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MORALITY BEFORE KNOWLEDGE

U-NeedKC: Development of a knowledge center in the building engineering education environment to support infrastructure transformation in the industry 5.0 era

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ABSTRACT

Background: The rapid development of digital technology and the emergence of the Industry 5.0 era require higher education institutions to transform into systems that are adaptive, collaborative, and technology-driven. However, the academic culture of digital writing and knowledge sharing among students of the Building Engineering Education program remains low. To address this gap, this study develops an initial design of U-NeedKC, a web-based Knowledge Center intended to support collaboration, training, and flexible academic information access. **Methods:** This research adopts the R&D approach using the 4D model (Define, Design, Develop, Disseminate), with a current focus on the design phase. Data were collected through observations, interviews, and literature reviews involving students and lecturers to identify user needs. **Findings:** The findings indicate that users face significant challenges related to limited digital literacy, suboptimal use of existing LMS features, technical constraints, and the absence of an integrated knowledge-sharing culture that supports collaboration and academic literacy. Based on these needs, the study produced the conceptual design of U-NeedKC, a web-based Knowledge Center integrating course modules, digital archives, workshops, discussion forums, and a point system, developed using user-centered and knowledge management principles. This design is expected to enhance learning engagement, information accessibility, collaborative practices, and digital competencies, although its effectiveness has not yet been empirically tested. **Conclusion:** This study concludes that the initial design of U-NeedKC represents a strategic educational innovation to strengthen digital writing culture and knowledge-sharing practices in higher education. By integrating collaborative features such as learning resources, discussion forums, training modules, and incentive-based engagement, the platform has the potential to foster a sustainable academic ecosystem that supports adaptive learning, social interaction, and institutional transformation in response to the demands of Industry 5.0. **Novelty/Originality of this article:** This study introduces a web-based Knowledge Center that integrates digital technology with collaborative learning practices to strengthen knowledge sharing and support sustainable educational transformation in higher education.

KEYWORDS: construction education; digitalization; industry 5.0; innovation; knowledge center; learning technology.

1. Introduction

In a dynamic era marked by accelerated technological innovation, vocational education, including Building Engineering Education (PTB), faces significant challenges in ensuring the relevance of learning within the ever-evolving digital ecosystem (Aithal &

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Maiya, 2023). The global transformation from Industry 4.0 to Industry 5.0 has transformed the way people work, collaborate, and access knowledge. This shift requires educational institutions to become not only users of technology, but also managers and producers of knowledge through integrated digital platforms capable of bridging academic needs and the demands of the industrial world (Linzalone et al., 2020; Tan et al., 2021).

In this era, vocational education must train students not only to master technical skills, but also to develop digital literacy, critical thinking, creativity, and adaptability. Strengthening digital capacity and knowledge management are strategic elements in producing competent and competitive graduates (Laily et al., 2024). In this context, the need for a digital ecosystem capable of integrating knowledge management, information literacy, and academic collaboration is increasingly pressing, especially in practice-oriented vocational education such as PTB.

To date, Jakarta State University has provided digital facilities such as a Learning Management System (LMS) and an e-Library. However, various studies and empirical findings indicate that these facilities do not fully support improving the quality of vocational learning, particularly in terms of academic collaboration, access to scientific resources, and fostering a culture of writing. The implementation of an LMS in vocational education still faces several limitations, such as limited accessibility, limited variety of learning content, and a lack of features that facilitate in-depth academic interaction (Herniawati et al., 2025; Munisamy et al., 2025).

This situation directly impacts students' low motivation to produce scientific work and explore knowledge independently. A strong culture of academic literacy has not yet developed, particularly because the available digital ecosystem functions more as a passive repository than as a dynamic space for intellectual development (Wulandari et al., 2020; Suryani et al., 2021). Several studies have shown that students consume information passively and rely more on general search engines than on seeking or utilizing credible academic sources (Suciati et al., 2014; Rahmawati & Sasmita, 2021). This phenomenon is reinforced by recent information literacy studies, which note that most students lack the ability to accurately evaluate the quality of digital sources (Dissen et al., 2022).

Research by Afifa & Astuti (2024) shows that the use of digital media, such as instructional videos, has been shown to improve student motivation and learning outcomes. However, this improvement has not been matched by the existence of a comprehensive and structured knowledge platform to support academic activities across the board. Students benefit from the one-way nature of digital media, but lack a space that allows for deeper academic interaction, scientific discussion, and collaboration.

Ramadhan et al. (2024) study confirmed that PTB students require online platforms that enable the exchange of ideas, thematic discussions, and collaboration in project work. Students require not only access to materials but also a space to engage in dialogue with fellow students, communicate with lecturers, and consult with industry practitioners. This demonstrates that today's primary need for students is not simply a learning platform, but rather a knowledge ecosystem that can connect learning, research, and technical competency development.

Furthermore, the project-oriented nature of vocational learning, including practical work, construction drawings, materials technology, and field problem-solving, necessitates systematic information storage. Students need quick access to construction standards, technical modules, research reports, field case studies, and relevant working drawing examples. The lack of an organized knowledge hub often makes it difficult for students to find credible references, thus hampering their ability to produce quality academic work.

More broadly, research on vocational education confirms that digital transformation can only be successful if accompanied by a strengthened collaborative culture and knowledge production (Fernández et al., 2023; Xu et al., 2024). Building engineering education, for example, requires a platform capable of supporting project-based learning practices such as teaching factories, construction design, technical drawing preparation, and computer-based simulations.

Several studies have also shown that the integration of information technology into engineering learning significantly improves students' creativity, problem-solving abilities, and technical skills needed in the industrial world (Dewi & Saputra, 2025). Students who are accustomed to interacting with feature-rich digital platforms tend to have better collaborative skills and digital literacy, two competencies highly sought after in the modern construction world. Literature on Knowledge Management Systems (KMS) emphasizes that effective educational organizations are those capable of systematically managing knowledge, from creation, storage, distribution, and utilization (Utami, 2023). Web-based KMS enable knowledge sharing, scientific discussions, content repositories, and online training that support the competency development of academic community members (Kruesi et al., 2020; Jaya & Ayub, 2021; Vitriani et al., 2023; Zamiri & Esmaeili, 2024).

A good KMS is not just a document repository, but an ecosystem that enables interaction, brings together various stakeholders, and encourages sustainable collaboration in the academic community. This aligns with the principles of Industry 5.0, which emphasize the integration of intelligent technology with humanistic values such as collaboration, creativity, and connectivity between humans and machines as a unified ecosystem (Carayannis et al., 2024; Hashim et al., 2024; Martini et al., 2024; Sheikh et al., 2025). The successful implementation of knowledge centers at several institutions has demonstrated that such platforms can strengthen research culture, academic collaboration, and digital literacy. For example, the PT PP (Persero) Knowledge Center and the ITB Cremona platform provide various facilities such as online training, a scientific repository, an internal peer review system, and discussion spaces that bring together students, lecturers, and practitioners. These facilities have been shown to improve the quality of academic discussions, expand access to learning resources, and accelerate competency development (Wulandari et al., 2020; Suryani et al., 2021). From this experience, it is known that an effective digital ecosystem is not only about providing comprehensive content, but also activating knowledge communities through interactive features, incentive systems, cross-institutional collaboration, and user-needs-based training integration.

