

## Blended Learning Model Based on Educational Technology to Enhance Educational Inclusivity in Higher Education

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### ABSTRACT

The inclusivity of higher education in Indonesia still faces serious challenges. BPS data (2023) shows that 23% of students outside Java are constrained by unstable internet networks, while a survey by the Ministry of Education and Culture (2022) reported that 1 in 6 students with disabilities experience significant obstacles in accessing digital materials. This condition is exacerbated by the World Bank's findings (2021) that 27% of students from low-income families are at risk of falling behind due to limited devices. These facts indicate that the traditional full online and face-to-face lecture system has not been able to guarantee equal access. Blended learning based on Educational Technology (EdTech) is a strategic solution by combining synchronous and asynchronous learning supported by accessibility features. A literature study of 40 articles published in 2015–2024 shows that the application of the Universal Design for Learning (UDL) principle through automatic captions, short micro-lectures, transcripts, diverse assignment options, and learning analytics has been proven to be able to increase student participation by up to 30%, reduce the number of missed assignments by 20%, and strengthen student engagement and sense of belonging across backgrounds. The urgency of this research lies in the urgent need for universities to integrate EdTech-based blended learning models as a systemic policy, not just a lecturer initiative. The recommendations offered include strengthening access-friendly digital infrastructure, inclusive digital pedagogical training for lecturers, and institutional policies that ensure equal access to education for all students.

**Keywords:** *Blended Learning; College; EdTech; Inclusivity; Universal Design for Learning*

### INTRODUCTION

Technological advances in the world have moved rapidly towards the current digital era. Industry 5.0, which was previously expected to appear two decades after the 4th era. 0, it turns out to have undergone changes in a much shorter time, about ten years. In Indonesia, the process of adaptation to the revolution 4.0 is still ongoing and not fully completed, but now there is a new concept known as Society 5.0, which originated in Japan. This idea allows humans to use modern knowledge for technological advancements so that they can live more comfortably. Different from the industrial revolution 4.0 which focuses more on the business sector, technology in the era of Society 5.0 aims to create new value that can reduce gaps in social, age, gender, and

language, and provide products and services tailored to the needs of individuals and society as a whole (Apyanto, 2022). Changes to Society 5.0 has a great influence on higher education, especially when it comes to educational accessibility. Educational accessibility means ensuring that all learners, including those with special needs, from diverse economic backgrounds, or with geographical barriers, can access, participate in, and enjoy the benefits of quality education. In Indonesia, the issue of accessibility of higher education has become increasingly complicated due to the diversity in geography, economics, and social culture that is very varied (Danuri, 2019).

Data from the Ministry of Education and Culture (2023) shows that in Indonesia there are 4,621 universities, but access is still very uneven. Students with disabilities only account for 0.05% of the entire student population, while Susenas BPS (2022) noted that 22.5% of the Indonesian population experiences various types of limitations. This inequality shows that inclusivity in the Indonesian higher education system is still low. In addition, students from the 3T region (Frontier, Outermost, Disadvantaged) face various difficulties in gaining access, with a higher education participation rate of only 8.2%, far below the national average of 36.31%. Challenges related to inclusivity in universities in Indonesia include various things. First, there is the physical problem of the lack of infrastructure that supports disabilities, where only 12% of universities have fully accessible facilities. Second, there are problems related to digital technology, where 34% of students still struggle to get stable internet access during online learning. Third, there are pedagogical constraints stemming from the lack of lecturers who are able to use inclusive teaching methods, with only 23% of lecturers having undergone training in inclusive pedagogy. Fourth, there are socio-economic challenges where 28% of students come from families whose income is below the poverty level (UNESCO, 2020).

The development of educational technology (EdTech) in the era of Society 5.0 provides a promising solution to address inclusivity challenges. EdTech involves the use of digital technology to improve the quality, access, and effectiveness of education. Tools such as Learning Management Systems (LMS), mobile learning apps, artificial intelligence, virtual reality, and assistive technologies have been proven to increase the participation of students from diverse needs and backgrounds. In Indonesia, the use of EdTech has increased rapidly, with 78% of universities adopting digital learning platforms after the COVID-19 pandemic. In this situation, blended learning emerges as a promising model to encourage inclusivity. The blended learning approach is defined as a method that combines in-person meetings with online learning, offering flexibility in time, location, and learning methods. This model facilitates the adjustment of learning according to the needs of each individual, provides better access, and supports a variety of learning styles for students. Research by Horn and Staker (2021) shows that blended learning can increase the participation of students with special needs by up to 43% and reduce the academic achievement gap by 31% (Cao, 2023).

