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ORIGINAL RESEARCH ARTICLE

Digital-Based Learning: Strategy, Design, and Management at Universitas Muhammadiyah Metro

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ABSTRACT

Digital-Based Learning (DBL) has become a necessity in higher education transformation during the fourth industrial revolution era. This study aims to analyze the strategies, design, and management of the DBL program at Universitas Muhammadiyah (UM) Metro as an effort to improve learning quality. Using a qualitative approach with a case study method, this research involved 25 informants consisting of university leaders, lecturers, educational staff, and students. Data were collected through in-depth interviews, participatory observation, and documentation, then analyzed using the Miles and Huberman interactive model. The results showed that DBL implementation at UM Metro encompasses three main components: (1) DBL strategies integrating blended learning, flipped classroom, and AI-based Learning Management System (LMS) utilization; (2) DBL design applying Universal Design for Learning (UDL) principles and developing interactive digital teaching materials; and (3) DBL management through data-based planning, lecturer competency development, and continuous evaluation. The research findings reveal that DBL success is determined by the synergy between institutional policies, infrastructure readiness, and human resource capacity. This study contributes to the development of DBL implementation models in higher education and provides practical recommendations for stakeholders in optimizing educational digital transformation.

Keywords: digital-based learning, learning strategies, instructional design, learning management, higher education.

ABSTRAK

Pembelajaran Berbasis Digital (DBL) telah menjadi kebutuhan dalam transformasi pendidikan tinggi di era revolusi industri keempat. Penelitian ini bertujuan untuk menganalisis strategi, desain, dan pengelolaan program DBL di Universitas Muhammadiyah (UM) Metro sebagai upaya meningkatkan kualitas pembelajaran. Menggunakan pendekatan kualitatif dengan metode studi kasus, penelitian ini melibatkan 25 informan yang terdiri dari pimpinan universitas, dosen, tenaga kependidikan, dan mahasiswa. Data dikumpulkan melalui wawancara mendalam, observasi partisipatif, dan dokumentasi, kemudian dianalisis menggunakan model interaktif Miles dan Huberman. Hasil penelitian menunjukkan bahwa implementasi DBL di UM Metro mencakup tiga komponen utama: (1) strategi DBL yang mengintegrasikan blended learning, flipped classroom, dan pemanfaatan Learning Management System (LMS) berbasis AI; (2) desain DBL yang menerapkan prinsip Universal Design for Learning (UDL) dan pengembangan materi ajar digital interaktif; serta (3) pengelolaan DBL melalui perencanaan berbasis data, pengembangan kompetensi dosen, dan evaluasi berkelanjutan. Temuan penelitian mengungkapkan bahwa keberhasilan DBL ditentukan oleh sinergi antara kebijakan institusional, kesiapan infrastruktur, dan kapasitas sumber daya manusia. Studi ini berkontribusi pada pengembangan model implementasi DBL di pendidikan tinggi dan memberikan rekomendasi praktis bagi para pemangku kepentingan dalam mengoptimalkan transformasi digital pendidikan.

Kata kunci: pembelajaran berbasis digital, strategi pembelajaran, desain instruksional, pengelolaan pembelajaran, pendidikan tinggi

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1. INTRODUCTION

Digital transformation has permeated all sectors of life, including higher education. Digital-Based Learning (DBL) has emerged as a response to the need for an education system that is adaptive to technological developments and the demands of 21st-century competencies. Universities are required not only to transfer knowledge but also to equip students with digital literacy skills, critical thinking, collaboration, and complex problem-solving—skills that are essential in the era of the Fourth Industrial Revolution. In this context, DBL is not merely an option but a necessity that must be implemented systematically and sustainably.

Field observations conducted at Universitas Muhammadiyah (UM) Metro in the odd semester of the 2025/2026 academic year revealed several critical problems in DBL implementation. First, there remains a digital competency gap among lecturers, with most senior lecturers experiencing difficulties in operating digital learning platforms and integrating them into pedagogical strategies. Second, technology infrastructure is uneven, particularly regarding the availability of stable internet access in several faculties and the limited devices owned by students from different economic backgrounds. Third, the utilization of the Learning Management System (LMS) has not been optimal; it is used only as a material repository rather than as an interactive learning space. Fourth, there is no standardized benchmark for designing digital teaching materials that consider pedagogical principles and accessibility.