Based on the needs analysis, digital learning challenges, and current vocational education dynamics, the development of a Digital Knowledge Center U-NeedKC (University Knowledge Center) for Building Engineering Education is highly strategic and urgent. U-NeedKC is designed as a learning ecosystem that functions not only as a knowledge repository but also as a space for academic interaction, a collaborative medium, and a digital training center. Key features such as scientific writing modules, discussion networks, article management, collaborative forums, academic repositories, online workshops, and integration with an LMS will strengthen students' information literacy (Dissen et al., 2022), improve the quality of project-based learning (Yandra & Sari, 2020), and support the development of a scientific writing culture (Ramadhan et al., 2024). Furthermore, U-NeedKC also provides space for developing digital media such as video tutorials, construction animations, and structural simulations, which are essential for engineering learning practices. With the advancement of construction technologies such as Building Information Modeling (BIM), the Internet of Things (IoT), artificial intelligence, and digital fabrication, students at Educational Engineering and Technology must be equipped with both technical understanding and digital literacy skills. Several studies have confirmed that integrating digital technology into engineering education can improve students' work competencies, technical skills, and readiness to enter the increasingly complex industrial world (Fernández et al., 2023; Dewi & Saputra, 2025; Tan et al., 2021).

Through U-NeedKC, students can develop 21st-century competencies, including digital literacy, online collaboration, problem-solving skills, and scientific writing skills, which are indicators of graduate quality in the Industry 5.0 era. U-NeedKC serves not only as a learning medium but also as an academic incubation space that encourages student innovation, creativity, and research. Thus, the development of U-NeedKC is expected to be a catalyst for improving the quality of vocational education. This platform serves not only as academic support, but also as a center for digital competency development, a collaborative platform, and a means of enriching knowledge for students and lecturers. In the long term, U-NeedKC

can help build a sustainable scientific culture, expand access to knowledge, and develop graduate competencies to be more adaptive, innovative, and highly competitive in the Industry 5.0 era.

2. Methods

2.1 Study design

This study uses a Research and Development (R&D) approach by adopting the 4D development model (Define, Design, Develop, Disseminate) as the main methodological basis in designing and developing the *Knowledge Center platform* named U-NeedKC. The R&D approach was chosen because it is able to provide a systematic and structured framework oriented towards the creation of educational products that are effective, valid, and according to user needs. The 4D model developed by Thiagarajan, Semmel, and Semmel is considered relevant for this study because it emphasizes the process of developing learning tools and educational innovation products with clear and traceable stages.

The research was conducted at the Building Engineering Education Study Program, Jakarta State University, as the target institution for the U-NeedKC platform implementation. This location was selected based on the real need for strengthening digital literacy, the availability of integrated learning resources, and an increased scientific writing culture among Building Engineering Education students and lecturers. Therefore, the main focus of this R&D research was not only to produce a digital platform prototype but also to ensure the product's suitability to the context and user characteristics in the vocational engineering education environment. The 4D model consists of four main stages: Define, Design, Develop, and Disseminate. These four stages not only provide direction in product design but also ensure that the development process is sequential, logical, and oriented toward user needs and the effectiveness of the development results.

2.1.1 Define stage

This initial stage serves to identify and analyze various fundamental needs that form the basis for the development of U-NeedKC. The needs analysis was conducted through several activities, including observation, interviews, and focus group discussions (FGDs) with lecturers, students, and educational staff Building Engineering Education Department.

Observations were conducted on the actual use of learning resources, digital learning systems (LMS), and access to e-libraries. These observations included how students search for information, their level of reliance on general search engines, and the perceived limitations of existing digital resources. Initial findings indicate that although students actively access the internet, their use of verified academic resources remains low.

Interviews were conducted with lecturers, who play a role in providing teaching materials and facilitating academic activities. The interviews revealed a pressing need for a dedicated platform that aggregates teaching materials, academic references, research products, and discussion forums. Lecturers revealed that there is currently no integrated platform that supports knowledge collaboration between students, lecturers, or across study programs within the Engineering Education cluster.

The focus group discussions (FGDs) involved student representatives from various semester levels. The FGDs confirmed that students need a digital platform that not only stores content but also provides a training system , a feature for uploading scientific papers, a question-and-answer forum, and a space for collaborative writing. Furthermore, they expressed difficulty finding credible learning resources due to limited access to paid journal databases and a lack of understanding in assessing the quality of digital sources. Based on these findings, the Define stage identifies several key needs. First, there is a need for an integrated digital platform that can bring together teaching materials, scientific references, and knowledge products in the field of building engineering. Second, students require improvements in information literacy, digital literacy, and academic writing skills in order

to effectively engage with digital learning resources. Third, lecturers need more systematic media for storing, organizing, and sharing learning content. Finally, institutions are required to strengthen digital ecosystems that support 21st-century learning as well as the principles of Industry 5.0. The information obtained at the Define stage becomes the basis for the conceptual design of U-NeedKC in the next stage.

2.1.2 Design stage

This stage focuses on developing the conceptual design of the U-NeedKC platform, including system structure, user interface design , feature mapping, and user flow . The design process is based on the findings from the Define stage, which identified user needs. The first step was to develop a conceptual design, an overview of how the platform would work, its core features, and the integration of content, users, and learning activities. The initial concept of U-NeedKC was designed to include five main components that support knowledge sharing and academic collaboration. The first component is the Knowledge Repository, which stores various academic resources such as course materials, practical modules, research outputs, student final projects, and scientific articles. The second component is the Digital Collaboration Space, which provides discussion features, forums, and collaborative environments where students and lecturers can develop knowledge projects together.

The third component consists of Training and Tutorial features that offer guidance on scientific writing, the use of building engineering software, and the latest developments in construction technology. The fourth component is the Academic Activity Dashboard, which displays user activity and records academic contributions, allowing users to track their engagement within the platform. The fifth component is a Content Management System, which enables lecturers to upload learning materials, provide academic guidance, and moderate student-generated content to ensure quality and relevance within the platform.

The second step is to structure the system using flowcharts, *site maps* , and database models to ensure effective relationships between components. This stage is crucial for determining how data will be stored, how users will access content, and how features will be interconnected to ensure the platform runs efficiently.

The third step was to design the interface, focusing on the principles of simplicity, intuitiveness, responsiveness, and user-friendliness for vocational students with diverse digital skills. Colors, layout, typography, and icons were selected based on UX studies and student preferences obtained in the Define phase. The fourth step is to develop a feature mapping by determining priority features for the initial prototype. Because this research only reached the stage of developing a conceptual prototype, the features developed focused more on functional design than technical implementation.

Thus, the Design stage produces a complete *blueprint* as a reference for prototype development in the next stage.

2.1.3 Develop stage

The Development phase is the process of building an initial prototype of the design that has been developed. Development is carried out in two main steps: prototype construction and expert validation. In the prototype construction stage, the conceptual design that was created in the Design stage is translated into a visual prototype that shows the platform display, menu layout, user interaction flow, and simulation of access to repository components, forums, and training features. It's important to emphasize that the prototype developed in this study does not yet encompass the full implementation of a web-based program. This means the prototype remains at the interactive design representation level and is not a widely usable digital platform. This aligns with the research objectives, which prioritize conceptual design development and initial validation.