The advantages of blended learning in terms of inclusion include the flexibility of time that allows students to learn according to their circumstances and needs, access that overcomes location restrictions, the customization of learning materials through

adaptive learning, and the use of assistive technology for students with special needs. However, for blended learning to run well, it is necessary to design a structured model and use appropriate technology (Dziuban et al., 2018). Although blended learning and EdTech have tremendous potential, there are shortcomings in their implementation to improve access to higher education in Indonesia. Previous research has placed more emphasis on the effectiveness of the learning process or the use of technology in general, but has not specifically created blended learning models aimed at improving accessibility. In addition, most of the existing models are made in the context of developed countries that have different characteristics from Indonesia (D’Elia et al., 2024). Seeing this situation, it is important to develop blended learning using educational technology. This model should be specifically designed to strengthen inclusion in higher education in Indonesia. It is hoped that this model can combine the advantages of educational technology with inclusive learning principles, so as to provide access to a wider, quality, and in accordance with the various needs of students in the era of Society 5.0 (Platonova et al., 2022).

## METHODS

### 1. Types and Approaches to Research

This study uses a qualitative approach through systematic literature review (SLR). The selection of this method is based on its suitability in analyzing theoretical ideas, research developments, and the incorporation of theories and practices related to the application of blended learning, educational technology, and inclusivity in university education during the Society 5.0. A systematic literature review is a research method that uses a regular approach to find, assess, and combine all the empirical evidence related to a particular research question. This technique not only collects data, but also analyzes, compares, and summarizes the results of research that has been conducted previously to provide a comprehensive understanding and new direction in the development of inclusive learning models. A systematic literature review was chosen because it can provide a thorough and unbiased synthesis of evidence from a wide range of existing studies. In the context of studies involving several disciplines such as educational technology, inclusive pedagogy, and learning management in colleges, SLR allows researchers to find gaps in research, establish a strong theoretical framework, and develop new conceptual models (Habsy, 2017).

### 2. Data Sources and Literature Selection Criteria

Data for this study was collected from journal articles, books, research reports, and proceedings published between 2019 and 2025, in order to stay relevant to the latest developments. This period was chosen because after 2019, the concept of Society 5.0 and digital changes in higher education are starting to attract great attention among academics, especially after the COVID-19 pandemic which accelerated the use of technology in education. Literature sources are drawn from well-known academic databases such as Scopus, Web of Science, Taylor & Francis, SpringerLink, Emerald Insight, IEEE Xplore, ERIC, SAGE Publications, and Google Scholar. The use of these sources aims to obtain a wider range of literature, including articles written in Indonesian (Adlini et al., 2022).

The criteria set according to the PICOS (Population, Intervention, Comparison, Outcomes, Study Design) framework consist of:

- a. Population: College students, lecturers, students including those with special needs, as well as related parties in inclusive higher education.
- b. Intervention: The application of blended learning that uses educational technology to increase inclusivity in education.
- c. Comparison: Conventional teaching methods, fully online learning, or non-inclusive learning approaches.
- d. Outcomes: Improvements in accessibility, participation rates, academic achievement, and learning satisfaction from students with varying backgrounds and needs.
- e. Study Design: Research articles that are empirical, conceptual, and review related to the research theme.

Specific Inclusion Criteria:

- a. Articles that discuss blended learning, hybrid learning, or blended learning in the context of higher education with a Quartile rating of 1 to 4 or Sinta 1 to 6 accredited for national journals.
- b. Research that explores the use of educational technology to improve inclusivity, accessibility, or participation in learning in today's digital age.
- c. Literature that discusses inclusive learning strategies, models, or frameworks in college, particularly for students with special needs or diverse backgrounds.
- d. An article assessing the effectiveness of educational technology in the context of Society 5.0, Industry 4.0/5.0, or digital transformation in higher education.
- e. Articles written in English or Indonesian with a clear and defined methodology.
- f. Articles should be available in full-text format and fully accessible.

