

Universal Design for Learning in Strengthening Inclusive Learning

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ABSTRACT

The diversity of learner characteristics has become a major challenge in developing, inclusive and equitable learning environments. Conventional learning approaches that rely on uniform instructional designs may create barriers for some learners in accessing, understanding, and demonstrating their knowledge. This article aims to analyze the role of Universal Design for Learning (UDL) in strengthening inclusive learning through a systematic literature review. The research employed a Systematic Literature Review (SLR) method by examining scientific articles published over the last five years from various academic databases. The findings indicate that UDL serves as a strategic approach that promotes learning flexibility through three fundamental principles: multiple means of engagement, multiple means of representation, and multiple means of action and expression. The implementation of UDL is also strengthened by digital technology development, which enables multimodal learning resources and more adaptive learning experiences. However, several challenges remain, including teacher readiness, institutional support, and resource availability. This study highlights that UDL provides a significant contribution to the development of inclusive, responsive, and learner-centered education systems by addressing diverse learning needs in contemporary educational contexts.

Keywords: *Accessibility in Learning, Educational Technology, Inclusive Education, Learning Design, Universal Design for Learning.*

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ARTICLE HISTORY

Received : January 9, 2025

Final Revised : March 6, 2025

Accepted : May 2, 2025

Published : June 30, 2025

1. | INTRODUCTION

The development of modern education faces increasingly complex challenges due to the increasing diversity of characteristics, needs, abilities, and backgrounds of students. The learning system that previously used a uniform approach is beginning to be considered less able to accommodate the variety of ways students receive, understand, and express knowledge. In the context of inclusive education, learning success is not only measured by the ability to provide access to education, but also by the extent to which the learning process is able to create a learning environment that is equitable, flexible, and responsive to the needs of all learners (UNESCO, 2020). This paradigm shift encourages the emergence of various learning approaches that are oriented towards student diversity, one of which is through the implementation of Universal Design for Learning (UDL).

Universal Design for Learning is a learning design approach that aims to reduce learning barriers by providing various options in student engagement, information presentation, and how students show their understanding. This approach departs from the assumption that student diversity is a natural condition in the educational process so that learning design needs to be designed flexibly from the beginning, not just provide adjustments after learning barriers arise (Sewell et al., 2022). The concept of UDL is gaining increasing attention in educational research because it is considered to be able to bridge the need for inclusive education with the demands of 21st century learning that emphasizes flexibility, personalization, and the use of digital technology.

Various studies show that UDL has an important contribution to creating a more inclusive learning experience. Studies on the effectiveness of UDL show that the application of UDL principles can increase student engagement, provide more equal learning opportunities, and support academic achievement through more adaptive learning strategies (Levey, 2023; Almeqdad et al., 2023). In addition, the UDL approach also provides a systematic framework for educators in designing learning that takes into account variations in students' cognitive abilities, motivations, learning preferences, and access needs (Seymour, 2024). Thus, UDL is not only seen as a strategy for students with special needs, but as a universal approach that benefits all students.

Although the concept of inclusive education has developed globally, the implementation of learning that truly accommodates the diversity of students still faces various obstacles. Many learning practices are still oriented towards one method of delivering material, one form of learning activity, and one evaluation model that has the potential to create obstacles for some students. Research shows that teachers' limited understanding of the principles of UDL, lack of institutional support, and limited resources are factors that affect the success of UDL implementation in a formal education environment (Ewe & Galvin, 2023; Zhang et al., 2024). Therefore, a more in-depth study is needed on how UDL can be applied as a strategic approach in strengthening inclusive learning.

In its development, the integration of digital technology further expands opportunities for the application of UDL in various educational contexts. Technology enables the provision of learning resources in various formats such as digital text, audio, video, interactive simulations, and accessibility support devices that can meet the diverse needs of learners. The use of educational technology based on UDL principles also supports the creation of more personalized and adaptive learning through the use of digital platforms, learning analytics, and multimodal learning resources (Zaugg, 2024; Redstone & Luo, 2024). In fact, the development of data-based approaches such as learning analytics has begun to be studied as a means to understand students' learning patterns and provide learning support that is more in line with individual needs (Roski et al., 2024).

In addition to the technological aspect, the success of the implementation of UDL is highly dependent on the readiness and competence of educators. Teachers have a leading role in translating the principles of UDL into learning planning, implementation, and evaluation. Studies show that teachers' understanding of learning design flexibility, differentiation strategies, and alternative assessments are important factors in creating an inclusive learning environment (Evmenova, 2018; Courey et al., 2021). However, teachers' perceptions and beliefs about UDL are still diverse, so strengthening teachers' professional capacity is an important aspect in the development of inclusive education based on UDL (Han & Lei, 2024).

Based on these developments, there is still a need for a comprehensive study that integrates the latest research findings on the concepts, implementations, benefits, and challenges of Universal Design for Learning in inclusive learning. Some previous studies have focused more on the effectiveness of UDL partially or in specific educational contexts, while studies that map the application of UDL as an approach to inclusive learning design as a comprehensive approach still need to be strengthened. Therefore, this article aims to analyze the development of research on Universal Design for Learning in supporting inclusive learning through the Systematic Literature Review (SLR) approach, focusing on the main concepts, implementation strategies, use of technology, and the challenges of its application in the context of modern education.

