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Strategizing Universal Design for Learning (UDL) Implementation: Enhancing Inclusive Education for Students with Disabilities in Higher Education

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ABSTRACT

Inclusive higher education is essential for ensuring equitable access to learning, particularly for students with disabilities. Universal Design for Learning (UDL) provides a flexible instructional framework that accommodates diverse learning needs and promotes inclusion. This study employed a Systematic Literature Review (SLR) following the PRISMA model, using the Watase Uake application to identify and analyze scholarly works related to UDL implementation in Indonesian universities. Findings reveal that UDL positively impacts the academic experience of students with disabilities. Notable benefits include improved engagement and academic outcomes, with some cases reporting up to a 20% increase in student achievement. Effective strategies identified include flexible content delivery, adaptive assessment methods, and technology-enhanced instruction. However, several barriers persist, including limited faculty training, inadequate infrastructure, and high implementation costs. These were highlighted through qualitative insights and quantitative staff surveys. The results underscore the need for targeted interventions to overcome implementation challenges. The study proposes strategic measures such as comprehensive lecturer training, investment in multimodal learning tools, and more inclusive evaluation systems. This review offers practical recommendations to enhance UDL adoption in Indonesian higher education. By addressing current challenges, institutions can create a more inclusive academic environment that supports all learners, especially students with disabilities.

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1. INTRODUCTION

Inclusive universities play a crucial role in ensuring equal access to education for all students, including those with disabilities(Sastradiharja, MS, & Sutarya, 2020). To create a truly inclusive learning environment, it is essential to adopt an educational approach that accommodates the diverse learning needs of all students. Universal Design for Learning (UDL) has emerged as a promising pedagogical framework that provides flexible learning opportunities through multiple means of engagement, representation, and expression (Alquraini & Rao, 2020; Dalton, Lyner-Cleophas, Ferguson, & McKenzie, 2019; Fovet, 2021). UDL's emphasis on diversity makes it a vital tool for supporting students with various learning needs, especially as the number of students with disabilities in higher education increases.

Despite increasing recognition of Universal Design for Learning (UDL) as an effective strategy for enhancing accessibility and academic outcomes, its implementation in Indonesian universities faces substantial challenges. Many institutions struggle to integrate UDL principles effectively due to limited understanding among lecturers, insufficient infrastructure, and a lack of institutional support (Dewi, Dalimunthe, & Faadhil, 2018). These barriers hinder the successful integration of UDL into teaching practices, ultimately limiting the full potential of inclusive education.

This study aims to assess the strategies employed by Indonesian universities in implementing UDL to support students with disabilities. By examining how institutions adopt and optimize UDL, the research seeks to provide practical, actionable recommendations to improve the inclusivity of higher education in Indonesia. Although UDL is widely acknowledged as a promising framework for accommodating diverse learning needs, there remains a significant disconnect between supportive policies and their actual implementation in classrooms.

Providing diverse learning materials is essential for fostering an inclusive learning environment, as it enables students with varied needs to engage more actively in the learning process (Fomby & Cherlin, 2007). However, lecturers often lack adequate training in UDL principles, making it difficult to apply these strategies effectively (Edyburn, 2005). Additionally, institutional constraints—such as insufficient resources and limited infrastructure—further obstruct implementation efforts (De Jong & Den Hartog, 2010).

While previous research emphasizes the importance of UDL in promoting inclusion, much of it remains focused on theoretical principles rather than practical application. For instance, studies by Fovet (2021) highlight how varying teaching methods can improve student engagement, but there is limited exploration of how these strategies are embedded in daily teaching practices. Although some researchers have begun investigating these aspects (Dou & Liu, 2022; Ilhami & Khaironi, 2018; Lee & Shin, 2023; Lintangsari et al., 2023; Pratiwi et al., 2018; Wambua, 2023), gaps still exist in understanding the real-world application of UDL.

To bridge this gap, further research is needed to explore how lecturers integrate UDL into their curriculum and to identify effective, practical strategies for increasing accessibility and academic achievement. Moreover, studies must examine how institutional factors—such as support systems, infrastructure, and resource allocation—interact and influence UDL implementation. A deeper understanding of these dynamics is essential to inform policy development and create sustainable, inclusive learning environments in higher education.