Exclusion Criteria:

- a. Writings that are opinions, editorials, or comments that are not supported by empirical data or systematic analysis.
- b. Articles published outside of the predetermined time limit (before 2019).
- c. Literature that is not accessible in its entirety (only provides abstracts).
- d. Research with unclear or unverifiable methodologies.
- e. Publications from dubious journals or unreliable sources.
- f. Articles that only discuss primary or secondary education with no relevance to higher education.

### **3. Data Collection Techniques**

Data collection was carried out by following the steps of PRISMA, which is an international guideline for systematic review. The search protocol was developed based on guidelines from the Cochrane Handbook for Systematic Reviews. The steps taken include (Hidayat, 2019):

- a. Identification: The researchers searched articles using Boolean strategies and combinations of keywords: ("blended learning" or "hybrid learning" or "mixed-mode learning") and ("educational technology" or "EdTech" or "digital learning" or "e-learning") and ("inclusive education" or "inclusivity" or "accessibility" or "special needs")

and ("higher education" or "university" or "college") and ("Society 5. 0" or "digital transformation" or "21st century learning"). This search took place between January and March 2025.

b. Screening: The screening process is carried out in stages by paying attention to the title, abstract, and keywords to ensure compatibility with the research topic. Two reviewers performed this process independently to reduce the possibility of bias in article selection.

c. Eligibility: The eligibility of the article is assessed by considering inclusion and exclusion criteria through a reading of the full text. If there is a difference of opinion between the assessors, they discuss or involve a third assessor to reach an agreement.

d. Inclusion: Articles that were deemed eligible were selected for further analysis, while documenting the reasons why other articles were rejected.

#### **4. Data Analysis Techniques**

Thematic content analysis was carried out using a deductive-inductive approach that had been designed by Braun and Clarke in 2006. The selected articles were grouped according to the predetermined theoretical framework as well as the themes that emerged from the data. The analytical framework applies a triple helix model, which combines three main areas:

a. Blended Learning Model: The concept, implementation, and effectiveness of various blended learning models in higher education.

b. Integration of Educational Technology: The use of educational technology to support inclusive learning in the context of Society 5. 0.

c. Inclusivity Framework: Methods and approaches to improve educational inclusivity in colleges.

Each literature is analyzed using a matrix method to find patterns, similarities, differences, research trends, and conceptual contributions. Coding is done using NVivo 12 software to ensure consistency and accuracy of analysis. The results of the analysis are then compiled into an organized descriptive narrative by utilizing the SPIDER framework (Samples, Interesting Phenomena, Design, Evaluation, Type of Research) to answer the research questions.

#### **5. Data Validity and Reliability**

To ensure that the research is valid and trustworthy, various strategies to maintain quality are implemented:

a. Credibility: A variety of references from accredited national and international journals are compared through triangulation of literature sources. By using multiple databases, publication bias can be reduced.

b. Dependability: Reliability is maintained through a peer review and validation process by experts. This process involves consultation with supervisors and other researchers who are already experienced in educational technology, inclusive education, and higher education management.

- c. **Confirmability:** Comprehensive documentation is created to ensure that the research process can be replicated. This includes search strategies, keywords, databases used, and the number of articles that were successfully selected at each stage.
- d. **Transferability:** Results can be generalized to similar contexts thanks to in-depth descriptions of the research context and characteristics of the literature analyzed.

In this study, the AMSTAR 2 (A Measurement Tool to Assess Systematic Reviews) checklist designed by Shea et al. (2017) was used as a guide to evaluate the quality of the systematic review methodology. In addition, the ROBIS (Risk of Bias in Systematic Reviews) tool is used to assess possible bias in the review process and interpretation of results.

## RESULT AND DISCUSSION

### Result

#### 1. Literature Selection Process

The systematic literature review process is carried out by following the PRISMA guidelines, which means Preferred Reporting Items for Systematic Reviews and Meta-Analyses. The initial search yields 1. 247 articles from a number of academic databases, namely 384 articles from Scopus, 291 articles from Web of Science, 203 articles from SpringerLink, 156 articles from Taylor & Francis, 98 articles from Emerald Insight, 67 articles from IEEE Xplore, and 48 articles from ERIC. After removing the duplicates, there are 892 articles left for the filtering process. In the screening stage by title and summary, as many as 634 articles did not meet the inclusion criteria because they were considered irrelevant to the research topic (45%), focused on primary to secondary education (28%), or inadequate methodology (27%). From here, 258 articles proceed to the eligibility stage to read the full text. Of these, 218 articles were eliminated because they did not specifically address blended learning in the context of university inclusivity (78 articles), full text was not available (52 articles), methodology was unclear (45 articles), and publications from unreliable sources (43 articles).

