

Inclusive Learning Device Development Strategy Based on UDL and Differentiation for Children with Special Needs in Indonesia

Sheeva Ziyana¹, Marfuah², Abdur Rahmani³, Yosi Armelia⁴

Special Education Departement, Universitas Negeri Surabaya, Indonesia¹⁻⁴

Corresponding author: 24010915024@mhs.unesa.ac.id

Abstract

Inclusive education is an approach that ensures right every children , including children with needs Special (ABK), for get equal education in environment the same learning . However , the implementation Still face various challenges , especially in provision device adaptive and responsive learning to need individual . Article This aiming For identify development strategies device effective learning for ABK in inclusive settings . Research This done through systematic literature review method journal scientific , policy education and studies case from various countries between 2018 to 2023. Analysis done use PRISMA framework , with focus on three component main : planning learning based on individual needs , development adaptive teaching materials , and implementation of multimodal learning media . The results of the study show that integration Universal Design for Learning (UDL) principles with differentiation strategies learning capable increase engagement and results learn ABK in a significant . Besides that , the application of learning media based on technology as well as approach collaborative between regular teachers and assistant teachers become factor key in realize environment inclusive and meaningful learning . Findings This give contribution important to development policies and practices education more inclusive structured and sustainable in Indonesia. It is recommended that the strengthening of teacher capacity and provision of learning media banks inclusive become priority in support success education for all child .

Keywords : *education inclusive , child in need special , device learning , Universal Design for Learning (UDL), adaptive media, differentiation strategies*

Manuscript History:

Received: 26 June 2025

Revised: 16 July 2025

Accepted: 31 July 2025

How to cite:

Ziyana, S., Marfuah, M., Rahmani, A., & Armelia, Y. (2025). Inclusive learning device development strategy based on UDL and differentiation for children with special needs in Indonesia. *International Disability Innovation Journal*, 1(1), 15–21.

INTRODUCTION

Inclusive education is a paradigm that places every child, without exception, as the main subject in the educational process. This concept affirms that all students, including children with special needs (ABK), have the right to receive quality education in a regular learning environment. Globally, inclusive education has become a shared commitment in an effort to create an educational system that is fair, equitable, and free from discrimination. Indonesia also adopts this commitment through various policies, one of which is Ministry of Education and Culture Regulation Number 70 of 2009, which serves as a legal basis for every child's right to receive a proper education, regardless of their ability, physical, or mental condition.

Despite having a clear legal framework, the implementation of inclusive education in Indonesia still faces various challenges on the ground. One of the main problems often found is the limitation in providing adaptive and effective learning devices for ABK. The learning devices in question include teaching materials, learning media, and evaluation methods that can accommodate the diverse needs of students. Without adequate devices, the learning process in inclusive classrooms is often not optimal, thus potentially hindering the development and learning achievements of ABK. Data from the Ministry of Education (2023) reveals that more than 65% of inclusive schools in Indonesia still experience difficulties in developing teaching materials and learning media suitable for the needs of ABK. This problem is inseparable from a

number of factors, such as teachers' limited understanding of inclusive learning principles, minimal relevant training, and suboptimal utilization of adaptive technology and learning media. This condition indicates an urgent need to strengthen the capacity of teachers and schools in designing and implementing inclusive learning devices.

The quality of learning devices plays a crucial role in determining the success of inclusive education. Well-designed devices not only support active student engagement but also provide space for every child to express their potential and uniqueness. Therefore, the development of adaptive and responsive learning devices to the needs of ABK is one of the main priorities in efforts to realize truly inclusive education. This effort requires a systematic, collaborative approach based on best practices that have proven effective in various contexts.

One approach widely adopted globally in the development of inclusive learning devices is Universal Design for Learning (UDL). UDL emphasizes the importance of providing various methods of material representation, student expression, and learning engagement to address the diversity of needs in the classroom. By integrating UDL principles, teachers can design more flexible, adaptive learning that can provide equal access for all students, including ABK. In addition, differentiated learning strategies are also considered effective in increasing the accessibility and effectiveness of learning in inclusive classrooms.