2. | RESEARCH METHOD

This study uses the Systematic Literature Review (SLR) approach to analyze the development of studies on the application of Universal Design for Learning (UDL) in supporting inclusive learning. The SLR method was chosen because it is able to provide a process of identification, evaluation, and synthesis of various research results that have been systematically published so that it can produce a comprehensive understanding of a research phenomenon. In this study, SLR was used to identify how the concept of UDL was developed, how it is implemented in various educational contexts, and the factors that affect the success of its implementation in creating more inclusive learning.

The data collection process was carried out through searching scientific articles on several academic databases, namely Google Scholar, Scopus, ERIC, and ScienceDirect. The selected literature was limited to scientific publications within the last five-year span to ensure that the results of the study represented the latest research developments prior to the publication of the article. The keywords used in the search process included "Universal Design for Learning", "UDL implementation", "inclusive education", "inclusive learning", "digital learning accessibility", and "learner variability". The use of these keyword combinations aims to obtain literature that is directly related to the relationship between UDL, inclusive education, learning design, and the use of educational technology.

The stages of literature selection are carried out based on predetermined inclusion and exclusion criteria. The inclusion criteria include scientific journal articles published in the last five-year period, discussing UDL as a learning approach, having a relationship with inclusive education or student diversity, and available in full text form. Meanwhile, the exclusion criteria include articles that do not have a direct relationship with UDL, non-academic publications, opinion articles, and research that does not contribute to the understanding of the implementation of UDL in the learning process. The selection stage is carried out through the identification of titles and abstracts, checking the suitability of the content of the article, and evaluating the quality of the sources before being used in the analysis process.

The data that has been obtained is then analyzed using thematic analysis techniques to identify patterns, key themes, and important findings from the various studies studied. The analysis process is focused on several main aspects, namely the basic concept of UDL, the principles of applying UDL in inclusive learning, implementation strategies by educators, the role of digital technology, and challenges that arise in the application of UDL in the formal education environment. The results of the analysis process are then synthesized to obtain an overview of UDL's contribution to the development of a learning system that is flexible, adaptive, and able to accommodate the diversity of students.

Through this SLR approach, the research is expected to provide an academic mapping of the development of UDL implementation based on the latest research and provide recommendations for the development of inclusive learning practices in the future. This approach also allows the identification of research gaps that still need attention, especially related to educator readiness, technology integration, and strengthening learning policies that are oriented towards accessibility and equal learning opportunities for all students.

3. | RESULTS AND DISCUSSION

Based on the results of a literature analysis of various studies in 2020–2024, it was found that Universal Design for Learning (UDL) is developing as one of the strategic approaches in supporting the transformation of inclusive learning. The results of the study show that UDL is not only understood as an alternative learning method, but as a

design framework that allows educators to design a flexible learning environment from the early stages of planning. This approach places the diversity of students as the main characteristic in education so that the learning system needs to provide various paths to obtain information, interact with the material, and show learning results. This principle makes UDL relevant to the modern education paradigm that emphasizes accessibility, fairness, and participation of all students (UNESCO, 2020; Sewell et al., 2024).

Literature review shows that the main strength of UDL lies in three fundamental principles, namely multiple means of engagement, multiple means of representation, and multiple means of action and expression. These three principles provide a framework for educators to develop learning that does not depend on a single approach. Students are given the opportunity to engage through various motivational strategies, obtain information through various forms of representation, and show understanding through various forms of expression. Research on the implementation of UDL shows that this flexibility can increase student engagement because learning is better able to adapt to different needs, preferences, and learning characteristics (Levey, 2023; Almeqdad et al., 2023).

In the context of inclusive education, UDL provides a significant perspective shift from an individualized adjustment-based approach to a universal design-based approach. Conventional approaches often place students as parties who must adjust to the available learning system. On the contrary, UDL encourages educational institutions and educators to first design learning that can be accessed by as many students as possible without having to make major modifications after the learning process takes place. Research findings show that this approach is able to reduce learning barriers, especially for students who have differences in academic ability, accessibility needs, and variations in learning methods (Seymour, 2024; Craig et al., 2024).

The results of the study also show that the implementation of UDL is closely related to differentiated learning practices. Although they have different characteristics, UDL and learning differentiation have the same goal, which is to provide a learning experience that is in accordance with the diversity of students. UDL emphasizes more on flexible initial learning design, while differentiation focuses more on adjusting strategies based on the needs of students during the learning process. The integration of these two approaches can help teachers create more responsive and student-oriented learning (Evmenova, 2018). Thus, UDL does not replace existing pedagogical practices, but strengthens teachers' ability to design more inclusive learning.