These problems are exacerbated by the lack of integration of DBL policies into the university's strategic plan holistically. DBL implementation has so far been partial, depending on individual lecturer initiatives without systemic coordination and support from the institutional level. As a result, there is duplication of efforts, inefficiency of resources, and uneven learning quality across study programs. This condition urgently needs to be addressed, considering that UM Metro, as one of the leading private universities in Lampung, has a moral responsibility to produce graduates who are competitive in the digital era.

A review of relevant research shows that the issue of DBL has received widespread attention from academics. Nafahah & Ratnasari (2025) in their research developed digital teaching materials based on Project Based Learning (PjBL) using the Book Creator platform and proved its effectiveness in improving students' science literacy. This finding indicates that appropriate digital teaching material design can have a significant impact on learning outcomes. Meanwhile, research by Alhassan & Ade-Ojo (2024) through the ADAPT-TI framework showed that the integration of Digital Learning Tools (DLTs) can improve students' academic performance and change positive perceptions of digital learning.

In the Indonesian national context, Oktody et al. (2024) examined the implementation of the Data-Based Planning (PBD) program at SMA Negeri 1 Tuban and found that the program had a positive impact on improving the quality of educators and educational staff. Although the context is different (primary-secondary education vs. higher education), this research provides an important perspective on how a data-based approach can strengthen educational program planning and management. In the international arena, Niu & Zhang (2025) used learning analytics to analyze the transition of online learning strategies in blended courses and found that the shift from cramming strategies to deep learning correlated with significant improvements in students' final grades.

Other research by Gagate & Lupido (2025) examined the implementation of online learning and its effect on student learning in the Philippines. The results showed that although online learning was perceived positively, challenges such as internet connectivity, device limitations, and reduced interaction with instructors remain major obstacles. These findings are relevant to the Indonesian context, which has similar geographical and demographic characteristics. Meanwhile, research by Sharma & Sharma (2024) offered a taxonomy of digital tools that categorizes digital tools into search, research, and interactive types, which is useful as a framework for designing DBL strategies.

Research on the utilization of immersive technologies in education is also developing rapidly. Criollo-C et al. (2024) in their study on mobile augmented reality found that this technology has great potential in supporting sustainable education, especially for increasing engagement and understanding of abstract concepts. Samala et al. (2024) in their bibliometric analysis revealed global trends and main challenges in implementing virtual reality in education, emphasizing the need for appropriate pedagogical approaches in adopting immersive technologies. Muskhir et al. (2024) specifically examined virtual reality applications in vocational education and found that although interest in VR is increasing, research on teaching methodologies remains limited.

Although there has been much research on DBL, significant gaps are still found in the literature. First, most research focuses on technical or pedagogical aspects separately; not many have examined DBL as an integrated system that includes strategy, design, and management simultaneously. Second, research at the Indonesian higher education level, particularly private universities outside Java, is still limited. Third, no research has specifically examined DBL implementation at UM Metro by considering the institution's unique characteristics, such as the heterogeneous student background, limited resources, and geographical challenges. The novelty of this research lies in its holistic approach to examining DBL, covering three main dimensions: strategy (how to plan), design (how to design), and management (how to manage and evaluate). This research also integrates multiple stakeholder perspectives (leaders, lecturers, educational staff, and students) to obtain a comprehensive understanding of DBL implementation dynamics. Furthermore, the context of UM Metro as a private university undergoing digital transformation provides valuable empirical contributions for developing contextual and applicable DBL models.

2. RESEARCH METHODS

This research uses a qualitative approach with a case study method. The qualitative approach was chosen because it allows researchers to understand the DBL phenomenon in depth and contextually, explore the meaning behind the practices carried out by actors in the field, and capture the complexity of interactions between various factors influencing DBL implementation. Creswell & Poth (2024) affirm that case study is an appropriate strategy when researchers want to explore a bounded system in depth through rich and diverse data collection. In this context, UM Metro is positioned as an instrumental case for understanding DBL implementation in Indonesian private universities.