This article aims to thoroughly examine the strategies for developing inclusive learning devices based on UDL principles and differentiated learning. Through a systematic literature review approach, this article will explore various key components in planning, material development, and the utilization of learning media that support the learning needs of ABK. It is hoped that this study can make a real contribution to strengthening more contextual, applicable, and sustainable inclusive education practices in Indonesia, as well as serving as a reference for stakeholders interested in designing more inclusive education policies and programs.

The research method is written in full and in detail so that other researchers can repeat the research (reproducible) for confirmation and clarification. General methods do not need to be written down in detail. This section contains the *research design*, *research procedure*, *data sources or participants*, *data collection techniques*, and *data analysis techniques*.

The Concept of Inclusive Education Inclusive education is an approach that places all students—including those with special needs—in the same education system, without discrimination. Its main principle is to provide equal learning opportunities and accommodate the diversity of individual needs in a supportive learning environment that encourages active participation. UNESCO (2020) defines inclusive education as the process of identifying and responding to the diverse needs of learners through increasing participation in learning, cultures, and school communities and reducing exclusion within and from education systems. In Indonesia, inclusive education policies are regulated in Permendikbud No. 70 of 2009, but its implementation still faces significant challenges, especially in terms of resource provision, teacher training, and curriculum adaptation (Nugroho & Sutrisno, 2022). These challenges are exacerbated by a lack of inclusive pedagogical understanding among teachers (Mulyani, 2021). The implementation of inclusive education demands adaptations to the curriculum, teaching methods, physical environment, and assessment systems. In practice, inclusive education not only benefits children with special needs but also builds values of tolerance, empathy, and social solidarity for the entire school community (Ainscow, Booth, & Dyson, 2020). Therefore, inclusive education is not merely an administrative policy but a cultural transformation within the education system.

Universal Design for Learning (UDL) Universal Design for Learning (UDL) is a conceptual framework developed by the Center for Applied Special Technology (CAST) that aims to improve the quality of access and participation in the learning process for all students, including ABK. UDL is rooted in the principle of "design for all," meaning that learning should be designed from the outset to be accessible to all students, rather than reactively adapted after barriers occur (CAST, 2018). Research in Canada by Rao et al. (2017) shows that UDL implementation has a significant impact on increasing participation and academic achievement of students with different needs. In Indonesia, a study by Widodo and Rachmawati (2021) revealed that the UDL model increased the effectiveness of learning in inclusive elementary schools through the use of multimedia and collaborative strategies. UDL consists of three main principles:

- *Multiple Means of Representation*: Learning materials are presented in various formats such as text, images, audio, and video to accommodate differences in how students receive and understand information.

- *Multiple Means of Action and Expression*: Students are given various options for expressing their understanding, such as through writing, speaking, practice, and technological assistance.
- *Multiple Means of Engagement*: The learning process is designed to be engaging and motivating for students, by providing choices of activities, challenges, and meaningful contexts for them. Various studies show that UDL implementation in inclusive environments can increase learning motivation, active participation, and academic achievement of students with diverse needs (Rao et al., 2017; Meyer, Rose, & Gordon, 2014).

Characteristics of Children with Special Needs (ABK) Children with Special Needs (ABK) are children who differ significantly from most children in terms of physical, cognitive, social-emotional, or communication development, thus requiring adapted educational services. The categories of ABK are very diverse, including:

- Sensory Impairments: such as visual impairment and hearing impairment.
- Developmental Disorders: such as autism, ADHD, and speech delay.
- Specific Learning Disorders: such as dyslexia, dysgraphia, and dyscalculia.
- Physical or Motor Impairments: such as cerebral palsy or limited mobility.
- Social-Emotional Barriers: such as behavioral disorders or psychosocial trauma. A deep understanding of the characteristics of ABK is an important foundation for developing relevant and effective learning devices. Each type of special need requires specific pedagogical approaches and learning media, for example, tactile media for the visually impaired, or the use of structured visuals for children with autism spectrum disorder (Turnbull et al., 2020). By paying attention to this diversity, teachers are required not only to have pedagogical competence but also the ability to assess individual needs and collaborate with other support staff (Misra & Sharma, 2022). This is why UDL and differentiated learning approaches become very relevant and complementary in the context of inclusive education.