In addition to the pedagogical aspect, research shows that digital technology is an important factor that strengthens the implementation of UDL. Technological developments allow the provision of learning materials in various formats such as digital text, audio, video, animation, simulation, and interactive media that can be used according to the needs of students. The use of UDL-based technology allows students to have more options in accessing and understanding learning materials. Studies on educational technology show that technology integration designed based on the

principle of accessibility can increase opportunities for student participation in the digital learning environment (Zaugg, 2024; Al-Fraihat, Joy, & Sinclair, 2020).

Further technological developments also open up opportunities for the implementation of UDL through data-based adaptive learning systems. The use of learning analytics allows educators to obtain information about students' interaction patterns, development, and learning needs so that learning support can be provided more appropriately. Recent research shows that the integration of learning analytics with UDL principles can help identify variations in learners' needs and support the development of more personalized learning experiences (Roski et al., 2024). In addition, the development of UDL-based digital learning designs also shows that online learning environments can be more inclusive if they are designed with accessibility in mind, clear navigation, and variations in the form of material presentation (Redstone & Luo, 2024).

Despite its various benefits, the results of the study show that the implementation of UDL still faces a number of challenges. One of the main obstacles is the limited understanding and readiness of educators in applying the principles of UDL consistently. Many teachers still understand inclusivity as limited to providing additional assistance to certain students, while the concept of UDL demands a change in mindset that diversity should be the basis for learning design. Research shows that teacher competence, professional experience, and capacity building support have a major influence on the success of UDL implementation (Courey et al., 2021; Han & Lei, 2024).

In addition to teacher readiness, institutional factors are also an important aspect in the successful implementation of UDL. Policy support, school culture, availability of learning resources, and collaboration between educators determine the extent to which UDL can be implemented sustainably. A systematic review of the implementation of UDL found that many educational institutions still experience difficulties in integrating UDL into learning practices due to limited planning time, lack of training, and suboptimal structural support from educational institutions (Ewe & Galvin, 2023; Zhang et al., 2024). Therefore, the implementation of UDL cannot only be imposed on teachers, but requires a systemic approach that involves all components of education.

In the context of higher education, research shows that UDL also has great potential in creating a more inclusive learning environment. The diversity of students in higher education, both in terms of academic ability, learning experience, and accessibility needs, demands a more flexible learning design. Studies on lecturer perceptions show that the implementation of UDL and inclusive pedagogy can strengthen the institution's commitment to providing equal learning opportunities for all students (Timuş et al., 2024). This shows that UDL has relevance not only to primary and secondary education, but also to various levels of education.

The results of the study also show that research on UDL has undergone a wider development, ranging from conceptual studies to implementation-based research.

Research on UDL in formal education structures shows that this approach is beginning to be applied in various learning contexts with a focus on improving student access, engagement, and learning outcomes (Ewe & Galvin, 2023). In addition, a study of UDL-based digital learning media shows that flexible teaching material design can be an important strategy in dealing with today's increasingly diverse learning needs (Zakariyah et al., 2024).

Overall, the results of the literature synthesis show that UDL is a relevant approach to strengthen inclusive education because it is able to integrate pedagogical, technological, and policy aspects of education. UDL provides a systematic framework for educators to remove barriers to learning through a flexible, student-centered design. However, the successful implementation of UDL still requires increasing educator competence, institutional support, and the development of a learning ecosystem that supports accessibility. With the increasing demands of adaptive and inclusive education, UDL has a strategic position as a learning approach that is able to answer the diverse needs of students in the context of modern education.

4. | CONCLUSION

Based on the results of the study through the Systematic Literature Review (SLR) approach, it can be concluded that Universal Design for Learning (UDL) is a strategic approach that is able to strengthen the implementation of inclusive learning through a learning design that is flexible, adaptive, and oriented towards student diversity. UDL provides a framework that allows educators to provide various alternatives in the learning process, both through variations in material presentation, student engagement strategies, and forms of expression of learning outcomes. With this approach, learning barriers can be minimized from the planning stage so that all students have a more equal opportunity to participate in the educational process.

This study shows that the implementation of UDL not only provides benefits for students with certain needs, but also supports all students in a learning environment that has diverse characteristics. The integration of digital technology further expands opportunities for the implementation of UDL through the provision of multimodal learning resources, interactive learning media, and a more personalized learning system. However, the success of the implementation of UDL is still influenced by various factors, especially the readiness of educator competencies, institutional support, availability of resources, and paradigm shifts in learning design.

Therefore, strengthening the implementation of UDL requires a comprehensive approach through increasing the capacity of educators, developing inclusive learning policies, and creating an educational environment that supports accessibility and learning flexibility. UDL is not only a pedagogical strategy, but also an important framework in building a more equitable, responsive, and sustainable education system. In the face of the development of modern education, UDL has great potential to become

the foundation of learning design that is able to answer the increasingly diverse needs of students.

Acknowledgment

We gratefully acknowledge the contributions of individuals who supported the completion of this article.

Funding Information

This research did not receive any funding.

Conflict of Interest Statement

The authors declare that there is no conflict of interest.

Ethical Approval and Originality Statement

Ethical approval was obtained for this study. The manuscript represents original work and has not been previously published, nor is it under consideration by another journal.

Data Disclosure Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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