masa depan; pembelajaran inklusif.

Abstract

Twenty-first-century education faces a major challenge in the mismatch between the need to develop students' future-ready skills and learning practices that remain largely standardized, inflexible, and insufficiently responsive to diverse learning needs. This condition calls for a pedagogical framework capable of bridging inclusive education with the development of 21st-century competencies. This study aims to analyze Universal Design for Learning (UDL) as a strategic framework for preparing students to meet the demands of future education. The research employed a descriptive qualitative approach through document analysis of various primary and secondary sources, including UDL guidelines, global education policies, and relevant scholarly articles, which were examined using qualitative content analysis. The findings indicate that the core principles of UDL—multiple means of engagement, representation, and action and expression—are strongly associated with the development of critical thinking, creativity, collaboration, communication, and adaptability skills. UDL has proven not only to support accessibility and inclusion but also to serve as a foundation for adaptive and future-oriented learning transformation. A significant finding of this study is that UDL should be reconceptualized from merely an inclusive pedagogical model into a strategic paradigm for future education, aimed at building learning systems that are equitable, flexible, and sustainable.

Keywords: *Universal Design for Learning (UDL); 21st-Century Skills; Future Education; Inclusive Learning.*

1. INTRODUCTION

The global transformation of education in the 21st century has positioned schools as spaces for developing critical thinking, creativity, collaboration, communication, digital literacy, and increasingly complex adaptability skills (Khoiri et al., 2021; Mor, 2025). Various international frameworks, including UNESCO and OECD, emphasize that student success is no longer determined solely by content mastery but also by the ability to navigate social diversity, technological advancements, and rapid changes in knowledge-based societies (González et al., 2020; Kennedy & Sundberg, 2020). Within this context, Universal Design for Learning (UDL) has emerged as a pedagogical approach designed to accommodate learner diversity through multiple means of engagement, representation, and action and expression (Sanger, 2020). UDL originated from the historical need to shift educational paradigms away from a “one-size-fits-all” model toward a more inclusive instructional design that responds to variations in learners’ needs, abilities, and educational backgrounds (Zhang et al., 2024).

Since its inception, UDL has been positioned as a systematic framework that bridges accessibility, educational equity, and meaningful learning opportunities for all learners, including those with and without disabilities (Chick et al., 2025). Empirical evidence indicates that UDL has been widely implemented across primary, secondary, and higher education settings to expand learning access and enhance student participation. However, its implementation in practice is often reduced to a form of technical instructional differentiation without fundamentally transforming curriculum design. This situation creates a mismatch between the ideal of UDL as a universal design system and educational practices that remain predominantly oriented toward standardized expectations and homogeneous assessments (Choi & Seo, 2024; Han & Lei, 2024).

In practice, future-oriented education requires learners not only to access information but also to develop agency, learning identities, and sustainable transdisciplinary competencies. The updated UDL 3.0 framework released in 2024 broadens its focus by incorporating systemic bias, learner identity, and social interdependence as integral elements of learning design. Nevertheless, many educational institutions continue to operate within traditional structures that regard inclusion as an add-on rather than as a foundational principle of teaching and learning. As a result, the development of 21st-century skills often remains fragmented because educational systems are not yet fully aligned with the principles of universality and epistemic justice (Gronseth et al., 2025).

Previous studies have primarily examined UDL within the contexts of inclusive education, digital learning technologies, and accessibility enhancement. However, most of these studies focus on conceptual reviews, localized implementations, or special education settings, and therefore have not comprehensively linked UDL to the broader strategic agenda of future education aimed at systematically strengthening 21st-century skills. Furthermore, the predominance of systematic reviews and scoping reviews in recent literature suggests that much of the existing research remains centered on theoretical synthesis rather than the development of new integrative frameworks capable of addressing the challenges of global educational transformation (Mayasari et al., 2025; Zakariyah et al., 2024). Consequently, there remains substantial room for investigating UDL as a strategic paradigm rather than merely an operational pedagogical model.

Another limitation of previous research lies in the insufficient analysis of the relationship between UDL, future readiness, and the development of sustainable

learning ecosystems. Many studies evaluate the effectiveness of UDL based on student engagement or teacher and learner perceptions, yet they rarely explore in depth how UDL can prepare learners to navigate automation, artificial intelligence, the creative economy, and global uncertainty. Future education requires the simultaneous integration of inclusivity, curriculum flexibility, and adaptive competency development. This gap highlights the need to reconstruct the understanding of UDL as not only a classroom strategy but also a foundation for long-term educational design (Han & Lei, 2024; Li et al., 2024).