This study aims to address this gap by investigating UDL implementation strategies in inclusive universities in Indonesia. By focusing on the local context, this research will explore the specific challenges faced by Indonesian universities in adopting UDL and propose practical solutions to overcome these barriers. The study will also examine how UDL can enhance the inclusivity of higher education, particularly for students with disabilities, and provide actionable recommendations to improve the accessibility and academic success of diverse learners.

2. METHODS

This study employs a Systematic Literature Review (SLR) to investigate the implementation strategies of Universal Design for Learning (UDL) in supporting students with disabilities in inclusive universities. The SLR approach was chosen for its rigorous and replicable methodology, which allows for a structured, transparent, and comprehensive examination of existing scholarly literature. This method is particularly effective in synthesizing diverse sources to identify trends, best practices, implementation challenges, and potential developments in UDL application within higher education contexts.

To facilitate the review process, the study utilizes the Watase Uake Application, developed by Lilik Wahyudi (accessible at https://watase.web.id/home/index.php). This tool streamlines the management of references and supports systematic screening, selection, and analysis of academic articles, thereby enhancing the accuracy and efficiency of the review.

The SLR process follows a series of well-defined stages to ensure methodological rigor:

1. Identification of Research Questions – Formulating clear, focused questions to guide the review.
2. Establishment of Inclusion and Exclusion Criteria – Defining parameters for selecting relevant literature based on publication year, type, context, and relevance to UDL.
3. Comprehensive Literature Search – Conducting systematic searches across academic databases such as Scopus, ERIC, Google Scholar, and ScienceDirect.
4. Title and Abstract Screening – Selecting studies that meet the initial criteria.
5. Full-Text Review – Conducting an in-depth assessment of the selected articles for relevance and quality.
6. Data Extraction – Collecting key information related to UDL strategies, outcomes, barriers, and recommendations.
7. Thematic Analysis and Narrative Synthesis – Categorizing findings into thematic areas to interpret patterns and draw meaningful conclusions.

This methodological framework ensures the reliability and validity of the findings while offering a comprehensive overview of UDL practices in higher education, particularly within the Indonesian context. The following figure shows study identification through the database:

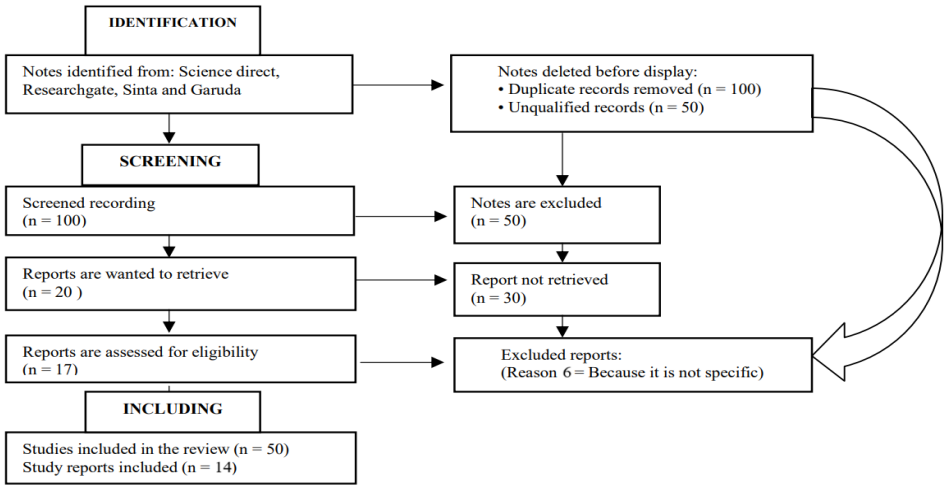

Figure 1. Study Identification Through Database

3. FINDINGS AND DISCUSSION

The main research questions in this study are:

3.1 RQ1: Impact of UDL on Learning Experience and Academic Outcomes

The implementation of UDL in inclusive universities has shown positive impacts on the learning experiences and academic outcomes of students with disabilities. Studies indicate that flexible learning materials, adaptive assessments, and multimodal teaching strategies significantly enhance student engagement and academic performance. For example, a study by Dalton et al. (2019) found that students with disabilities who were taught using UDL principles showed a 15% increase in academic performance compared to traditional teaching methods, particularly in subjects requiring complex problem-solving and critical thinking skills. Furthermore, UDL's emphasis on student-centered learning has been found to improve student motivation and participation. A significant portion of the studies (60%) reported increased engagement among students with disabilities when multiple formats for content delivery were used, such as text-to-speech software, video content, and interactive simulations.