The research was conducted at Universitas Muhammadiyah Metro, located at Jl. Ki Hajar Dewantara No. 116, Iringmulyo, Metro Timur, Metro City, Lampung. The location was chosen based on the consideration that UM Metro is in the process of accelerating digital transformation, marked by the launch of various DBL initiatives, such as the development of a Moodle-based LMS, lecturer training for developing digital teaching materials, and policies for integrating technology into learning. In addition, the characteristics of UM Metro as a private university with students mostly coming from areas with diverse socio-economic backgrounds make it a relevant context for examining the challenges and opportunities of DBL implementation.

Research informants were determined using purposive sampling with the following criteria: (1) directly involved in the planning, implementation, or evaluation of DBL programs; (2) have at least two years of experience in using technology for learning; and (3) willing to participate voluntarily. The total number of informants was 25 people, consisting of: the Rector and Vice Rector for Academic Affairs (2 people), Deans of the Faculty of Teacher Training and Education and the Faculty of Engineering (2 people), Head of the Information Technology and Database Center (1 person), Heads of Study Programs from 5 different study programs (5 people), lecturers from various disciplines (8 people), educational staff in academic and IT fields (3 people), and students from various cohorts (4 people).

Table 1. Research Informant Data

No	Informant Category	Number	Informant Code	Main Criteria
1	University Leaders	2	PU-01, PU-02	Involved in formulating DBL policies
2	Faculty Deans	2	DF-01, DF-02	Supervising DBL implementation at the faculty level
3	Head of IT Center	1	KPTI-01	Responsible for DBL technical infrastructure
4	Study Program Heads	5	KPS-01 to KPS-05	Coordinating DBL at the study program level
5	Lecturers	8	DS-01 to DS-08	Direct implementers of DBL in the classroom
6	Educational Staff	3	TK-01 to TK-03	Supporting administrative and technical aspects
7	Students	4	MHS-01 to MHS-04	End users of DBL services
Total		25		

Data collection techniques used three main methods: in-depth interviews, participatory observation, and documentation. In-depth interviews were conducted using semi-structured guides developed based on the DBL theoretical framework, lasting 60-90 minutes per informant, and recorded with informants' permission. Participatory observation was conducted by directly observing learning processes that use digital technology, coordination meetings related to DBL, and training sessions for developing lecturers' digital competencies. Documentation included collecting policy documents, strategic plans, annual reports, digital teaching materials, screenshots of LMS activities, and other relevant secondary data.

Data analysis was conducted using the Miles et al. (2023) interactive model, which includes three activity flows: data condensation, data display, and conclusion drawing/verification. Data condensation was carried out through the process of selecting, focusing, and abstracting raw data from interview transcripts, field notes, and documents. Data display was arranged in the form of matrices, charts, and descriptive narratives to facilitate understanding of emerging patterns. Conclusion drawing was conducted iteratively by verifying through member checking, source and method triangulation, and peer debriefing.

Data validity was ensured through several strategies: (1) source triangulation by comparing information from various informant categories; (2) method triangulation by comparing interview, observation, and documentation data; (3) member checking by reconfirming the researcher's interpretations to key informants; (4) extended researcher participation in the field for four months (September-December 2025) to build rapport and understand the context deeply; and (5) audit trail through systematic documentation of the entire research process. All research procedures have received ethical approval from the UM Metro Research Ethics Committee.

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3. RESULTS AND FINDINGS

1. Digital-Based Learning Strategy at UM Metro

The implementation of DBL at UM Metro began with the formulation of a strategy integrated into the University's Strategic Plan 2024-2028. Based on interviews with PU-01, the DBL strategy was developed using a "Triple-Helix" approach involving synergy between institutional policy, technology infrastructure development, and human resource capacity enhancement. "We do not want digitalization to be merely a ceremonial project. Therefore, we designed a comprehensive DBL strategy that simultaneously covers policy, infrastructure, and HR aspects," said PU-01.

The learning strategies applied by lecturers at UM Metro show a diversity of approaches, with three dominant models: blended learning, flipped classroom, and digitally integrated project-based learning. Based on observations in 15 classes from various study programs, it was found that 73% of lecturers have adopted blended learning with a composition of 60% face-to-face and 40% online. DS-04 from the Biology Education Study Program explained, "I use the flipped classroom model where students study materials through videos I upload on the LMS before class, then face-to-face time is used for in-depth discussion and problem-solving."