After the prototype was completed, expert validation was conducted by lecturers specializing in engineering education, learning tool development, and educational

technology. The experts provided input on content feasibility, feature functionality, design aesthetics, potential for further development, and its suitability to user needs. This validation aimed to ensure that the U-NeedKC prototype met academic standards and could be further developed in subsequent research.

2.1.4 Dissemination stage

The final stage in the 4D model is Dissemination, which involves disseminating the developed product so that it can be used by a wider audience. However, in this study, the dissemination stage has not yet been implemented, as development is still at the conceptual prototype stage. The Dissemination phase will be realized through further research that includes limited-scale trials, platform refinement, and actual implementation within the Building Engineering Education Study Program. This dissemination is planned to include prototype demonstrations to lecturers and students, user training, and platform integration with existing academic systems.

Fig. 1. 4D method

2.2 Data collection techniques

The data collection techniques in this study were comprehensively designed to identify user needs, map digital learning challenges, and obtain a comprehensive overview of the academic ecosystem in the Building Engineering Education Study Program. A multiprocedural approach was used to generate valid, rich, and representative data, thus supporting the design of the U-NeedKC Knowledge Center in a targeted manner. Four main methods were used in this process: observation, interviews, focus group discussions (FGDs), and literature review.

First, observations were conducted to understand the actual digital learning practices taking place within the environment. The observations examined how students and lecturers interact with learning technology, from how they access the LMS, download materials, to their tendencies to use digital devices in lectures. Furthermore, the observations highlighted emerging obstacles, such as delays in accessing materials due to internet connection issues, lack of synchronization of the LMS interface with reference sources, or students' learning patterns that still rely on face-to-face methods. The results of these observations provide an empirical picture of the gap between the potential of technology and learning practices occurring in the field.

Second, structured interviews were conducted with students and lecturers to further explore the observation findings. The interviews explored user expectations and needs for digital learning platforms. Lecturers expressed the need for integrated storage for teaching materials, research references, and student project documentation. Students, on the other hand, emphasized the need for a platform that provides quick access, automated search features, and easy-to-follow academic writing guidelines. Interviews were conducted using systematically structured question guidelines to ensure data consistency and alignment with research objectives.

Third, Focus Group Discussions (FGDs) were conducted to gather direct input from small groups of students, lecturers, and educational staff. The FGDs served to explore ideas regarding features deemed most important for inclusion in the U-NeedKC platform. FGD participants discussed aspects of functionality, navigation flow, interface readability, and integration priorities, such as digital archive features, forums, workshops, and a points

system. The FGDs also discussed potential collaborations with industry, such as providing training content or updated technical materials relevant to curriculum needs.

Fourth, a literature review was conducted to obtain a theoretical and empirical basis for Knowledge Management System development, LMS effectiveness, and digital education practices. The literature analyzed included international journals, research reports, LMS development standards, and technical documentation. This literature analysis serves as a conceptual foundation that strengthens the argument regarding the urgency of developing a web-based platform like U-NeedKC. Through this literature review, this study confirms that the integration of digital repositories, discussion forums, and self-paced learning systems has been proven to improve digital literacy and conceptual understanding of students in various educational institutions. By combining these four data collection methods, this study yielded a comprehensive picture of the evolving academic needs and digital culture. This data provided a solid foundation for formulating the design and key features of U-NeedKC.

2.3 Data analysis

Data obtained through observation, interviews, focus group discussions (FGDs), and literature review were processed using a qualitative analysis approach. This analysis was conducted to identify patterns, categorize information, and formulate interpretations that could be used as a basis for developing the platform design. Three main steps were taken: data reduction, data classification, and data presentation.

The first stage is data reduction, a selection process aimed at filtering important information from all the raw data collected. At this stage, researchers separate data relevant to the research objectives and eliminate information that does not contribute to system development. For example, student complaints regarding assignment load were not recorded because they were not directly related to digital needs, while findings regarding difficulties accessing the LMS, limited digital resources, and the need for discussion forums were recorded in detail. Data reduction was carried out systematically to maintain the research's focus.

The second stage is data classification. The filtered data is then organized into main themes discovered through analysis. Three thematic categories emerged in this study. First, the *feature requirements category* , which relates to user needs for specific features such as document storage space, interaction forums, course systems, and workshops. Second, the *digital literacy constraints category* , which contains findings regarding students' low digital academic writing skills, difficulties using the LMS, and limited device usage patterns on mobile phones. Third, the *system development priorities category* , which includes recommendations from focus group discussions and interviews regarding features that should be developed first based on the urgency and frequency of user needs.

The third stage is data presentation, which presents the analysis results in narrative form, thematic diagrams, and supporting tables. Data presentation is intended to facilitate interpretation and ensure that the analysis findings are fully understood by the reader. A relationship diagram between variables, for example, is used to demonstrate the relationship between digital literacy barriers and the need for a discussion forum. The interview findings table presents a summary of respondents' answers regarding the most needed features. This presentation emphasizes that the analyzed data is not simply a collection of information but has been processed into a strong argumentative basis for designing the U-NeedKC platform.

2.4 Prototype development

The development of the Knowledge Center within the Building Engineering Education program was carried out through several integrated processes to ensure the platform effectively meets user needs. This development process included the design and implementation of key features, including courses, archives, and workshops. The product development stages are as follows:

2.4.1 Course feature development

The Course feature is designed as an online learning space that provides learning materials related to Building Engineering Education. The first stage of development is material identification, where researchers collect teaching materials from lecturers, including lecture slides, practical modules, construction standards, and other references. The second stage is content preparation, which includes compiling the materials in an easy-to-understand format, such as theory summaries, structural illustrations, engineering diagrams, and demonstration videos. This effort is made to ensure that the materials are not only informative but also visually appealing. The third stage is platform integration, which involves inserting the content into the selected web-based LMS. This integration allows flexible access to the materials, including download and preview features, so students can study anytime, from their laptops or mobile phones.

2.4.2 Archive feature development

The Archives feature serves as a digital repository providing academic documents such as research journals, project reports, student theses, and scientific articles. Its development begins with a document collection process, which involves selecting credible document sources, including research findings from lecturers and students. Content is then organized by grouping documents into categories such as building structures, construction management, building materials, and engineering drawings. This grouping aims to make it easier for users to find references through quick searches. The final stage is storage and access, which ensures documents are securely stored in cloud storage and accessible only to authorized users. The access system is built with file security in mind to prevent copyright infringement.

2.4.3 Workshop feature development

The Workshop feature is designed to support training and seminar activities for students and the general public. The development process includes workshop planning, which involves identifying relevant topics such as civil engineering software training, seminars on the latest construction technologies, and scientific writing workshops. Next comes content creation, including presentation materials, training modules, and video tutorials to support the workshop activities. The final stage is participant registration and management, which allows users to register online and manage attendance data, certificates, and participant feedback through an integrated system. Overall, these three features are fundamental in supporting U-NeedKC's function as a comprehensive digital knowledge center.