At the same time, current educational realities continue to reveal disparities in access, variations in implementation quality, and differences in educators' readiness to apply UDL authentically. Many teachers face limitations in professional training, curriculum pressures, and ambiguous interpretations of UDL, resulting in inconsistent implementation. Ideally, however, UDL should strengthen flexible, personalized, and future-oriented learning experiences without imposing additional exclusive burdens on particular groups of learners. The discrepancy between inclusive policy aspirations and implementation capacity further underscores the need for new research that positions UDL within the broader strategic perspective of future education.

Based on these considerations, an important question emerges: How can UDL be reconstructed as a future-oriented educational framework that is not only inclusive but also effective in preparing learners with 21st-century skills in a holistic manner? Addressing this question is crucial because future education requires approaches capable of simultaneously integrating equity, flexibility, innovation, and global readiness. This study seeks to fill both conceptual and strategic gaps through a more comprehensive analysis of the role of UDL in building future learning ecosystems. Accordingly, this research contributes to expanding the understanding of UDL from a pedagogical approach toward a sustainable paradigm for educational transformation.

2. LITERATURE REVIEW

Universal Design for Learning (UDL) in Education

Universal Design for Learning (UDL) is an educational framework developed to create flexible, inclusive learning environments capable of accommodating the diverse needs of learners. The concept is rooted in the idea of universal design in architecture, which was later adapted to education by the Center for Applied Special Technology (CAST) to ensure that all learners have equitable learning opportunities through proactive instructional design rather than through modifications made after barriers emerge (CAST, 2024). UDL emphasizes three core principles: multiple means of engagement (various ways of fostering learner motivation), multiple means of representation (various ways of presenting information), and multiple means of action and expression (various ways for learners to demonstrate understanding). These principles are designed to address the neurological, social, cultural, and academic variability among learners that has often been overlooked in traditional instructional approaches.

In educational practice, UDL has been shown to enhance accessibility, learner engagement, and academic achievement across different levels of education. Research indicates that the implementation of UDL helps educators design more adaptive learning experiences through the use of digital technologies, instructional differentiation, and flexible assessment practices (CAST, 2024). This approach is highly relevant in heterogeneous classrooms because it focuses not only on students with special educational needs but also on all learners with diverse learning styles, cultural

backgrounds, and levels of academic readiness. Consequently, UDL expands the concept of inclusion from merely ensuring physical access to fostering meaningful cognitive and social participation.

Furthermore, the evolution of UDL demonstrates a transformation from a pedagogical model into a broader educational paradigm that is both critical and transformative. The latest version, UDL 3.0, highlights the importance of addressing bias, learner identity, belonging, and justice-oriented design within the learning process (CAST, 2024). This perspective reinforces the idea that education is not merely about knowledge transmission but also about empowering learners as individuals who possess agency in their own learning journeys. In this context, UDL serves as a crucial foundation for developing future-oriented learning environments that are not only effective but also equitable and sustainable.

Nevertheless, the literature also highlights several challenges in the implementation of UDL. Many educators continue to experience difficulties in developing a comprehensive understanding of UDL, particularly in integrating its principles into curriculum design and learning assessment (Lambert et al., 2023). Limitations in professional development opportunities, planning time, and institutional support often result in only partial implementation of UDL. Therefore, the effectiveness of UDL largely depends on the readiness of educational systems to provide supportive policies, appropriate technologies, and continuous teacher capacity-building initiatives.

21st-Century Skills

Twenty-first-century skills refer to a set of competencies required for individuals to thrive in a complex, dynamic, and increasingly digital global society. One of the most widely recognized frameworks, the Partnership for 21st Century Learning (P21), identifies four core competencies known as the 4Cs: critical thinking, creativity, collaboration, and communication (Isabirye et al., 2025; Kennedy & Sundberg, 2020). In addition, information literacy, media literacy, technological literacy, flexibility, leadership, and complex problem-solving abilities are considered essential components of these skills. These competencies have emerged in response to global economic changes, the Fourth Industrial Revolution, and the growing demand for an adaptive workforce.