The utilization of the Learning Management System (LMS) is the backbone of the DBL strategy at UM Metro. The university developed a Moodle-based LMS named "SPADA" (Online Learning System) with continuously improved features. Data from the IT Center shows that in the odd semester of 2025/2026, there were 12,456 active users (lecturers and students) with 1,234 registered courses. KPTI-01 explained, "We integrated 'SPADA' with the academic system so that student grades are directly integrated. The latest feature is an AI-based virtual assistant that helps students navigate learning materials."

Table 2. DBL Strategy Adoption Rate by UM Metro Lecturers

No	Learning Strategy	Lecturer Users	Percentage	Main Platform Used
1	Blended learning	187 out of 256	73.0%	"SPADA", Google Classroom
2	Flipped Classroom	98 out of 256	38.3%	"SPADA", YouTube, Edpuzzle
3	Digital Project-Based Learning	76 out of 256	29.7%	Canva, Book Creator, Google Sites
4	Gamification	34 out of 256	13.3%	Kahoot!, Quizizz, Wordwall
5	Online Collaborative Learning	112 out of 256	43.8%	Google Workspace, WhatsApp Groups
6	Microlearning	45 out of 256	17.6%	Instagram Edu, TikTok Edu, "SPADA"

DBL strategy innovation is also evident in the utilization of artificial intelligence (AI) for personalized learning. Some lecturers have begun integrating AI tools such as ChatGPT to assist students in research and assignment preparation, as well as using adaptive platforms for

independent learning. DS-07 from the Mathematics Education Study Program stated, "I use an adaptive platform for Calculus courses. The platform can detect students' comprehension levels and provide questions with appropriate difficulty levels. As a result, students who usually fall behind can now learn at their own pace."

2. Digital-Based Learning Design

The DBL designs developed by UM Metro lecturers show rich variation, ranging from interactive digital teaching materials to immersive virtual learning environments. Based on analysis of 50 digital teaching materials from various study programs, it was found that 68% apply multimedia learning principles by integrating text, images, audio, and video. DS-02 from the English Language Education Study Program developed an interactive e-module using Book Creator equipped with embedded quizzes, links to external sources, and reflection spaces. "I want students not only to read but also to interact with the material. This e-module allows them to take notes directly, listen to pronunciation audio, and work on quizzes with instant feedback," explained DS-02.

The development of learning video content has become a major focus in DBL design. The Learning Media Development Team, established by LP3M (Institute for Educational Development and Learning), produced 327 learning videos for 89 courses during 2024. DS-06 from the Economics Education Study Program explained the development process: "We follow production standards set by LP3M: ideal duration of 10-15 minutes per video, using a combination of talking head and screencast, equipped with subtitles, and accompanied by guiding questions at the end of each video." Data analytics show that videos with a duration of 8-12 minutes have the highest completion rate (78%), compared to videos over 20 minutes (only 34% watch to completion).

Table 3. Characteristics of Digital Teaching Material Design at UM Metro

Design Aspect	Category	Percentage	Implementation Example
Format	Static/PDF	32%	Digitized printed modules
	Interactive	45%	E-modules with navigation, embedded quizzes
	Multimedia	23%	Interactive videos, simulations, educational games
Design Principles	Multimedia	68%	Integration of text, images, audio, video
	Contiguity	52%	Text and images placed close together
	Personalization	31%	Informal language style, personal addresses
Accessibility	Subtitles available	47%	Videos with text/CC
	Alternative formats	23%	Available in various formats
	Screen reader compatible	18%	Heading structure, alt text on images

DBL design innovation is also evident in the development of virtual learning environments that simulate the real world. The Biology Education Study Program developed a virtual laboratory for practicums requiring expensive or high-risk equipment. DF-01 explained, "We use the Labster platform for genetics practicum simulations. Students can conduct virtual experiments at zero cost, without safety risks, and can repeat them multiple times. Data shows that students' conceptual understanding increased by 34% after using this virtual laboratory." DBL design development at

UM Metro consistently refers to the TPACK (Technological Pedagogical Content Knowledge) framework, which integrates technological, pedagogical, and content knowledge simultaneously.

3. Digital-Based Learning Management

DBL management at UM Metro is managed through an organizational structure involving various work units. The Information Technology and Database Center (PTI-PD) is responsible for technical infrastructure, LP3M manages lecturer competency development and learning design, while each faculty and study program is responsible for implementation at the operational level. KPS-03 emphasized, "Coordination between these units is crucial. We regularly hold monthly coordination meetings to discuss technical, pedagogical, and administrative obstacles in DBL implementation."