2.5 Validation and evaluation

Prototype validation and evaluation were conducted in two main stages: alpha testing and beta testing. These tests aimed to ensure that the conceptual design and user interface met standards for functionality, usability, and academic requirements. The first stage, alpha testing, was conducted through an expert review involving lecturers, educational technology practitioners, and information systems developers. The experts were asked to assess the relevance of the design, the logical structure of the platform, the consistency of navigation, and the quality of the content. They provided feedback on page layout, icon usage, clarity of instructions, and completeness of features. Alpha testing helped identify design issues early so that improvements could be made before the system was tested by live users.

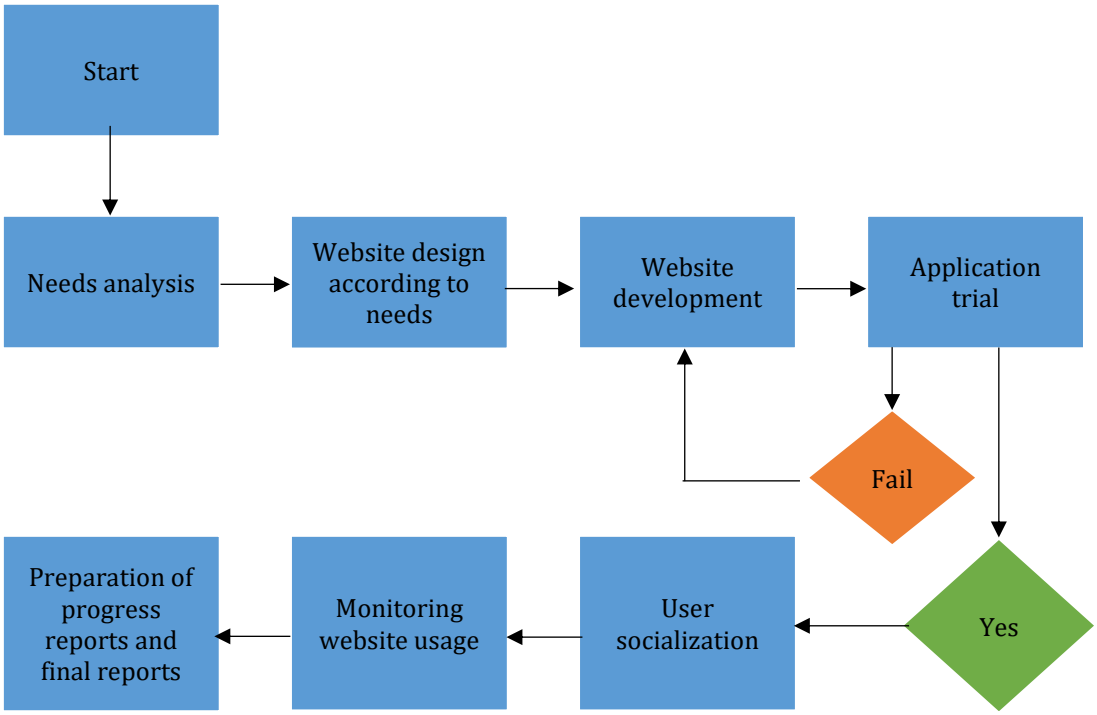

Fig. 2. U-NeedKC website creation implementation stage flowchart

The second phase, beta testing, involved students and lecturers as real users to assess the interface's effectiveness and ease of access. Users were asked to try out all features, such as accessing courses, downloading archived documents, attending workshops, and providing feedback on their user experience. Aspects evaluated included system response time, suitability of features to user needs, content readability, and potential technical challenges. Beta testing results were used to refine the final design before full-scale implementation. Through these two testing phases, the U-NeedKC prototype was gradually refined to achieve the desired quality standards. Systematic evaluation ensured that the platform was not only functional, but also relevant, easy to use, and capable of supporting academic needs within the environment. A flowchart illustrating the U-NeedKC development procedure is presented in Fig. 2.

3. Results and Discussion

3.1 User needs analysis

User needs analysis was conducted through observation, in-depth interviews, and focus group discussions involving students and lecturers of the Building Engineering Education Study Program. The data collection results indicate that there are various fundamental problems related to access to academic information, digital literacy, and a lack of knowledge sharing culture in the academic environment. Students reported difficulties in finding academic documents, course materials, final project reports, and relevant digital reference sources to support the learning process. Although this study has provided a Learning Management System (LMS) and E-Library as digital tools, their utilization is considered not optimal in supporting collaborative academic interactions.

This condition aligns with previous findings showing that LMS effectiveness depends on users' ability to independently access, understand, and organize digital information (Herniawati et al., 2025). The impact of limited digital literacy results in students being less able to utilize LMS features optimally to increase learning engagement (Fernández et al., 2023). This barrier is also evident in the context of vocational education, where the use of digital technology should be able to strengthen the learning of technical competencies and practical skills (Antonietti et al., 2022; Tan et al., 2021).

Official data from the one of the University Public Service Institute (PTB) shows that more than 15,000 student accounts and 500 lecturer accounts are active on the LMS, supporting nearly 2,000 online classes, 62,656 discussion posts, and 191,468 exam items accessed over the past year. While these figures are quite high, the intensity of LMS utilization as a center for academic collaboration and a knowledge repository has not yet been fully achieved. This finding is supported by research by Munisamy et al. (2025), which identified that e-learning governance in higher education often faces obstacles related to system integration, user training, and infrastructure quality.

At the student level, interviews revealed that most users only utilize LMS for three basic activities: downloading course materials, taking quizzes, and uploading assignments. Higher-level interactions such as academic discussions, sharing references, collaborative writing, and integrating digital knowledge sources remain very limited. This fact is reinforced by the findings of Suciati et al. (2014) who stated that reading interest and access to digital libraries among Indonesian students tend to be low, influenced by a lack of information literacy and minimal awareness of the importance of knowledge management in the academic process.

Technical barriers also contribute significantly to the low utilization of LMSs and digital repositories. Many students rely on low-capacity devices, particularly smartphones, with limited storage and less-than-ideal performance. Internet access is often volatile, especially for students living outside urban areas. This hinders their ability to access instructional videos, digital scientific journals, and interactive modules. Afifa & Astuti (2024) noted that video-based media is often underutilized by structural engineering students due to limited device and network access.

Furthermore, user needs also include a broader knowledge-sharing space, beyond simply document collection. Students expressed the need for an integrated platform that would allow them to conduct academic discussions, publish ideas or simple scientific papers, and access thematically curated learning materials. Lecturers also emphasized the need for a system capable of supporting professional development activities, such as workshops, internal seminars, and interactive forums with industry practitioners.

In this context, the development of the U-NeedKC platform is highly relevant. As a website-based Knowledge Center, U-NeedKC offers a more comprehensive approach than conventional LMSs. Features such as digital archives, discussion forums, workshops, point systems, and structured online courses can address these needs. This aligns with the concept of a Knowledge Management System (KMS), which integrates the creation, storage, distribution, and utilization of knowledge in educational settings (Kruesi et al., 2020; Zamiri & Esmaeili, 2024; Utami, 2023; Suryani et al., 2021). KMS has proven effective in improving the performance of educational organizations when collaboration features are supported by a standardized and user-friendly system.

The literature also notes that digital repositories help students improve their information literacy skills and expand access to scientific sources (Sheikh et al., 2025; Oseghale, 2023). Meanwhile, knowledge sharing practices can improve the quality of academic discussions, develop critical thinking skills, and strengthen relationships between students and lecturers (Wulandari et al., 2020; Salem & Arkiang, 2020).