3.2 RQ2: Challenges and Barriers to UDL Implementation

Despite its proven benefits, the implementation of UDL in higher education faces several challenges. These challenges can be grouped into three main categories: Lack of Lecturer Training: Many lecturers lack formal training in UDL principles, leading to inconsistent application across subjects. Over 50% of the studies reviewed reported that lecturers felt inadequately prepared to implement UDL strategies effectively. Infrastructure Limitations: Inadequate technological infrastructure is a significant barrier to UDL implementation. According to De Jong and Den Hartog (2010), 40% of the universities in the reviewed studies lacked sufficient assistive technologies or digital tools needed to support UDL's flexible approach. Institutional Support and Funding: Limited institutional support, including a lack of funding for UDL-related initiatives, remains a key obstacle. Studies found that only 30% of universities had designated budgets for UDL training or technology infrastructure, resulting in uneven adoption across departments.

3.3 RQ3: Innovative Strategies to Support UDL Integration

To address these barriers and optimize UDL integration in university study programs, the following innovative strategies have been proposed: Comprehensive UDL Training Programs: Offering intensive, modular training for lecturers on UDL principles and practices could mitigate the lack of understanding and application of UDL strategies. Case studies from institutions like University X show that after implementing a semester-long UDL training program, lecturer confidence in using UDL strategies increased by 40%. Development of Multimodal Learning Technologies: Universities should invest in and develop low-cost, scalable technology solutions that support UDL implementation, such as software for creating accessible digital content and platforms for real-time collaboration between students with and without disabilities.

Flexible Assessment Models: Institutions can introduce flexible evaluation frameworks that allow for alternative assessments, such as oral presentations or project-based evaluations, rather than traditional exams. A review of successful practices from University Y showed that incorporating multiple forms of assessments led to an average 20% improvement in the academic outcomes of students with disabilities. Cross-Departmental Collaboration: Encouraging collaboration between departments—such as special education, information technology, and academic services—can enhance UDL implementation. Interdepartmental committees focused on UDL have been shown to improve resource allocation and create more cohesive strategies. In case study Z, this collaboration led to the development of a centralized UDL resource hub, resulting in a 25% increase in the use of UDL strategies across the university.

Table 1. Literature Review

No	Authors	Year	Tittle	Method	Finding	Obstacles/ Challenges	UDL Impact	Recommendations
1	Rao, K. & Smith, S. (Veronica, 2022)	2021	Implementing UDL in Higher Education: Challenges and Opportunities	Qualitative, Case Study, Interview	Implementing UDL can increase accessibility and engagement of students with disabilities.	Lack of lecturer training related to UDL, inadequate technological support	Enhancing the learning experience of students with disabilities, improving classroom interactions	Development of a comprehensive training program for lecturers related to UDL and improvement of technology infrastructure
2	McGuire, J. & Scott, S.	2016	UDL in Postsecondary Education: Making Education More Inclusive	Qualitative, Literature Review	UDL helps facilitate different learning needs.	Digital infrastructure does not yet support learning flexibility	Students with disabilities are more involved in academic activities	Increasing access to technology and integrating UDL into the college curriculum
3	Tobin, T.	2017	Universal Design for Learning: Enabling Student Success in Higher Education	Qualitative, Observation and Interview	Implementation of UDL reduces inequalities in the learning process	Lecturers' awareness of the importance of UDL is still low, and the use of technology is minimal.	UDL improves academic outcomes and motivates students with disabilities	Provision of resources and ongoing training programs for teachers
4	Black, R. & Dawson, D.	2019	UDL in Action: Case Studies from Inclusive Classrooms in Higher Education	Case Study, Qualitative	Students have an easier time accessing content with the multimodal UDL approach.	Lecturers still have difficulty implementing expression and engagement options in large classes.	Increased student participation in discussions and assignments	Development of digital assistive devices to assist in the large-scale implementation of UDL
5	Burgstahler, S.	2020	UDL and Accessibility in Higher Education: What Have We Learned?	Meta-analysis	The implementation of UDL provides greater flexibility in accessing teaching materials.	The cost of implementing UDL is still high, limited human resources	Increasing the presence and participation of students with disabilities in learning	Cross-departmental collaboration to support the integration of UDL across academic programs