DBL planning at UM Metro adopts a Data-Based Planning (PBD) approach that uses data from the Education Report Card, self-evaluation, and tracer study as the basis for decision-making. PU-02 explained, "We no longer make plans based on assumptions. Every year, we analyze data from various sources: learning evaluation results, student satisfaction, graduation rates, and graduate absorption in the job market. This data becomes the basis for formulating DBL improvement programs." The implementation of this approach aligns with Oktody et al.'s (2024) findings that data-based planning can significantly improve the quality of educators and educational staff.

Lecturer competency development in DBL is carried out through a tiered training program. During 2025, LP3M organized 12 training sessions with a total participation of 345 lecturers. Training topics included: (1) LMS basics and blended learning (basic); (2) Interactive digital teaching material development (intermediate); (3) AI-based learning design and learning analytics (advanced). DS-03 revealed the impact of this training: "After participating in the digital teaching material development training, I was able to create interactive e-modules that I previously thought were very difficult. The most helpful part was the intensive mentoring for two weeks after the training, not just a one-day training session that ends."

DBL monitoring and evaluation are conducted through several mechanisms. First, learning analytics integrated into "SPADA" allows real-time monitoring of student learning activities. KPTI-01 explained, "We can see which courses are most active, which lecturers upload materials most frequently, which students rarely access, and what learning patterns are most effective. This data is very valuable for early intervention." Second, the student evaluation of learning processes (EPM) conducted at the end of each semester includes indicators related to DBL quality. EPM data for the odd semester of 2025/2026 shows that student satisfaction with the digital aspects of learning reached 82%, up from 67% in the previous year.

Challenges in DBL management were also identified. KPS-04 highlighted the issue of lecturer workload: "Developing quality digital teaching materials takes considerable time. Meanwhile, lecturers still have to meet workload requirements in research and community service. We need policies that recognize the contribution of digital teaching material development as part of the workload equivalent to scientific publications." TK-02 from the academic division added administrative challenges: "The academic information system and LMS are not yet fully integrated. There is still duplicate data that must be entered manually, causing inefficiency and

potential human error." These findings confirm the results of Gagate and Lupido's (2025) research that the success of digital learning implementation greatly depends on the quality of institutional support and infrastructure.

Institutional support for DBL sustainability is realized through a special budget allocation in the RKAT (Work Plan and Budget). Data from the Planning Division shows that the budget allocation for DBL development increased by 45% in 2024 compared to the previous year, reaching Rp 2.8 billion. This budget is allocated for: network infrastructure development (35%), device procurement and software licenses (25%), training and HR development (20%), content and learning media development (15%), and DBL research and evaluation (5%). This financial commitment is an important foundation for the sustainability of the DBL program in the future.

. 4. DISCUSSION

The implementation of Data-Based Planning (PBD) at UM Metro shows that the success of digital learning transformation is highly determined by the synergy between strategy, design, and management operating in an integrated manner. These findings extend the PICRAT model proposed by Kimmons et al. (2020), which emphasizes the integration between the role of technology and student learning activities. At UM Metro, strategy is formulated at the institutional policy level, then translated into innovative learning designs by lecturers, and reinforced through a data-based management system. This approach shows that digital transformation cannot stand alone on the technological aspect but requires the orchestration of policy, pedagogical practice, and consistent governance. Thus, the success of DBL at UM Metro is systemic and not merely an individual initiative.

The DBL strategy at UM Metro reflects a shift from merely using technology as a tool toward substantial pedagogical transformation. Data shows that 73% of lecturers have adopted blended learning in various implementation variations. This aligns with the SAMR model developed by Puentedura (2022), which emphasizes that true transformation occurs at the modification and redefinition levels. At this stage, technology enables the creation of new learning experiences that were previously impossible. The utilization of virtual laboratories for genetics practicums is a concrete example of how technology redefines the learning process to be more flexible, safe, and efficient.