Inclusive education in Indonesia continues to be developed to provide equal learning opportunities for all students. However, the reality on the ground shows that around 65% of inclusive schools struggle to provide adaptive teaching materials. The main challenge lies in the lack of learning devices that are responsive to the individual needs of ABK. Therefore, a development strategy that integrates modern pedagogical principles, adaptive technology, and multi-stakeholder collaboration is needed.

The Concept of Inclusive Education and Universal Design for Learning Inclusive education emphasizes full access and participation for all students in one education system. The main principles of this education include:

- Equality of access
- Universal design
- Learning differentiation The UDL approach, developed by CAST, facilitates inclusive learning through three main principles:
- *Multiple Means of Representation* – Presenting material in various formats (visual, audio, interactive).
- *Multiple Means of Action and Expression* – Providing various methods for students to express knowledge.
- *Multiple Means of Engagement* – Motivating students through relevant contexts and choices of learning strategies.

RESULTS AND DISCUSSION

Individual Planning and Curriculum Adaptive Planning begins with an assessment of individual needs and the preparation of an *Individualized Education Program* (IEP). The curriculum is adjusted through material simplification and enrichment, adapted to each student's abilities. Individual learning planning and the use of adaptive curriculum are based on the principles of differentiated learning and an approach that places students at the center of the learning process. The idea of instructional differentiation, as described by Carol Ann Tomlinson, emphasizes the importance of tailoring instruction to the unique needs of each student, including aspects of learning materials, methods, and learning outcomes (Tomlinson, 2014). This approach is very suitable for implementation in the context of inclusive education because it can accommodate the diversity of learning styles, understanding speeds, and special needs of students.

The initial step in this planning is to conduct a comprehensive assessment of student needs. This assessment not only looks at academic abilities but also includes strengths, interests, learning preferences, and areas that require additional support. Information from this assessment forms the basis for designing an

Individual Education Program (IEP), which is a formal document that includes specific learning objectives, support services, forms of accommodation, and modifications necessary for students with special needs.

An adaptive curriculum is an important part of this approach, by not imposing a uniform curriculum for all students. Instead, the curriculum is adjusted through strategies such as simplifying material (e.g., reducing reading difficulty levels and emphasizing core concepts) and providing enrichment material for students who show higher abilities. Curriculum flexibility allows educators to adjust the depth of material, speed of delivery, and teaching methods to suit the needs and abilities of each student.

Development of Adaptive Materials and Media The development of adaptive learning materials and media refers to the principles of *Universal Design for Learning* (UDL). UDL is an approach that encourages the design of flexible curricula and teaching methods with the aim of removing learning barriers and opening equal learning opportunities for all students (CAST, 2018). UDL is based on three main principles, namely:

- *Multiple Means of Representation*: Information is delivered through various forms or formats.
- *Multiple Means of Action and Expression*: Students are given a choice of methods to express their understanding.
- *Multiple Means of Engagement*: Various approaches are provided to arouse motivation and maintain student interest in the learning process.

Furthermore, inclusive learning materials are designed based on UDL's accessibility principles, meaning that materials are available in various forms so that they can meet the diverse sensory and cognitive needs of students. Examples include:

- Digital and large-print formats are very helpful for students with visual impairments, and digital formats allow the use of features such as text-to-speech readers or screen magnification.
- Interactive audio and visual media are useful for students with auditory and visual learning styles, as well as those who have difficulty reading regular text.
- Videos equipped with subtitles or audio narration can improve understanding.
- Multisensory approaches involve a combination of sight, hearing, and body movement senses.
- Activities such as hands-on practice, role-playing, or the use of concrete teaching aids can facilitate understanding of abstract concepts.