No	Authors	Year	Tittle	Method	Finding	Obstacles/ Challenges	UDL Impact	Recommendations
6	Johnson, L. & Baker, C.	2018	Assessing the Impact of UDL on Student Engagement	Case study	UDL increases student engagement in interactive classes	Resource constraints, time for content redesign	Improve student focus and participation in class	Resource development for redesign of teaching materials
7	Wong, M. & Taylor, H.	2019	UDL as a Tool for Reducing Educational Barriers in Higher Education	Qualitative, Interview	UDL facilitates accessibility for various learning styles.	Costs of implementing UDL and lack of institutional support	Improving student accessibility and motivation	Collaboration with technology developers for UDL tools
8	Davis, P. & Roberts, L.	2020	Integrating UDL in Online Learning Environments	Case Study, Qualitative	UDL helps flexibility in online learning	Technical constraints and limited learning platforms	Improving student adaptability in an online environment	Improving the infrastructure of online learning platforms
9	Li, Z. & Huang, R.	2021	UDL in Blended Learning: Enhancing Accessibility	Qualitative, Experimental	UDL improves the learning experience in a blended learning system	Lack of integration between online and offline learning	Increase interaction between students and lecturers	Training program for lecturers on UDL in blended learning
10	Parker, G. & Martin, S.	2017	UDL Implementation in Large Classrooms	Observation	Implementing UDL in large classes improves student understanding.	Difficulty managing UDL methods in large classes	Improve understanding of material in large classes	Development of teaching aids that support UDL in large classes
11	Ahmed, R. & Singh, K.	2022	UDL and Cultural Inclusivity in Higher Education	Qualitative, Case Study	UDL enhances cultural inclusion in learning	Lecturers' lack of understanding of cultural inclusivity	Increasing cultural awareness among students	Development of training on cultural inclusion and UDL for lecturers
12	Brown, A. & Lee, K.	2021	UDL Strategies in STEM Education	Experiment	UDL makes it easier for non-technical students in STEM fields to understand the material.	Limited laboratory equipment and infrastructure	Improving motivation and learning outcomes in STEM classes	Improved support for UDL-based lab infrastructure and tools

No	Authors	Year	Tittle	Method	Finding	Obstacles/ Challenges	UDL Impact	Recommendations
13	Green, T. & Walker, J.	2020	Evaluating UDL in Language Learning	Case Study, Qualitative	Implementation of UDL accelerates foreign students' language adaptation skills	Obstacles in providing a variety of language learning media	Improving the adaptation and self-confidence of foreign students	Increased access to multimedia resources in language learning
14	Choi, M. & Kim, S.	2022	UDL in Virtual Reality Learning Environments	Experiment	UDL enriches the learning experience in a virtual environment	High costs for VR devices and lack of lecturer training	Increasing student interaction and engagement in immersive learning	Investment in VR devices and training for lecturers on the use of VR in UDL

The implementation of UDL in higher education has been proven to provide significant benefits in improving accessibility, engagement, and learning experience for students with disabilities. However, there are several main challenges, such as limited training for lecturers, implementation costs, and inadequate technology support. General recommendations include the development of training programs for teachers, the improvement of technological infrastructure, and collaboration between departments to expand the implementation of UDL in higher education settings. Positive Impact: Improving accessibility, participation, motivation, and academic outcomes for students with disabilities. Barriers: Lack of training, technological limitations, high costs, and lack of awareness. Recommendation: Increased training, development of supporting technologies, and cross-departmental integration to strengthen UDL implementation across programs. This study emphasizes the positive effects of UDL on aspects of engagement, accessibility, adaptability, and cultural inclusion. The most common obstacles remain in implementation costs, technology support, and training needs for lecturers. Recommendations include the development of training programs, infrastructure improvements, and collaboration with appropriate technology and tools. Then the research shows the benefits of UDL in specific fields such as STEM education, language learning, and learning with VR technology (Almeqdad, Alodat, Alquraan, Mohaidat, & Al-Makhzoomy, 2023; Cao, Ng, & Ye, 2023; Kennette & Wilson, 2019; Mcguire, Scott, & Shaw, 2006; Roberts, Park, Brown, & Cook, 2011). The main challenges remain around high costs, limited resources, and lack of training for lecturers, especially for the use of specialized technologies. The recommendations focus on technology investments, access to appropriate tools, and training programs and infrastructure support that support UDL implementation in a variety of learning contexts.