In the national context, Indonesia still ranks in the moderate digital literacy index, at around 62%, lower than the ASEAN average of 70% (Sindonews, 2024). This indicates that students need a digital environment that supports improved information literacy, technology literacy, communication literacy, and data literacy. U-NeedKC is expected to catalyze this digital competency improvement through interactive features that emphasize independent and collaborative learning.

By referring to user needs, digital literacy challenges, and technological limitations, the direction of U-NeedKC development becomes increasingly clear: providing an integrated platform that can bridge the technology and knowledge gap, improve academic culture, and open up space for cross-disciplinary collaboration in the digital ecosystem.

3.2 U-NeedKC design outcomes

The design phase resulted in the conceptual framework of U-NeedKC, which serves as a web-based Knowledge Center platform. This framework was designed based on the 4D model in the Define and Design phase, with a focus on integrating key features that support vocational learning activities, scientific repositories, knowledge management, and academic collaboration. This design follows the principles of User Experience (UX) and Human-Centered Design, ensuring all features are easily accessible, intuitive, and aligned with the needs of diverse users, both students and lecturers. This feature provides organized online and hybrid learning modules per course. Each module can contain materials in the form of PDFs, videos, construction simulations, and interactive exercises. This learning approach has been proven to increase student engagement (Fernández et al., 2023; Herniawati et al., 2025). The module system allows students to learn flexibly at their own pace.

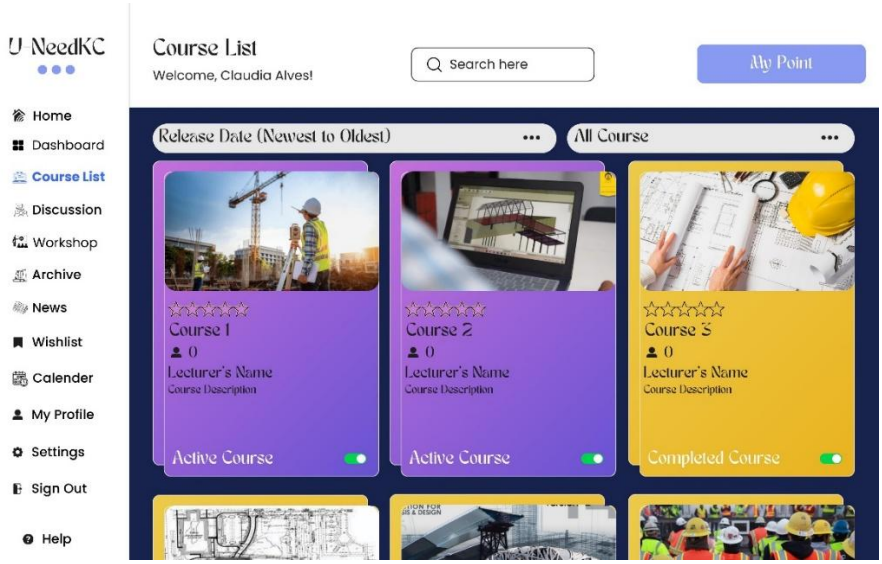

Fig. 3. Course feature

The archive serves as a digital repository for storing academic documents such as student papers, lab reports, research proposals, scientific articles, and final assignments. This system adopts the knowledge repository concept as explained by Sheikh et al. (2025). The existence of a digital repository makes it easier for students to find references and simultaneously fosters a culture of scientific publication.

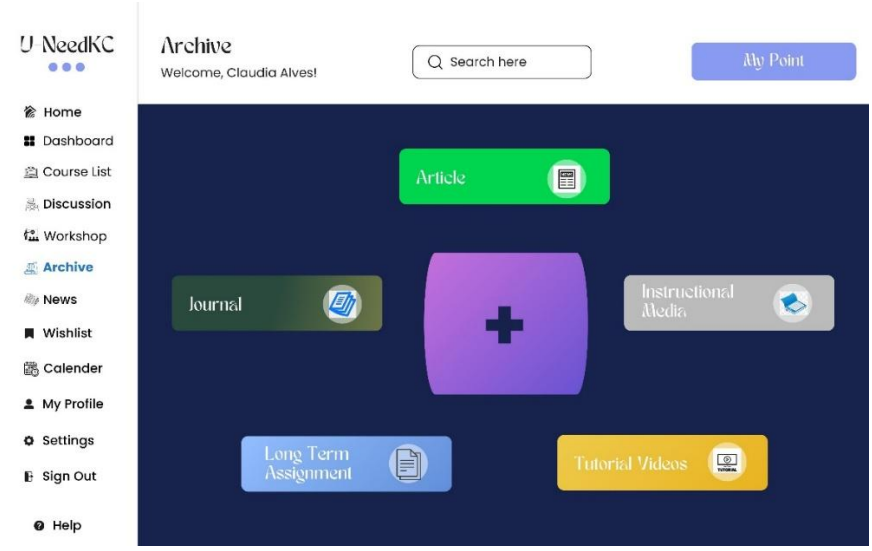

Fig. 4. Archive feature

Workshops are designed to be hubs for competency development. Activities such as construction software training, academic writing, BIM, and collaboration workshops can be accommodated within this feature (Wang et al., 2023). Research by Linzalone et al. (2020) and Vyas (2024) confirms that digital transformation in higher education requires ongoing training support for effective technology adaptation.