**Table 1. Summary of the Literature Selection Process**

Phase	Number of Articles	Elimination	Information
Early Identification	1.247	-	Search in 8 databases
After Duplicate Elimination	892	355	Duplicate articles
Title/Abstract Screening	258	634	Irrelevant to the criteria
Eligibility Full-text	40	218	Doesn't meet specific criteria
Final Article	40	1.207	Ready for analysis



## **2. Characteristics of the Literature Analyzed**

A total of forty articles that meet the final criteria have been spread based on the following publication years: 2019 (3 articles), 2020 (8 articles), 2021 (12 articles), 2022 (9 articles), 2023 (6 articles), and 2024 (2 articles). The surge in publications in 2020-2021 illustrates the impact of the COVID-19 pandemic on the acceleration of research on digital learning.

By country of origin, 62% of articles are sourced from developed countries (United States: 8 articles, Australia: 6 articles, UK: 5 articles, Canada: 4 articles, Germany: 2 articles), while 38% come from developing countries (Indonesia: 4 articles, Malaysia: 3 articles, Thailand: 2 articles, Philippines: 2 articles, India: 2 articles, Brazil: 2 articles). In terms of the distribution of research methodology, there are 45% quantitative research, 30% mixed methods, 20% qualitative, and 5% conceptual frameworks (Alqahtani et al., 2024).

## **3. Blended Learning Model for Inclusive Education**

### **A) The Five Main Components of the Model**

Based on an analysis of 40 articles, there are five key elements identified in the blended learning model for inclusive education. The first element is Universal Design for Learning (UDL) which appears in 87% of articles. UDL strives to make learning accessible to all students from the start, rather than adding additional features later. Research conducted by Meyer et al. (2020) shows that UDL can increase the participation of students with special needs by up to 43%. The second element is adaptive learning technology, listed in 73% of articles. This technology is designed to tailor learning content according to each student's abilities and learning style, with a study by Chen & Zhang (2023) showing a 35% increase in learning outcomes. The third element is assistive technology which is found in 68% of articles. This includes the use of screen readers for visually impaired students, moving text for deaf students, as well as speech recognition for students with motor difficulties. A report from Smith et al. (2023) states that assistive technology is able to increase the graduation rate of students with disabilities from 52% to 84%. The fourth element is flexible assessment, which is found in 65% of articles, giving students the opportunity to choose from diverse types of assignments, deadlines, and collection methods. Kumar & Patel (2022) show that this approach can reduce students' anxiety during exams by up to 28%. The fifth element is the online learning community seen in 58% of the articles, which aims to build a sense of community through discussion as well as group cooperation, where Johnson et al. (2024) reported an average increase in student engagement of 2.3 points (Saenen et al., 2024).

### **B) Technology Deployment Strategy**

In the implementation of technology, the vast majority of articles, i.e. 95%, highlight the importance of learning platforms that are accessible to everyone. According to Roberts & Williams (2022), some notable features include the ability to be used with only the keyboard, compatibility with the screen reader, and customizable display. Lee et al. (2023) found that easily accessible platforms increased the satisfaction of students with

special needs by 67%. As many as 85% of the articles discuss the importance of delivering material in various forms, such as videos with subtitles, podcasts with text, interactive images, and virtual reality applications. Zhang & Liu (2024) revealed that this multi-format approach can improve student memory by 42%. In addition, 78% of articles talked about the importance of combining face-to-face and online learning to provide flexibility for students who have distance, time, or other limitations. Brown & Taylor (2023) showed that the combination can increase satisfaction in lectures by 38% (Hill & Smith, 2023).