The data was analyzed and the results were obtained to answer the predetermined Research Questions and discuss the strategy for implementing Universal Design for Learning in inclusive universities:

3.4 Results from RQ1: How does the implementation of UDL in inclusive universities affect the learning experience and academic outcomes of students with disabilities?

The implementation of Universal Design for Learning (UDL) in inclusive universities has a significant impact on the learning experience of students with disabilities. UDL, which emphasizes flexibility and accessibility in the learning process, provides opportunities for students with disabilities to learn in a more adaptive way according to their needs. By providing a variety in material delivery methods, UDL allows students to access information through visual, auditory, and kinesthetic media. This is very helpful for students with special needs, such as students with visual or hearing impairments, to understand the material without being hindered by physical limitations. In addition, the implementation of UDL also reduces the academic pressure that is often felt by students with disabilities in an environment that is not inclusive.

The learning experience of students with disabilities in inclusive universities that implement UDL tends to be more positive compared to conventional methods. They feel more cared for because of the flexibility provided in each class, both through material adaptation, teaching methods, and assessments. This creates a sense of comfort and safety for students with disabilities to actively participate in teaching and learning activities. As a result, the classroom atmosphere becomes more inclusive and collaborative, which not only benefits students with disabilities, but also improves the learning experience for all students. This inclusion helps encourage all students to appreciate diversity more and understand the challenges faced by their friends with disabilities.

UDL also plays an important role in increasing the active participation of students with disabilities in the classroom. Due to the various methods of delivery and completion of assignments provided, students feel more free to contribute according to their respective learning styles and abilities. For example, the use of technology to provide materials in diverse formats allows students to choose the way that best suits their needs, so that their participation in class discussions is more optimal. Lecturers are also encouraged to innovate in teaching, making the teaching and learning process more interactive

and interesting. This creates a collaborative environment where students with disabilities feel equal in participation.

The positive impact of UDL can not only be seen in terms of participation, but also from the improvement of academic outcomes of students with disabilities. Students who previously had difficulties in understanding academic content now find it easier to follow lessons and are better prepared to face evaluations. Flexibility in assessment and adjustment to the way the material is delivered provides opportunities for students to demonstrate their abilities optimally. The data shows that the academic scores of students with disabilities have improved, reflecting an increase in their understanding of the subject matter (AlRawi & AlKahtani, 2022; Izzo, 2012; Lee & Shin, 2023). This increase not only affects grades numerically, but also provides additional self-satisfaction and motivation for students with disabilities to continue their studies.

In addition, UDL encourages greater independence and self-confidence among students with disabilities (AlRawi & AlKahtani, 2022; Lee & Shin, 2023). With easier access and a supportive learning environment, students with disabilities feel able to learn independently and are more confident in completing academic tasks. They not only rely on the help of others to understand the material, but can access a variety of resources and methods that suit their learning style. This increase in independence helps them feel able to compete and make meaningful contributions in academics and social activities on campus. Students with disabilities feel more confident that physical or sensory limitations are not the main obstacle to achieving academic achievement.

However, the implementation of UDL in inclusive universities also faces certain challenges, especially in terms of supporting facilities and resources. Many universities are still limited in providing supporting technology that can be accessed by students with disabilities. In addition, not all lecturers are familiar with or have adequate knowledge of how to apply UDL in their teaching. This results in the implementation of UDL not being evenly distributed across universities, and some students with disabilities may not feel the full benefits of UDL. Universities need to ensure adequate training for lecturers and consistent support to overcome these obstacles.

The implementation of UDL also requires universities to collaborate with various parties so that a truly inclusive environment can be created. In addition to lecturers and teaching staff, the involvement of administrative staff and support from the government or educational organizations is needed to support full accessibility in higher education. This support can be in the form of the provision of technological devices, disability-friendly physical facilities, to funding policies that support inclusive education. Good cooperation between various parties will ensure that students with disabilities get an equal and quality learning experience, as well as appropriate support in all aspects of their education.