In education, fostering 21st-century skills requires a paradigm shift from content memorization toward competency-based learning. Learners must be equipped with the ability to analyze information, innovate, work across disciplines, and navigate continuously evolving socio-technological challenges (Trilling & Fadel, 2009). Therefore, modern education should not focus solely on content mastery but must also support character development, metacognitive growth, and lifelong learning. Schools function as ecosystems that prepare learners to become self-directed learners and responsible global citizens.

However, numerous studies indicate that educational systems in many countries continue to face a gap between the demands of 21st-century skills and actual classroom practices. Rigid curricula, standardized test-based assessments, and the dominance of teacher-centered learning often hinder the development of creativity and problem-solving abilities (Cho et al., 2020). Furthermore, digital divides and inequities in educational access exacerbate learners' opportunities to develop future-oriented competencies. These challenges suggest that educational reform must move beyond content modification toward the transformation of learning design itself.

In relation to UDL, 21st-century skills share a strong connection because both emphasize flexibility, personalization, and learner empowerment. UDL provides a

pedagogical framework that facilitates the development of 21st-century competencies through adaptive and learner-centered educational experiences. When learning is designed around diverse forms of engagement, representation, and action and expression, learners are more likely to develop creativity, collaboration, and critical thinking skills. Therefore, the integration of UDL and 21st-century skills represents a strategic approach to preparing future education systems that are inclusive, relevant, and responsive to global challenges.

3. METHOD

This study employed a descriptive qualitative approach to understand and interpret Universal Design for Learning (UDL) within the context of future education, particularly in preparing learners with 21st-century skills. This approach was selected because it focuses on exploring meanings, conducting conceptual analysis, and critically synthesizing educational phenomena based on textual data without involving statistical analysis. The research design enabled the researchers to systematically, contextually, and comprehensively describe the relationship between UDL principles and the need for developing 21st-century skills.

The data sources consisted of both primary and secondary data. Primary data included the Universal Design for Learning Guidelines developed by CAST, global education policies from UNESCO, OECD, and the Partnership for 21st Century Learning, as well as key academic documents related to UDL implementation. Secondary data were obtained from relevant scholarly articles, books, and research reports. Sources were selected purposively based on their topical relevance, academic credibility, and theoretical and empirical contributions to the study of UDL, inclusive education, and 21st-century skills.

Data were collected through document analysis by reviewing various documents indexed in the Scopus and SINTA databases using keywords such as "Universal Design for Learning" and "21st-century skills." The collected documents were screened, classified, and analyzed according to their relevance to the research focus. Data analysis was conducted using qualitative content analysis through the stages of data reduction, thematic categorization, interpretation, and meaning-making to identify patterns, gaps, and educational implications across the sources.

The trustworthiness of the data was ensured through source and theoretical triangulation by comparing various academic documents, policy papers, and theoretical perspectives. The research procedures included problem identification, document retrieval, source selection, data coding, thematic analysis, interpretation, and conceptual synthesis. The main research materials encompassed UDL principles, 21st-century skills, inclusive learning, and educational transformation. Therefore, the findings are expected to serve as a foundation for future studies as well as for the implementation of more adaptive educational practices.

4. RESULTS

This study demonstrates that Universal Design for Learning (UDL) holds a strategic position as a pedagogical framework relevant to preparing learners for the demands of 21st-century skills. Based on document analysis of various primary and secondary sources, the findings reveal that the core principles of UDL – multiple means of engagement, representation, and action and expression – are consistently aligned with the development of critical thinking, creativity, collaboration, communication, digital literacy, and learning flexibility. These findings affirm that UDL functions not only as an inclusive approach for accommodating learner diversity but also as an instructional

design framework that supports educational transformation in response to the needs of increasingly complex modern societies.

The review further indicates that the implementation of UDL across various educational contexts contributes to improved learning accessibility, active participation, and personalized learning experiences. The analyzed documents show that UDL-based instruction encourages educators to design more adaptive learning strategies through the integration of technology, diverse methods of content delivery, and flexible assessment practices. In this context, learners are provided with greater opportunities to develop 21st-century competencies because the learning process is no longer standardized; instead, it accommodates differences in learning styles, motivation, and modes of expressing understanding.