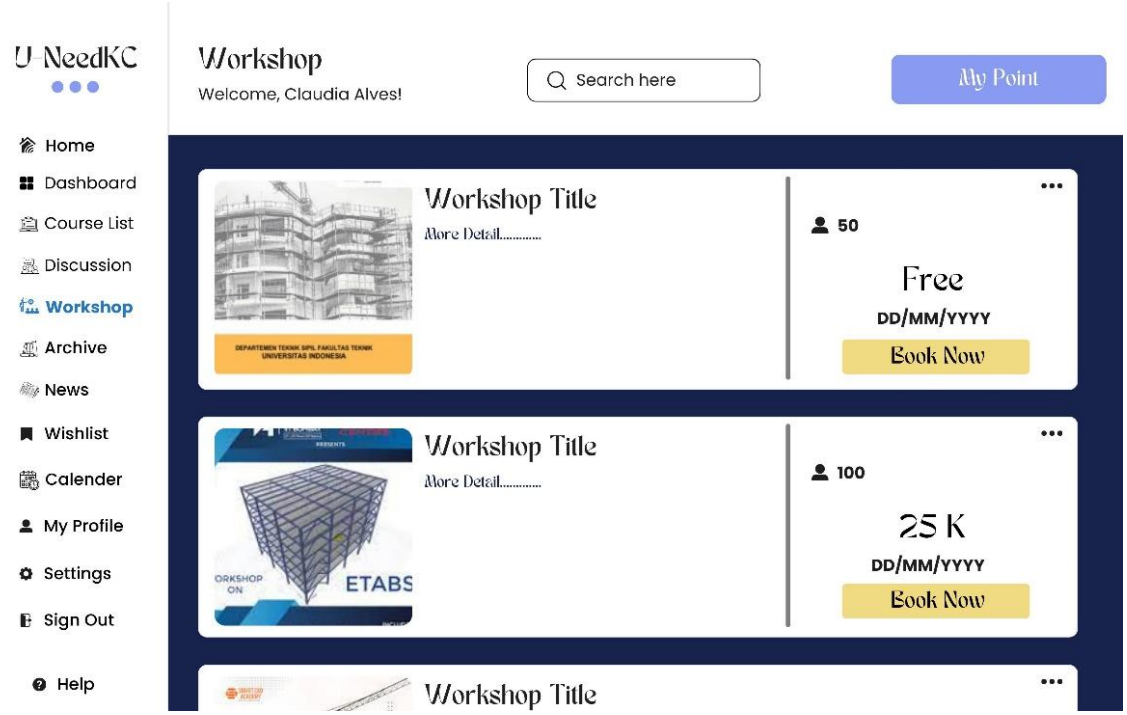

Fig. 5. Workshop feature

Forums provide a space for interaction between students, lecturers, and industry practitioners. This function supports the knowledge sharing process, as explained by Wulandari et al. (2020). Academic discussions can improve students' critical thinking skills, creativity, and communication abilities.

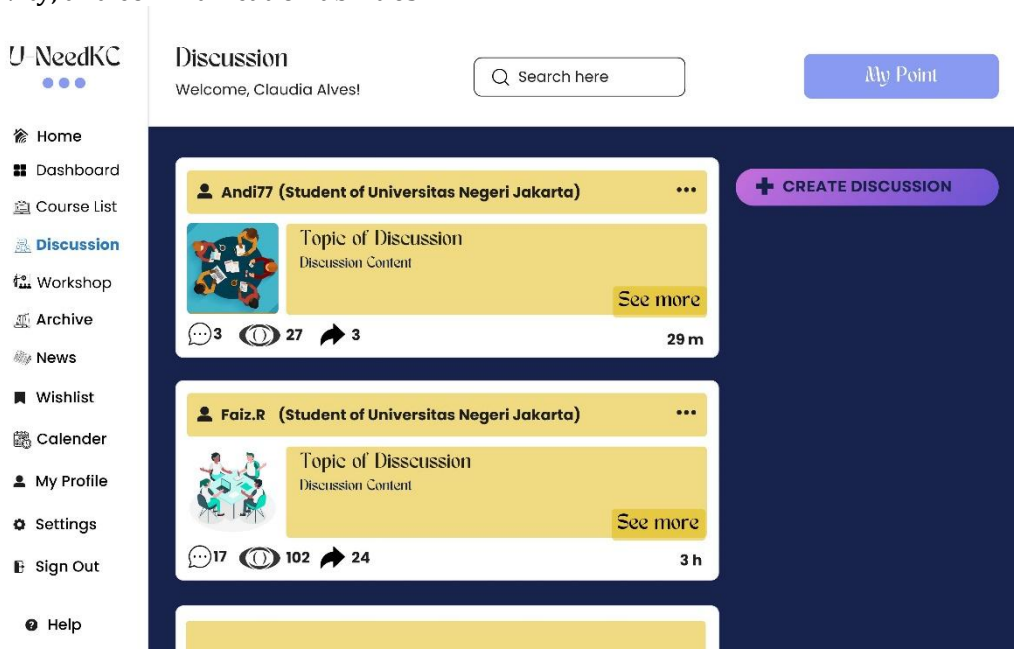

Fig. 6. Discussion forum feature

The points system encourages active user engagement. Students earn points for each contribution they make, such as uploading mini-articles, responding to discussions,

publishing summaries, or uploading academic work to the Archive. This approach has been shown to be effective in increasing motivation in digital-based learning (Haikal et al., 2025; Vitriani et al., 2023). The U-NeedKC design framework integrates these five features in an organized manner. An effective information retrieval model (Jaya & Ayub, 2021) is implemented to ensure fast and accurate document and material searches. Furthermore, the interface is designed to be responsive to mobile devices, given that most students access the LMS via mobile phones (Ramadhan et al., 2024).

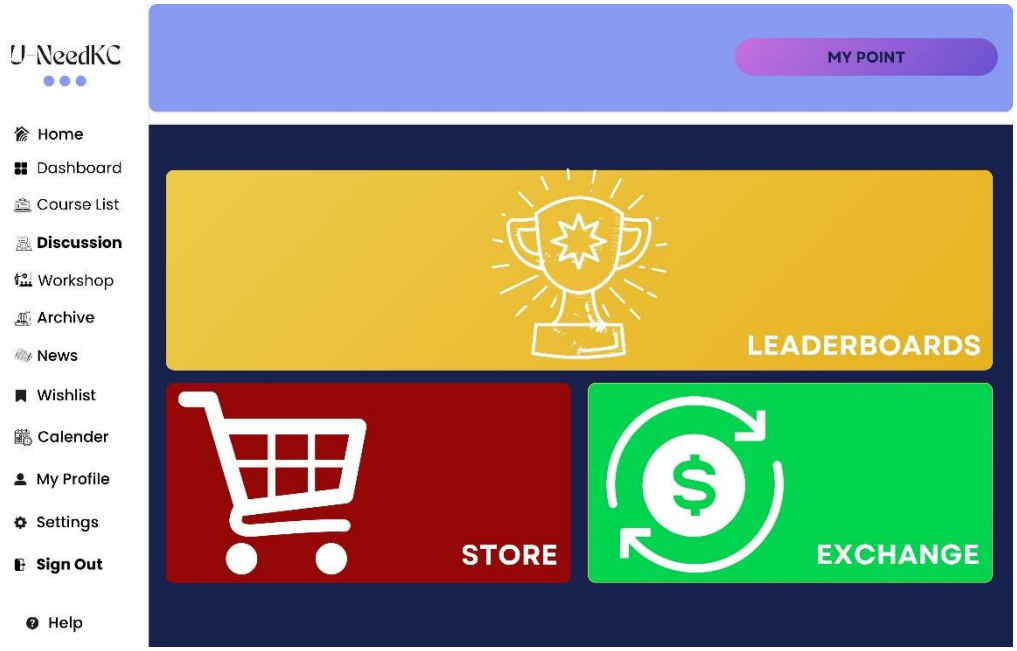

Fig. 7. Point system

3.3 Relevance to building engineering education

The development of U-NeedKC is highly relevant to the needs in addressing global challenges, particularly within the context of Industry 5.0. The program is required to produce graduates who master theoretical and practical construction competencies, while also adapting to digital technologies, multidisciplinary collaboration, and the integration of technological and human values. U-NeedKC supports this goal by providing a digital ecosystem that enhances learning interactivity, flexibility, and collaboration. Courses enable access to online or hybrid materials anywhere and anytime, while Archive serves as a scientific repository fostering academic literacy.

The relevance is further strengthened through the connection between academia and industry facilitated by Workshop and Discussion Forum, enabling interaction with practitioners and building essential 21st-century skills such as digital literacy, communication, critical thinking, and cross-disciplinary collaboration. Additionally, integration with LMS supports efforts toward digital-based education and national policy directions promoting innovation in higher education. Therefore, U-NeedKC represents a strategic transformation tool that enhances graduate quality, strengthens writing and knowledge-sharing culture, and supports national infrastructure development through academic contribution.