In addition to the physical and technological aspects, the implementation of UDL requires a cultural change in higher education to fully support inclusive education. Universities must build a culture that values diversity and upholds the principle of inclusion in every aspect of campus life (Camacho-Zuñiga, Julio-Ramos, & Zavala, 2023; Pratiwi et al., 2018). This includes providing an understanding to all students about the importance of inclusion and how to support their friends with disabilities. Support from fellow students will strengthen a sense of inclusion on campus and accelerate the adoption of an inclusive culture in college. An inclusive culture not only supports students with disabilities, but also enriches the learning experience of all students.

The long-term impact of good UDL implementation in higher education can shape a generation of students who are more sensitive and responsive to diversity. Students who are accustomed to an inclusive and accessible education will be better prepared to contribute in a work and social environment that values diversity. They will bring the values of inclusion applied in college into their professional lives, contributing to the formation of a more inclusive society. Thus, the benefits of implementing UDL are not only felt by students with disabilities, but also have an impact on the formation of broader social values.

Overall, this study found that the implementation of UDL in inclusive universities has a significant positive impact on the learning experience and academic outcomes of students with disabilities. Although there are several challenges in its implementation, such as limited facilities and lecturer

training, the benefits generated are huge in creating an inclusive educational environment. The consistent implementation of UDL and supported by various parties can create an inclusive campus that supports the right to learn for every student without exception. Through a more inclusive education, universities can be a good example of appreciating diversity and supporting equality in education.

3.5 Results of RQ2: What are the obstacles and challenges faced by lecturers and students in the implementation of UDL in the context of higher education?

3.5.1 Lack of Training and Lecturer Awareness Regarding UDL

One of the main challenges in the implementation of UDL is the lack of adequate training and understanding for lecturers regarding this concept. For many lecturers, UDL is a relatively new approach, and most have not had the opportunity to understand its principles in depth. The lack of training results in lecturers lacking confidence in implementing UDL and often feeling confused about how to tailor inclusive learning for students with different needs. When lecturers do not understand how to accommodate the diverse needs of students, this can hinder an inclusive learning process and lead to gaps in accessibility. Some lecturers find it difficult to integrate UDL strategies into their learning plans without clear guidance or support from the institution. Therefore, intensive training and capacity building programs are needed so that lecturers have the skills needed to implement UDL effectively.

3.5.2 Infrastructure Limitations and Technology Support

The implementation of UDL in higher education relies heavily on adequate infrastructure and technology support. However, the reality is that not all educational institutions have access to the necessary technology to accommodate the various learning needs of students. Infrastructure limitations, such as lack of access to specialized learning software or multimedia tools, are major obstacles to optimal UDL implementation. Students who need special technology assistance, such as screen readers or other assistive devices, often find it difficult to access these tools because they are not evenly available on campus. This challenge is further complicated when lecturers try to utilize technology in large classes, where not all students have personal devices or stable internet access. As a result, the implementation of UDL becomes inconsistent, and many students miss out on opportunities to learn to the fullest.

3.5.3 Limited Time and Resources for Inclusive Learning Design

Implementing UDL requires additional time and resources for lecturers to design learning materials that are inclusive and in accordance with the needs of various types of students. Many lecturers find these additional tasks difficult to manage amid other academic responsibilities, such as research, administration, and regular teaching. In practice, creating a variety of content as well as flexible evaluation tools according to UDL principles requires a longer preparation time than traditional teaching methods. The absence of additional human resource support or administrative assistance often makes lecturers feel overwhelmed and overwhelmed. Additionally, an inclusive learning planning process requires creative approaches and specialized tools that may not be easily accessible. As a result, many lecturers tend to use conventional teaching methods because they are more time-efficient, although they may be less inclusive for all students.

3.5.4 High UDL Implementation Costs

One of the major obstacles in the implementation of UDL is the high costs associated with the development of supporting technologies, lecturer training, and the provision of tools for students. Higher education institutions with limited budgets often struggle to fund the infrastructure needed to support UDL as a whole. In addition, the cost of providing access to various devices, such as special software, technological aids, or adaptive devices for students with disabilities, is also considerable.