The analysis also identified a strong conceptual relationship between UDL and 21st-century skills through three key dimensions: learning access, competency development, and future readiness. UDL provides the foundation for accessibility and inclusion; 21st-century skills constitute the core competencies required for success; and the integration of both leads to learners' readiness to face global challenges, digital transformation, and socio-economic change. These findings suggest that UDL serves as a critical bridge between inclusive education and the development of future-oriented capacities.

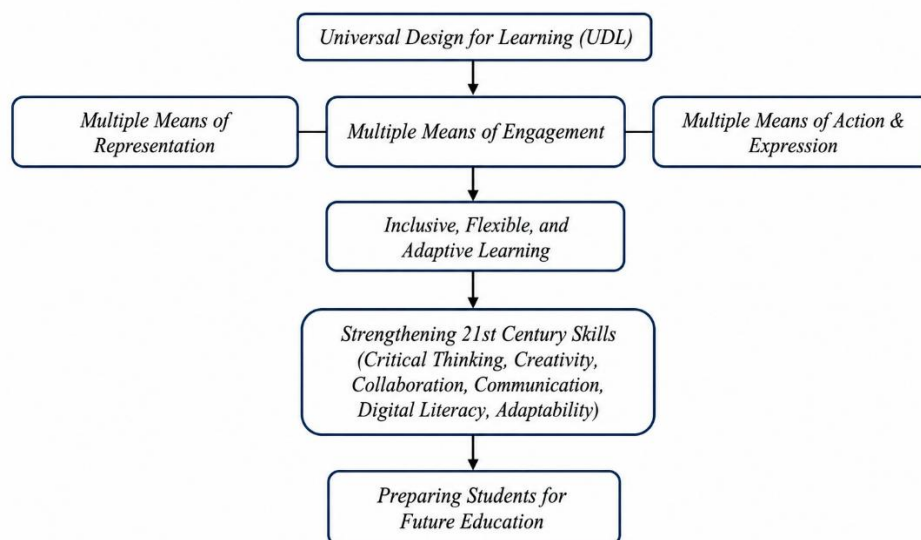


Figure 1. Framework of the Main Research Findings

In addition to the positive findings, this study also identified several challenges in the implementation of UDL, including limited teacher understanding, inconsistencies in curriculum design, and insufficient institutional support. Many instructional practices remain oriented toward traditional approaches that provide limited support for flexibility and personalization. This situation creates a gap between the ideal of UDL as a universal design framework and the realities of its implementation in educational settings. Therefore, the effectiveness of UDL largely depends on systemic transformation involving teacher professional development, curriculum reform, and the integration of supportive educational policies.

Table 1. Summary of Main Findings

Main Aspect	Research Findings	Implications
UDL Principles	Aligned with the needs of inclusive	Supports equitable

21st-Century Skills	and flexible learning Closely associated with critical thinking, creativity, collaboration, and communication	access to learning Prepares learners for future competencies
Implementation	Enhances personalization and learner participation	Strengthens the quality of learning
Challenges	Limitations related to teachers, curriculum, and policy	Requires educational system reform
Strategic Position	UDL serves as a bridge between inclusion and global readiness	Highly relevant for future education

Overall, the findings confirm that UDL is a strategic framework capable of bridging the needs of inclusive education with the development of 21st-century skills. This integration demonstrates that future education requires learning designs that not only provide access but also holistically develop learners' adaptive capacities. The findings further reinforce the importance of reconstructing education from a standardized model toward a more flexible, equitable, and future-oriented system.

Discuccion

The findings of this study confirm that Universal Design for Learning (UDL) is a strategic pedagogical framework that is not only relevant in the context of inclusive education but also possesses strong potential to prepare learners for the demands of 21st-century skills. Theoretically, these results reinforce the perspective of CAST (2018), which argues that UDL is designed to address learner variability through multiple means of engagement, representation, and action and expression. However, this study extends that theoretical position by demonstrating that the three UDL principles not only enhance learning accessibility but also directly contribute to the development of critical thinking, creativity, collaboration, communication, and adaptability as core 21st-century competencies. Consequently, UDL in this study moves beyond being merely an inclusion-oriented approach and emerges as a broader framework for future educational transformation.