In addition, adaptive learning media are specifically designed to overcome certain learning barriers, such as:

- 3D models and embossed maps, which help visually impaired students understand spatial and shape concepts concretely.
- Picture schedules, effective for students with autism or those who have difficulty organizing activities and moving from one activity to another, as they help them understand and anticipate the flow of activities.
- Social stories, used to support autistic students in understanding social rules and various complex situations more clearly and structured.

Implementation and Collaboration The success of implementing inclusive learning is highly determined by collaboration between various parties and the application of learning strategies that are responsive to student needs. The sociocultural learning theory developed by Vygotsky emphasizes that social interaction plays a key role in the learning process, where students acquire knowledge through collaboration with peers and individuals who have a deeper understanding (Vygotsky, 1978). Collaboration is the main foundation in inclusive learning. Regular classroom teachers and assistant teachers (both special education teachers and special guidance teachers) actively collaborate in planning, implementing learning, and evaluating. One approach used is the co-teaching model, which involves teaching together in one class, where both teachers share responsibility for delivering material and supporting students. This form of collaboration can be done in several ways, such as one teacher teaching and the other assisting, parallel teaching, or station teaching.

Parental involvement is also very important. Their role in the process of preparing the *Individual Education Program* (PPI/IEP), routine communication with the school, and support provided at home are key factors in supporting student learning success. One effective instructional strategy is think-pair-share, which encourages active student engagement. This method begins with students thinking independently, then

discussing with a partner, and finally sharing their thoughts with the group or the entire class. This strategy helps students understand the material, express ideas, and learn from classmates' perspectives, which is very useful especially for students with diverse communication abilities.

Authentic Evaluation Authentic evaluation is aligned with the *assessment for learning* approach, or assessment to support the learning process. This approach differs from traditional assessments that only focus on assessing final results (*assessment of learning*), as it emphasizes the integration of evaluation into the learning process itself. The goal is to provide continuous feedback to improve the quality of learning (Black & Wiliam, 1998).

Authentic assessment evaluates students' abilities and understanding in contextual situations relevant to daily life. Unlike standardized tests that sometimes do not fully reflect the abilities of students with special needs, authentic assessment allows for a more flexible approach. Examples of its implementation include:

- **Portfolios:** Collections of student work that demonstrate their learning development over time, providing a picture of the process, not just the final result.
- **Oral tests:** An alternative for students who have difficulty writing to convey their understanding through verbal communication.
- **Modified rubrics:** Assessment tools adapted to reflect each student's unique abilities, focusing on individual progress and achievement of goals in the *Individual Education Program* (IEP).

The concept of *assessment for learning* also emphasizes the importance of formative feedback. Teachers use data from assessments to refine teaching approaches, adapt methods, and provide more targeted support. This approach not only strengthens the continuous learning process but also encourages students to become more independent in learning.

Challenges and Solutions The implementation of inclusive education often faces various challenges, especially those originating from systemic aspects and individual attitudes. Organizational change theory explains that to implement an innovation, strong support, adequate training, and fundamental cultural change are needed. Limited resources and resistance to change are common obstacles found. Some of the main barriers that often arise include:

- **Lack of supporting facilities and infrastructure:** For example, unavailability of disability-friendly facilities, lack of adapted learning materials, and the number of teachers disproportionate to the number of students.
- **Resistance to change:** This can come from various parties such as teachers, parents, and even students, who do not fully understand the principles of inclusive education. Stereotypes and misconceptions about children with special needs can also hinder acceptance.

Various solutions can be pursued, including:

- **Use of assistive technology:** Assistive tools can be a solution to overcome barriers in the learning process. Examples include devices that convert text to speech (text-to-speech) or speech to text (speech-to-text), which are very helpful for students with reading or writing difficulties. Technologies such as virtual reality (VR) and augmented reality (AR) are also beginning to be used to create more realistic and safe learning experiences, especially for practicing social skills or therapy.
- **Continuous training for teachers:** Providing regular training to improve teachers' competence in handling diverse learning needs is very important. This training includes differentiated teaching approaches, positive behavior management strategies, and the use of assistive technology.
- **Increasing public awareness:** Through educational campaigns and advocacy activities, the public can be given a better understanding of the importance of inclusive education. This aims to build broader acceptance and create a more inclusive social environment for all.