3.4 Implications and research limitations

The development of U-NeedKC has strategic implications for enhancing academic literacy and fostering a culture of collaboration within the Building Engineering Education Study Program. By integrating a digital repository, points system, discussion forums, and

workshop spaces, this platform has the potential to foster a more interactive and participatory learning ecosystem. Previous studies have confirmed that the use of structured educational technology can enhance a culture of sharing, enhance learning motivation, and enhance students' digital competencies (Kruesi et al., 2020; Suryani et al., 2021; Zamiri & Esmaeili, 2024; Kruesi et al., 2020). Furthermore, U-NeedKC is designed to facilitate collaboration between academics and the construction industry through thematic forums and project-based activities relevant to the needs of the workplace. This platform serves as a sustainable platform for integrating academic and professional insights.

However, this study has several limitations. First, the development of U-NeedKC has not yet entered the alpha and beta testing phase, so the effectiveness of the design, feature functionality, and the quality of the user experience cannot be empirically measured. The resulting design is still in the conceptual framework stage, so it cannot be operationally evaluated for usability, accessibility, or its impact on the learning process. Second, the limitations of empirical data arise because the needs analysis is based only on small-scale observations and interviews, so its validity still needs to be strengthened through quantitative surveys and data collection from a broader user group. Third, the success of the platform is highly dependent on digital infrastructure conditions such as internet stability, device availability, and institutional support for system maintenance, which remain common challenges in Indonesian universities. Finally, the academic culture of engineering students, who tend to be less accustomed to scientific writing and sharing digital knowledge, presents a particular obstacle. This requires additional strategies such as digital literacy programs, academic writing training, project-based workshops, and departmental policies that encourage student scientific publications to ensure optimal use of the platform.

3.5 Recommendations for U-NeedKC development

Recommendations for the next phase of U-NeedKC development focus on the next steps from the Develop and Disseminate phases in the 4D model. In the Develop phase, a functional prototype needs to be implemented immediately by integrating key features such as Courses, Archives, Forums, Workshops, and the Points System into a responsive web platform that is easily accessible to users on various devices. Once the prototype is complete, an alpha trial should be conducted with lecturers and students to evaluate the quality of the interface, navigation flow, and technical functionality in depth. This stage is then followed by a beta trial involving a wider user base, including industry partners, so that the platform can be tested in a more realistic and varied usage context.

Content feature development is also a key recommendation. The platform needs to be enhanced with e-modules, video tutorials, interactive construction simulations, and an AI-based content recommendation system that can facilitate users in finding relevant academic references (Sungkar et al., 2023; Yandra & Sari, 2020). In terms of infrastructure, cloud storage integration is needed to ensure security, scalability, and ease of managing large amounts of academic documents. Furthermore, establishing a platform management team is crucial to ensure technical maintenance, content curation, user management, and ongoing feature updates. The development phase needs to be complemented by a data-driven evaluation mechanism through usage analytics to monitor user behavior, identify the most frequently used features, and determine the direction of ongoing development based on actual needs. By implementing these recommendations, U-NeedKC is expected to develop into a comprehensive and sustainable digital ecosystem that supports the transformation of learning in the field of building engineering and contributes to the development of student competencies in the Industry 5.0 era (Supriya et al., 2024).

4. Conclusions

Based on the findings of this study, it can be concluded that the need for an integrated digital platform in the Building Engineering Education Study Program (PTB) at Jakarta State University has become an academic urgency that cannot be postponed. The low culture of

scientific writing, limited space for knowledge sharing, and minimal access to curated academic repositories indicate that the existing digital ecosystem does not fully support the comprehensive development of student competencies. Although this study already has an LMS and E-Library, their utilization is not optimal because the available features are still limited to providing materials and uploading assignments, thus insufficient to build a culture of discussion, collaboration, and sustainable knowledge production. This condition has an impact on student learning patterns that tend to be passive and consumptive towards information, and lack a platform to develop reflective and analytical skills that are essential in vocational education. In response to these various limitations, the development of the U-NeedKC (University Knowledge Center) concept emerged as a strategic innovation designed to strengthen PTB's digital capacity. This platform consists of five main features Courses, Archives, Workshops, Discussion Forums, and a Point System which function as a unified ecosystem to support independent learning, academic collaboration, and the improvement of digital literacy. Each feature is designed to address various vocational learning needs, such as providing academic references, enhancing 21st-century skills, and facilitating scientific interactions that have not been adequately facilitated through existing digital platforms.

However, this research has only reached the *Design stage* in the 4D development model, so the U-NeedKC platform is only available in the form of a conceptual design and has not yet been realized as an operational website. Therefore, further research at the *Develop* and *Disseminate stages* is crucial to ensure that the feature design can be implemented effectively in a real-world context. The development stage includes prototyping, user testing, content validation, and refining the interaction flow to ensure it meets the needs of students and lecturers. Furthermore, the successful implementation of U-NeedKC also depends heavily on institutional support, particularly through integration with the LMS and E-Library, the provision of reliable server infrastructure, and intensive training for users to be able to utilize the platform optimally. Strengthening digital culture and the active contribution of the academic community are also key factors in ensuring the platform's sustainability. If institutional support, technical readiness, and user participation can work in harmony, U-NeedKC has the potential to become a catalyst for the transformation of vocational learning relevant to the demands of the Industry 5.0 era. This platform is not only expected to enrich students' learning experiences, but also strengthen scientific culture, improve digital literacy skills, and support the creation of a collaborative, adaptive, and highly competitive academic community within the environment.

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During the preparation of this article, the author used ChatGPT (OpenAI) to assist in the assist in improving grammar, clarity, and academic tone of the manuscript. After using this tool, the author reviewed and re-edited the manuscript and takes full responsibility for the content of this manuscript.

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References
Afifa, K., & Astuti, T. (2024). The effect of digital learning media on motivation and learning outcomes of IPAS. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3155-3165. https://doi.org/10.29303/jppipa.v10i6.7513

Aithal, P. S., & Maiya, A. K. (2023). Innovations in higher education industry–Shaping the future. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, *7*(4), 283-311. https://doi.org/10.2139/ssrn.4770797

Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education?. *Computers in Human Behavior*, *132*, 107266. https://doi.org/10.1016/j.chb.2022.107266

Carayannis, E. G., Kostis, P. C., Kafka, K. I., & Valvi, T. (2024). Toward Industry 6.0 and techno-centric vs human-centric smart balancing: the journey from industry and society 4.0 toward industry and society 5.0 and beyond. In *Sustainable Economic Development* (pp. 171-184). Routledge.