One particularly noteworthy finding is that much of the previous literature has primarily positioned UDL as a strategy for learners with special educational needs or as a tool for improving accessibility. In contrast, the findings of this study reveal that UDL has a far more universal relevance. This is a significant contribution because it demonstrates that flexible instructional design not only reduces learning barriers but also actively fosters an ecosystem for developing future-oriented competencies among all learners. This broader interpretation suggests that UDL can be repositioned not merely as a responsive model for addressing diversity but as a proactive pedagogical foundation for navigating global change. This perspective aligns with the revisions introduced in the UDL Guidelines 3.0, which emphasize learner agency, identity, and justice-oriented learning (CAST, 2024).

Compared with previous studies, the results of this research share several similarities while also presenting important distinctions. Al-Azawei et al. (2016) found that UDL effectively enhances flexibility in digital learning and increases student engagement, while Rao et al. (2014) highlighted the benefits of UDL in improving access to inclusive education. The findings of the present study are consistent with these works regarding flexibility and inclusion. However, they differ by positioning UDL within a more strategic context—as a holistic framework for fostering 21st-century skills. In other words, while previous research largely focused on implementation effectiveness, this

study expands the discourse to a conceptual and future-oriented level by presenting UDL as a bridge between inclusivity, pedagogical transformation, and global readiness.

Furthermore, this study found that although UDL has substantial potential, its implementation continues to face systemic challenges, including limited teacher capacity, inflexible curricula, and educational policies that do not fully support universal design principles. These findings are consistent with those of Smith et al. (2019), who identified insufficient professional training and weak policy integration as major barriers to UDL implementation. In this context, a gap remains between the theoretical ideals of UDL and actual educational practice. The significance of this study lies not only in confirming these implementation challenges but also in demonstrating that the primary obstacle is not the UDL framework itself; rather, it is the educational ecosystem that is not yet fully prepared for systemic transformation.

The generalization of these findings should be approached with caution because the descriptive qualitative, document-based methodology was not intended to produce statistical generalizations but rather analytical generalizations. This means that the findings can be applied as a conceptual framework across various educational contexts, particularly in policy development, curriculum design, and teacher training. However, adaptation remains necessary according to local needs, cultural contexts, and educational infrastructures. Nevertheless, the consistency of findings across diverse international sources suggests that the relationship between UDL and 21st-century skills possesses strong conceptual validity across contexts.

The primary contribution of this study lies in reconstructing the role of UDL from an inclusive pedagogical model into a paradigm for future education. This research offers a novel perspective by positioning UDL as a strategic design framework for preparing learners to thrive in an era characterized by digital disruption, artificial intelligence, and global complexity. As such, the study provides a theoretical foundation for developing curricula that are more flexible, equitable, and future-oriented. This contribution is particularly important because many previous studies have remained fragmented across the domains of inclusion, educational technology, and 21st-century skills without offering a fully integrated conceptual framework.

However, this study also has limitations. The use of document-based data means that the findings are highly dependent on the quality and scope of the analyzed sources. The study does not examine direct classroom implementation or the perspectives of educational practitioners. Therefore, future research is recommended to employ field studies, mixed-methods approaches, or educational action research to investigate how UDL concretely shapes 21st-century skills in schools, higher education institutions, and digital learning environments. Comparative studies across countries or educational levels would also be valuable in broadening understanding of the contextual effectiveness of UDL.

Overall, this discussion demonstrates that UDL possesses far greater potential than is often assumed in the educational literature. The recognition that UDL can function as a strategic foundation for future education represents one of the most significant insights of this study. UDL is not merely about providing equitable access to learning; it is also about building educational systems capable of preparing learners to become adaptive, critical, creative, and ready to navigate an ever-changing world. Therefore, the future of inclusive and relevant education requires a deeper integration between UDL principles and the development of 21st-century skills.

5. CONCLUSION

UDL highlights a new direction for education that positions flexibility, equity, and diversity as the fundamental pillars of learning that is relevant to the dynamics of the 21st century. From this perspective, education can no longer be limited to the transmission of knowledge; rather, it must be designed as a system that empowers every learner to develop according to their potential, context, and the challenges of their time. This article emphasizes that the future of education largely depends on the ability of institutions, educators, and policymakers to transform learning design into an ecosystem that is adaptive, inclusive, and sustainable. Therefore, readers should recognize that the integration of universal learning design, the development of future-oriented competencies, systemic readiness, and a commitment to educational transformation constitutes the key foundation for preparing a generation capable of learning, adapting, and making meaningful contributions in an ever-changing world.

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