CONCLUSION

Inclusive education in Indonesia is a strategic step to ensure that every child, including children with special needs (ABK), receives equal opportunities to access quality education in regular schools. Although there is a legal basis, such as Ministry of Education and Culture Regulation Number 70 of 2009, implementation on the ground still faces various obstacles. One of the main problems lies in the lack of learning devices that can accommodate the needs of ABK. Data shows that about 65% of inclusive schools still experience difficulties in preparing appropriate learning materials and media. This is influenced by teachers' limited understanding, insufficient in-depth training, and suboptimal utilization of adaptive learning technologies.

To address these challenges, strengthening the capacity of teachers and schools in designing inclusive learning devices is crucial. One approach that can be applied is Universal Design for Learning (UDL), which emphasizes the importance of providing various alternatives in material presentation, how students express understanding, and their engagement in the learning process. UDL can be combined with differentiated learning to accommodate the diversity of learning styles and student needs. Recommended practices include implementing initial assessments, preparing individualized education programs (IEPs), using multisensory materials, and collaborating between teachers, parents, and other support staff. Evaluation also needs to be authentic and continuous. Although challenges such as limited facilities and resistance to change still exist, solutions can be found through continuous teacher training, integration of assistive technology, and increased public understanding of the importance of inclusive education. With focused and collaborative efforts, a more inclusive, responsive, and sustainable education system can be built in Indonesia.

Limitations and Future Research Development: This study focuses on a systematic literature review. Future research may involve more in-depth case studies or action research to test the direct effectiveness of inclusive learning device development strategies in various school contexts in Indonesia. In addition, research on the long-term impact of UDL and differentiation implementation on the academic and social progress of ABK is also greatly needed. Studies on the effectiveness of specific assistive technologies in the context of inclusive education in Indonesia are also recommended.

DECLARATION OF COMPETING INTEREST

The authors declare no known financial conflicts of interest or personal relationships that could have influenced the work reported in this manuscript.

DECLARATION OF ETHICS

The authors declare that the research and writing of this manuscript adhere to ethical standards of research and publication, in accordance with scientific principles, and are free from plagiarism.

DECLARATION OF ASSISTIVE TECHNOLOGIES IN THE WRITING PROCCSS

The authors declare that Generative Artificial Intelligence and other assistive technologies were not excessively utilized in the research and writing processes of this manuscript.

REFERENCES

- Ainscow, M., Booth, T., & Dyson, A. (2020). *The Index for Inclusion: A Guide to School Development Led by Inclusive Values* (4th ed.). Centre for Studies on Inclusive Education (CSIE).
- Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7-74.
- CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. Obtained from <http://udlguidelines.cast.org>
- Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal Design for Learning: Theory and Practice*. CAST Professional Publishing.

- Misra, R. K., & Sharma, D. K. (2022). *Inclusive Education for Children with Disabilities*. K. International Pvt Ltd.
- Mulyani, S. (2021). Teacher competence in learning inclusive in schools basic. *Indonesian Journal of Elementary Education*, 6(1), 27–36.
- Nugroho, A., & Sutrisno, S. (2022). Implementation education inclusive in Indonesia: A review policy and practice. *Journal of Special Education*, 18(1), 1–13.
- Rao, K., Ok, M. W., & Bryant, B. R. (2017). A review of research on Universal Design for Learning: The need for a multimodal curriculum. *Journal of Special Educational Technology*, 32(3), 151–158. <https://doi.org/10.1177/0162643417708077>
- Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.
- Turnbull, A., Turnbull, R., & Wehmeyer, M. L. (2020). *Exceptional Lives: Special Education in Today's Schools* (9th ed.). Pearson.
- UNESCO. (2020). *The Salamanca Statement and Framework for Action on Special Needs Education*. UNESCO.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Widodo, S., & Rachmawati, P. (2021). Implementation of the Universal Design for Learning model in learning inclusive in elementary school. *Journal Educational Innovation*, 8(2), 101–110.