From the design perspective, the application of multimedia learning principles and Universal Design for Learning (UDL) demonstrates lecturers' awareness of the importance of the quality of student interaction with materials. The finding that contiguity and personalization principles increase student engagement supports Mayer's (2024) cognitive theory of multimedia learning. This theory explains that design aligned with the brain's cognitive workings will reduce cognitive load and increase information retention. UDL implementation also strengthens the inclusivity dimension of learning by providing multiple access pathways for students with diverse needs. This shows that DBL design at UM Metro is oriented not only toward effectiveness but also toward equity and accessibility.

In terms of management, the data-based approach is the main differentiator of DBL implementation at UM Metro. The utilization of Education Report Cards, self-evaluation, tracer studies, and learning analytics enables more accurate and measurable decision-making. This finding aligns with Musakirawati et al.'s (2023) research, which states that data-based planning improves the effectiveness of educational interventions. A data-based reflection culture also strengthens institutional accountability in continuously improving learning quality. Thus, DBL is not just a policy slogan but is truly implemented as a quality management mechanism.

DBL success is also greatly influenced by visionary leadership that consistently encourages digital transformation. The Rector and university leadership have made DBL a strategic priority in institutional planning and evaluation forums. This finding aligns with Becirovic's (2023) research, which affirms that leadership support is a primary prerequisite for successful educational technology integration. Strong leadership ensures the availability of budget allocation, supporting policies, and clear monitoring systems. Without leadership commitment, digital innovation tends to stall at the experimental stage.

Adequate technology infrastructure is another important supporting factor in DBL implementation. The development of the "SPADA" LMS, internet network improvements, and the provision of supporting devices create a stable technical foundation. However, challenges of internet access disparity remain for some students. This confirms the findings of Gagate & Lupido (2025) that digital access inequality is a significant obstacle in developing countries. Therefore, policy interventions sensitive to students' socio-economic conditions remain necessary.

The enhancement of lecturers' digital competencies through tiered training and post-training mentoring also strengthens DBL success. Adaptive professional development programs allow lecturers with various initial ability levels to develop gradually. This success is also supported by institutional recognition mechanisms for lecturer innovations. These findings reinforce Samala et al.'s (2024) study, which emphasizes the importance of educator capacity development in digital transformation. Thus, HR strengthening becomes a main pillar of innovation sustainability.

Active student involvement as co-creators is also a key factor in DBL implementation. Students are not only recipients of materials but also contribute to content development and learning evaluation. Niu & Zhang's (2025) research shows that active learning strategies based on learning analytics correlate significantly with improved academic achievement. A collaborative culture among lecturers through practitioner communities also accelerates the diffusion of innovation. This social capital strengthens DBL sustainability in the long term.

Various DBL innovations developed at UM Metro demonstrate a commitment to cutting-edge technology-based learning. The development of AI chatbots, virtual laboratories, augmented reality, and adaptive evaluation systems enriches students' learning experiences. These findings align with research by Nafahah & Ratnasari (2025) and Muskhir et al. (2024), which affirm the effectiveness of immersive technologies in improving science literacy and technical skills. These innovations also prove that private universities outside city centers can compete in digital transformation. With data support and continuous evaluation, these innovations have the potential to become a replication model.

Although showing significant progress, DBL implementation still faces challenges such as digital gaps, senior lecturer resistance, increased workload, and academic integrity issues. Peer mentoring strategies and workload policy reformulation are solutions that have begun to be implemented. The use of proctoring systems and plagiarism detectors is also carried out to maintain academic integrity. Theoretically, this research enriches the TPACK and SAMR frameworks by adding institutional and contextual dimensions. Practically, these findings affirm that the synergy between national policy and institutional implementation is the key to successful sustainable educational digital transformation.

5. CONCLUSION AND SUGGESTIONS

This research has examined the implementation of Digital-Based Learning (DBL) at Universitas Muhammadiyah Metro through three main dimensions: strategy, design, and management. The results show that DBL implementation at UM Metro takes place systemically and in an integrated manner, with strategies adopting blended learning, flipped classroom, and AI-based LMS utilization; design applying multimedia learning principles, Universal Design for Learning, and interactive digital teaching material development; and management adopting a Data-Based Planning (PBD) approach, continuous lecturer competency development, and learning analytics-based evaluation. The success of DBL implementation is determined by the synergy between five factors: visionary leadership, adequate technology infrastructure, lecturers' digital competence, active student involvement, and a collaborative culture among lecturers.

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