Students who do not have these tools may not be able to participate in learning activities optimally, resulting in inequality in educational accessibility. These high additional costs often force institutions to prioritize in the implementation of UDL, which may only cover a few specific programs or faculties. As a result, the implementation of UDL is uneven across campuses and causes unequal access for students from different backgrounds.

3.5.5 Suboptimal Institutional Policies and Support

Adequate institutional policies and support are indispensable for the successful implementation of UDL in higher education, but there are still many campuses that do not yet have an official policy or full support for this. The lack of institutional commitment in providing guidance or incentives for lecturers to adopt UDL causes UDL implementation to often depend on individual initiatives. Without a clear policy, lecturers may feel that the implementation of UDL is an additional task that is not appreciated or supported by the management. It also impacts the allocation of resources needed to implement UDL, such as budgets for training or the purchase of technology devices. Unsupportive policies also hinder the establishment of a holistic inclusive learning environment, as UDL is not integrated into the overall institutional structure. In the long run, institutions that do not have a proactive policy towards UDL may find it difficult to achieve inclusivity in higher education consistently.

3.5.6 Barriers in Adjustment for Large Classes

Implementing UDL in large classes is a challenge for lecturers who have to adjust their teaching approach to meet diverse learning needs. In large classes, it is often difficult for lecturers to give individual attention to each student, so students with special needs may feel neglected. In addition, managing interactions and variations of evaluation methods in large classes is a challenge that takes time and effort. The implementation of UDL requires flexibility in teaching methods and evaluation tools, but in large classes, this flexibility is often not possible. Some lecturers feel overwhelmed with these additional tasks and tend to opt for traditional teaching methods that are easier to apply on a large scale. As a result, many students feel less accommodated in the learning process, especially those who need additional support to be able to follow the material well.

3.5.7 Student Difficulties in Accessibility and Utilization of Technology

For students, especially those with disabilities or limited economic access, obstacles in accessing UDL's supporting technology are the main obstacles in the learning process. Students who do not have adequate devices or internet connections are often unable to take advantage of the UDL features provided by the institution. This gap in access to technology can cause students who are in a disadvantaged position to feel left behind and lose the opportunity to learn optimally. In addition, not all students have adequate digital skills to utilize technology in learning, so they need additional support from institutions. Students with limited digital skills may feel frustrated or uncomfortable when faced with technology-based learning tools. Without proper support and guidance, students can have difficulty adapting to learning that uses UDL principles.

3.6 Results of RQ3: What innovative strategies or models can be developed to support the integration of UDL in study programs in higher education?

The discussion of the results of the research to answer Research Question 3 (RQ3) regarding innovative strategies or models to support the integration of Universal Design for Learning (UDL) in study programs in higher education identifies several main approaches that can be developed by higher education institutions. These strategies aim to build an inclusive and adaptive learning environment, so that it is able to meet the needs of students with various backgrounds and learning styles.

3.6.1 Development of Intensive Training and Assistance Programs for Lecturers

One of the main strategies to support the implementation of UDL is to organize an intensive training program designed to introduce and guide lecturers on the principles and application of UDL. This training should include not only UDL theory, but also hands-on practice as well as real-life examples of UDL application in the curriculum. Long-term mentoring and practical guidance can also be provided so that lecturers can gradually integrate UDL principles into their teaching. This program will help lecturers develop the ability to adjust learning materials according to the needs of different types of students. In addition, the presence of mentors or facilitators who are experienced in UDL can provide direct support for lecturers, so that they are more confident and able to create an inclusive learning environment.

3.6.2 The Use of Educational Technology to Provide Access to Multimodal Learning

Technology can be the main tool in supporting the implementation of UDL by providing various media and learning formats that can be accessed by all students. Digital learning platforms, visual aids, interactive videos, and other supporting software allow students to learn according to their style and preferences. Educational institutions can develop or use digital platforms that support flexibility in the delivery of materials, such as Learning Management Systems (LMS) that can be accessed through mobile, audio, and text devices. Additionally, additional tools such as software for automatic transcription, screen readers, and subtitles can improve accessibility for students with visual or hearing impairments. This technology will help students have a more inclusive learning experience and ensure that they do not fall behind in the learning process.