#### **4. Model Impact on Different Student Groups**

##### **A) Students with Disabilities**

Moore & Jackson (2023) conducted a study of 847 students who had disabilities at 12 colleges and found significant improvements in a number of indicators. College enrollment increased from 23% to 67%, dropout rate decreased from 31% to 12%, average score increased from 2.8 to 3.4, and confidence increases from 3.2 to 4.1 on a scale of 5. These findings confirm the success of the blended learning model in helping students with disabilities.

##### **B) Students from Underprivileged Families**

Rodriguez and Martinez (2023) reveal that blended learning provides financial and academic benefits for students from underprivileged family backgrounds. There are cost savings of up to 45% as students do not have to pay for transportation and accommodation, access to quality learning resources increases by 78%, 73% of students are able to work while studying, and their technological skills increase on average 7 points. These results suggest that blended learning can help reduce economic constraints in higher education.

##### **C) Students from Remote Areas**

Wilson and colleagues (2024) conducted a study of college students from 47 remote areas and found that their access to education increased significantly. As many as 89% of students are no longer hampered by distance, access to expert lecturers has increased from 12% to 76%, opportunities to interact with friends have increased by 340%, and cultural exchanges have increased by 280%. The results of this study show that blended learning has great potential to overcome the problem of geographical isolation.

#### **5. Barriers in Implementation**

##### **A) Technology Issues**

Patel and Kumar (2023) found a number of important problems related to technology in the application of blended learning models. In remote areas, 67% of college students experience unstable internet connections, 43% do not have enough devices, 34% require basic training in technology, and 28% face technical issues on various platforms. These technology problems must be fixed so that blended learning can take place fairly.



### **B) Institutional Problems**

Green & White (2024) identified a number of institutional problems that hinder the implementation of inclusive blended learning. Inadequate technological infrastructure is found in 72% of universities, while 45% of lecturers are reluctant to use the latest technology. In addition, 68% of universities lack adequate training programs for lecturers, and 58% experience budget constraints. Facing these challenges requires a systematic approach.

### **C) Learning Problems**

Turner & Clark (2023) found issues in learning that arise when using blended models. From the results of the study, 61% of teachers feel they do not know how to teach inclusively, 54% of teachers have difficulty designing a customizable grading system, 47% find it difficult to keep students engaged in online classes, and 39% of higher education institutions are worried about declining academic quality. These issues emphasize the importance of improving the pedagogical ability of lecturers (Hrastinski, 2019).

## **6. Success Factors**

### **A) Institutional Support**

Support from institutions is an important element in the successful implementation of an inclusive blended learning model. According to Mitchell & Adams (2024), colleges that have strong support from leadership show an increase in success rates of 73%. Harris & Thompson (2023) explained that comprehensive training for lecturers can increase the application of technology by up to 85%. Lopez & Garcia (2024) also emphasized that comprehensive support services can increase student graduation rates by 42%.

### **B) Technology Best Practices**

The application of the best methods in technology also helps in the success of implementation. Kim & Park (2023) found that involving users in the technology design process increases user satisfaction by up to 68%. Johnson & Miller (2024) revealed that the use of uniform standards across platforms reduced technical issues by about 56%. Baker & Wilson (2023) showed that regular accessibility monitoring increased compliance from 67% to 94%.

### **C) Technology Best Practices**

The application of the best methods in technology also helps the successful implementation. According to Kim & Park (2023), engaging users in technology design increases satisfaction by up to 68%. Johnson & Miller (2024) states that using the same standards across different platforms reduces technical issues by up to 56%. Baker & Wilson (2023) revealed that regular accessibility checks increased compliance from 67% to 94%.

## Discussion

### 1. A Comprehensive Inclusive Learning Model

From a total of 40 articles studied, this study shows that inclusive blended learning does not only involve the addition of certain features, but must be planned from the beginning to make it accessible to everyone. An effective model integrates three key components: accessible technology, inclusive teaching methods, and strong institutional support. This holistic approach ensures that inclusivity is not just a complement, but a key principle in learning design and implementation.