Dewi, A. C., & Saputra, E. E. (2025). The influence of digital comic-based instructional media on students' narrative text writing skills at SMP Muhammadiyah Rappang. *IJORER: International Journal of Recent Educational Research*, *6*(3), 890-903. https://doi.org/10.46245/ijorer.v6i3.828

Dissen, A., Qadiri, Q., & Middleton, C. J. (2022). I read it online: understanding how undergraduate students assess the accuracy of online sources of health information. *American journal of lifestyle medicine*, *16*(5), 641-654. https://doi.org/10.1177/1559827621990574

Fernández, A., Gómez, B., Binjaku, K., & Meçe, E. K. (2023). Digital transformation initiatives in higher education institutions: A multivocal literature review. *Education and information technologies*, *28*(10), 12351-12382. https://doi.org/10.1007/s10639-022-11544-0

Haikal, M. F., Anwar, S., & Islamy, M. R. F. (2025). Problem based learning methods in the digital era: measuring the impact on students learning motivation and social

character. *Jurnal Iqra': Kajian Ilmu Pendidikan*, *10*(1), 1-17. https://doi.org/10.25217/ji.v10i1.5053

Hashim, M. A. M., Tlemsani, I., Mason-Jones, R., Matthews, R., & Ndrecaj, V. (2024). Higher education via the lens of industry 5.0: Strategy and perspective. *Social Sciences & Humanities Open*, *9*, 100828. https://doi.org/10.1016/j.ssaho.2024.100828

Herniawati, A., Holifah, L., & Syakur, A. (2025). The Effectiveness of Learning Management System (LMS) Use in Higher Education. *International Journal Corner of Educational Research*, *4*(1), 20-29. https://doi.org/10.54012/ijcer.v4i1.625

Jaya, T. A. L., & Ayub, M. (2021). Pengembangan Knowledge Management System dengan Teknik Information Retrieval. *Jurnal Teknik Informatika dan Sistem Informasi*, *7*(1), 85-99. https://doi.org/10.28932/jutisi.v7i1.3316

Kruesi, L., Burstein, F., & Tanner, K. (2020). A knowledge management system framework for an open biomedical repository: communities, collaboration and corroboration. *Journal of Knowledge Management*, *24*(10), 2553-2572. https://doi.org/10.1108/JKM-05-2020-0370

Laily, N., Irdiana, S., Rusdiyanto, R., & Silalahi, M. (2024). Antecedents of knowledge management: The case of professional employees in Indonesia. *Knowledge and Performance Management*, *8*(1), 49. https://doi.org/10.21511/kpm.08(1).2024.04

Linzalone, R., Schiuma, G., & Ammirato, S. (2020). Connecting universities with entrepreneurship through digital learning platform: functional requirements and education-based knowledge exchange activities. *International Journal of Entrepreneurial Behavior & Research*, *26*(7), 1525-1545. https://doi.org/10.1108/IJEBR-07-2019-0434

Martini, B., Bellisario, D., & Coletti, P. (2024). Human-centered and sustainable artificial intelligence in industry 5.0: Challenges and perspectives. *Sustainability*, *16*(13), 5448. https://doi.org/10.3390/su16135448

Munisamy, M., Osman, S. Z. M., & Mageswaran Sanmugam, N. W. F. (2025). From Platforms To Practice: A Systematic Review Of Learning Management System Integration In Vocational Teaching. *Journal of Modern Education*, *7*(27), 01-21. https://doi.org/10.35631/IJMOE.727001

Oseghale, O. (2023). Digital information literacy skills and use of electronic resources by humanities graduate students at Kenneth Dike Library, University of Ibadan, Nigeria. *Digital library perspectives*, *39*(2), 181-204. https://doi.org/10.1108/DLP-09-2022-0071

Salem, M. A., & Arkiang, F. (2020). Pemanfaatan Internet sebagai Sumber Belajar untuk Meningkatkan Prestasi Akademik Mahasiswa (Studi Kasus pada Mahasiswa Jurusan P. IPS FTIK UIN Maliki Malang). *REMIK: Riset dan E-Jurnal Manajemen Informatika Komputer*, *5*(1), 34-42. https://doi.org/10.33395/remik.v5i1.10626

Sheikh, R. A., Ahmed, I., Faqihi, A. Y. A., & Shehawy, Y. M. (2025). Global perspectives on navigating Industry 5.0 knowledge: Achieving resilience, sustainability, and human-centric innovation in manufacturing. *Journal of the Knowledge Economy*, *16*(5), 15997-16032. https://doi.org/10.1007/s13132-024-02498-4

Suciati, U., & Heriyanti, M. N. (2014). Perilaku Pencarian Informasi Mahasiswa Pascasarjana Universitas Gadjah Mada di Era Search Engine. *JURNAL IPTEKKOM (Jurnal Ilmu Pengetahuan & Teknologi Informasi)*, *16*(1), 29-40. https://doi.org/10.17933/iptekkom.16.1.2014.29-40

Sungkar, L., Arthur, R., & Anisah, A. (2023). Pengembangan E-Modul Konstruksi dan Utilitas Gedung Berbasis Proyek pada Kompetensi Keahlian Desain Pemodelan dan Informasi Bangunan (DPIB) di SMK. *Jurnal Pendidikan Teknik Bangunan*, *3*(1), 33-54.

Supriya, Y., Bhulakshmi, D., Bhattacharya, S., Gadekallu, T. R., Vyas, P., Kaluri, R., ... & Mahmud, M. (2024). Industry 5.0 in smart education: Concepts, applications, challenges, opportunities, and future directions. *IEEE Access*, *12*, 81938-81967. https://doi.org/10.1109/ACCESS.2024.3401473

Suryani, S., Sudrajat, B., Hendryadi, H., Oktrivina, A., Hafifuddin, H., & Ali Buto, Z. (2021). Can Islamic work ethics encourage knowledge-sharing behaviors? The role of job

embeddedness and organizational identification. *Journal of Islamic Accounting and Business Research*, *12*(8), 1181-1199. https://doi.org/10.1108/JIABR-03-2021-0103

Tan, S. C., Chan, C., Bielaczyc, K., Ma, L., Scardamalia, M., & Bereiter, C. (2021). Knowledge building: Aligning education with needs for knowledge creation in the digital age. *Educational Technology Research and Development*, *69*(4), 2243-2266. https://doi.org/10.1007/s11423-020-09914-x

Utami, T. (2023). Kajian pengembangan knowledge management system (kms) di kementerian perdagangan. *Jurnal Cendikia Niaga (JCN)*, *7*(1), 31-45. https://doi.org/10.52391/jcn.v7i1.831

Vyas, P. (2024). Knowledge management and higher education institute: Review & topic analysis. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(3), 100349. https://doi.org/10.1016/j.joitmc.2024.100349

Wang, L., Huang, M., Zhang, X., Yan, X., Jin, R., Wanatowski, D., ... & Chohan, N. (2023). Incorporating BIM into the upper-division curriculum of construction engineering and management. *European Journal of Engineering Education*, *48*(3), 482-501. https://doi.org/10.1080/03043797.2022.2112150

Xu, J., Jiang, T., Wei, M., & Qing, Z. (2024). The digital transformation of vocational education: Experience and reflections of Shenzhen Polytechnic University. *Vocation, Technology & Education*, *1*(2), 1-12. https://doi.org/10.54844/vte.2024.0522

Yandra, M., & Sari, N. M. (2020). *Development of E-Modules Based on Project Based Learning Model for Highway and Bridge Construction Subject at Vocational High Schools. 464 (Psshers 2019), 184–187*. https://doi.org/10.2991/assehr.k.200824.043

Zamiri, M., & Esmaeili, A. (2024). Methods and technologies for supporting knowledge sharing within learning communities: A systematic literature review. *Administrative Sciences*, *14*(1), 17. https://doi.org/10.3390/admsci14010017

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