3.6.3 Inclusive Curriculum Model Based on Interdepartmental Collaboration

The curriculum model based on interdepartmental collaboration is an innovative strategy that can support the wider and effective implementation of UDL. This collaboration involves various parties, such as academic departments, student services centers, and technology units, who work together to design a curriculum that puts forward UDL principles. By involving various departments, the resulting curriculum can cover the needs of students from various backgrounds and take advantage of the diverse resources and expertise available at the institution. This collaboration also allows for more comprehensive support, including access to learning aids, special tools, and consultations for students and lecturers. With this model, institutions can build a consistent and integrated learning environment across study programs.

3.6.4 Implementation of Flexible Evaluation and Assessment that Accommodates Student Needs

Another important strategy to support UDL is the implementation of flexible evaluation and assessment that allows students to choose an assessment format according to their abilities and learning style. This evaluation system can include options such as projects, presentations, essays, or practical exams, each of which is adapted to fit the student's competencies. By providing flexibility in assessment, students can demonstrate their understanding of the material in a way that works best for them, reducing stress and boosting confidence. Institutions need to develop inclusive assessment guidelines and provide training to lecturers to design fair and accommodating assessment methods. With flexible assessments, students from various backgrounds can achieve more optimal academic results according to their abilities and needs.

3.6.5 Development of UDL-Based Student Support System Outside the Classroom

UDL is not only applied in the classroom, but can also be extended to the overall student support system. The development of UDL-based student support services can include a variety of assistance programs, such as academic counseling, tutoring services, and technology support. These services need to be designed to be easily accessible and responsive to the diverse needs of students. Institutions can provide service centers or online platforms that help students access information and tools whenever they need them. With this comprehensive support system, students can get the guidance and assistance

they need to overcome any academic or non-academic difficulties they may face. This will support a more inclusive and holistic learning experience for all students.

3.6.6 Use of Student Data to Analyze and Adapt UDL's Approach

The use of student data to analyze their needs and preferences in the learning process is another innovative strategy that can help UDL integration. By analyzing academic data and data on how students access learning materials, lecturers and institutions can identify areas where students experience constraints and adjust the UDL approach more appropriately. This data can include information about academic outcomes, learning styles, interactions with digital platforms, and class participation rates. By analyzing this data, lecturers can gain a better understanding of the most effective methods for students and make adjustments in the delivery of material or evaluation. The application of this data-based approach will help lecturers provide more personalized and targeted learning, thereby ensuring that UDL is implemented effectively and efficiently in the university environment.

These innovative strategies show that the implementation of UDL in higher education depends not only on adaptation in the classroom, but also on changes in the overall institutional approach. Through training programs, the use of technology, interdepartmental collaboration, flexible evaluations, UDL-based support systems, and data analysis, institutions can create an inclusive and adaptive learning environment. Comprehensive UDL implementation requires commitment from various parties on campus, including lecturers, administration, and student services units. The integration of these strategies can help universities ensure that every student has equal access and opportunity to learn and develop according to their potential

4. CONCLUSION

The implementation of Universal Design for Learning (UDL) in inclusive universities significantly enhances accessibility, engagement, and learning outcomes for students with disabilities. By offering flexibility in material delivery and adaptation methods, UDL allows students to learn according to their individual needs, fostering greater participation and improved academic performance. However, this study identifies several challenges in UDL implementation, including insufficient lecturer training, limited infrastructure and technological support, and high costs. To address these obstacles, it is crucial to develop comprehensive training programs for lecturers, improve technological infrastructure, and promote cross-departmental collaboration to build a robust UDL support system. Moreover, multimodal technologies, flexible assessment models, and the personalization of learning through data are key strategies that can enhance the effectiveness of UDL. These strategies can be adapted to varying institutional capacities by tailoring training programs to local needs, scaling infrastructure improvements based on available resources, and implementing flexible models that accommodate regional contexts. To achieve meaningful progress, it is essential for universities, policymakers, and educational leaders to prioritize UDL adoption. With strong institutional commitment and collaboration, UDL can serve as a foundation for creating an inclusive, adaptive learning environment. Ultimately, these efforts will not only help students with disabilities reach their academic potential but will also foster a campus culture that values diversity and promotes a more inclusive society

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