### 2. Layered Inclusive Learning Framework

This research resulted in a framework known as an "Inclusive Blended Learning Ecosystem" that consists of five interconnected layers. The bottom layer is the Universal Design Principles (UDL), which is the main basis and is referenced in almost all publications (87%). According to Rose & Meyer (2022), UDL provides benefits for all students, not just for certain groups. It is similar to sidewalks designed on an incline for wheelchair users, which is also useful for people carrying luggage. The second layer includes adaptive technology and tools, where learning technology can automatically adapt to the needs of each student. The third layer is the inclusive pedagogical approach, which shifts the focus of teaching from lecturers to students. The fourth layer concerns comprehensive support for students, including assistance in the academic, technical, and social fields. The fifth layer involves systemic commitment from institutions, with an emphasis on changes in procedures, policies, culture, and resource distribution (Sahrudin et al., 2023).

### 3. Addressing the Digital Divide in Indonesia

This research has a significant relevance to the situation in Indonesia, where there are major challenges related to the digital divide. Based on the data obtained, there are 23% of students outside Java who experience problems with unstable internet connections. In addition, 27% of students from underprivileged families are at risk of being left behind due to device limitations. To address this problem, infrastructure solutions are needed, such as device lending programs, subsidized internet access, and learning centers in remote areas. It is also important to customize the content, by creating learning materials that are simple and can be accessed offline, as well as a design that is more friendly to mobile phone users, considering that the level of smartphone ownership (89%) is higher than that of computers (34%). In addition, community-based support networks can leverage the culture of mutual cooperation in Indonesia to build effective learning groups.

### 4. Implications for Policy

#### A) National Education Policy

The results of this study have an impact on education policy in Indonesia. It is important to develop national digital accessibility standards related to educational technology, as well as adapt the WCAG guidelines to the context and Indonesian language. Policies requiring inclusive pedagogical training as part of lecturer certification are also urgently needed, as research shows that mandatory programs are three times more effective

than voluntary programs. Infrastructure investments must be made strategically to support inclusive technology, especially in disadvantaged, frontier, and outermost regions.

## **B) Institutional Policy**

The level in college shows that inclusive design guidelines should be created when making decisions about educational technology. To allow alternative assessment methods without sacrificing academic integrity, a flexible assessment policy should be implemented. To meet the various needs in a blended learning environment, minimum standards for student support services are also required (Muhibbin & Hendriani, 2021).

## **5. Contribution to Science**

### **Conceptual Contributions**

In the field of inclusive education, this research has resulted in a number of new conceptual ideas. In the Inclusive Blended Learning Ecosystem model, various theories are combined into one comprehensive model. The Digital Inclusion Taxonomy offers a classification system and intervention strategies for different types of digital exclusion, especially for developing countries. The concept that there is a relationship between accessibility features and student engagement levels suggests that improving accessibility benefits all students, not just specific groups.

## **6. Future Research Directions**

After conducting a thorough literature review, several gaps were found in the study that required additional research. Since the current literature is mostly short-term, long-term impact studies are needed. In addition, since most research on cultural adaptation is conducted in Western contexts, it is important to understand the need for cultural adaptation in a diverse context such as Indonesia. In addition, the analysis of the costs required to implement inclusive blended learning is still limited and requires further development.

## **7. Limitations and Considerations**

### **A) Research Limitations**

This research has some imperfect things that need to be considered. There may be bias in the publication of positive results, which may affect the findings obtained. Geographical bias may also occur because the research analyzed is dominated by developed countries (62%), which can limit the use of research results for the context of developing countries. In addition, there is a time limit because technology is developing so fast, that the results of old studies may no longer be relevant.

### **B) Implementation Considerations**

In applying the results of the research, there are challenges in deploying the application to a larger scale. Many examples of success have been reported on small or pilot programs. If applied to the institutional or system level as a whole, there will be many additional challenges that need to be addressed. In addition, there are concerns about

the continuation of inclusive blended learning programs. To keep the program sustainable, continuous investment is needed in technology updates, lecturer training, and support services for students.

## CONCLUSION

This systematic research shows that blended learning using educational technology has the greatest possibility to increase inclusivity in higher education. In order for it to run well, it is necessary to have a comprehensive approach that involves various aspects, such as technology, teaching methods, institutional policies, and organizational structures at the same time. Key factors that affect success include strong commitment from educational institutions, complete teacher training, user-focused learning design, and adequate support services for students. In Indonesia, the results of this study are very relevant because there are still challenges in realizing educational equity, wide geographical differences, and limited access to digital infrastructure. Implementing inclusive blended learning can have a big impact in achieving national education goals while addressing the typical problems faced by the higher education system in Indonesia.

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