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**AN ARTIFICIAL INTELLIGENCE–ASSISTED PROJECT-BASED HYBRID LEARNING  
MODEL FOR ENHANCING STUDENTS’ DIGITAL LITERACY COMPETENCE**

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**Abstrak**

Urgensi penelitian ini adalah mengembangkan tiga pendekatan (project based learning, hybrid learning, dan artificial intelligence) untuk meningkatkan kompetensi literasi digital sehingga menghasilkan model pembelajaran yang dapat diimplementasikan dalam mata kuliah Media ICT dan mempersiapkan lulusan yang memiliki kompetensi literasi digital yang diperlukan di era Society 5.0. Rumusan masalah pada penelitian ini adalah: 1)Apakah model PjBHL berbantuan AI layak digunakan pada mata kuliah media ICT di Universitas Wijaya Putra?; 2)Apakah model PjBHL berbantuan AI praktis digunakan pada mata kuliah media ICT di Universitas Wijaya Putra?; dan 3)Apakah penggunaan model PjBHL berbantuan AI meningkatkan kompetensi literasi digital pada mata kuliah media ICT di Universitas Wijaya Putra?. Pendekatan pemecahan masalah dalam penelitian mengidentifikasi rendahnya kompetensi literasi digital mahasiswa berdasarkan observasi dan pretest, dengan menganalisis keterbatasan model pembelajaran direct instruction dalam mengembangkan literasi digital, sehingga perlu menilai potensi penggunaan AI dalam mendukung model PjBHL. Tujuan penelitian ini adalah untuk mengetahui kelayakan, kepraktisan, dan keefektifan model PjBHL berbantuan AI untuk meningkatkan kompetensi literasi digital mahasiswa, oleh karena itu penelitian pengembangan yang menggunakan pendekatan ADDIE (Analysis, Design, Development, Impementation, and Evaluation). Berdasarkan kelima tahapan ADDIE model PjBHL berbantuan AI dinyatakan layak, praktis, dan efektif meningkatkan kompetensi literasi digital mahasiswa. Model ini juga mendapatkan respon positif dari mahasiswa dan dinilai relevan oleh para ahli dalam bidang pembelajaran, ICT, dan teknologi pendidikan. Rata-rata peningkatan kompetensi literasi digital mencapai 24,4 poin pada seluruh indikator.

**Kata kunci:** Model Project Based Hybrid Learning; Artificial Intelligence; Literasi Digital; Mahasiswa.

**Abstract**

*The urgency of this study lies in integrating three pedagogical approaches—Project-Based Learning, Hybrid Learning, and Artificial Intelligence—to enhance students’ digital literacy competence, thereby producing a learning model that can be implemented in the ICT Media course and preparing graduates with the digital literacy skills required in the era of Society 5.0. The research questions addressed in this study are as follows: (1) Is the AI-assisted Project-Based Hybrid Learning (PjBHL) model feasible for use in the ICT Media course at Universitas Wijaya Putra? (2) Is the AI-assisted PjBHL model practical to implement in the ICT Media course at Universitas Wijaya Putra? and (3) Does the use of the AI-assisted PjBHL model improve students’ digital literacy competence in the ICT Media course at Universitas Wijaya Putra? The problem-solving approach adopted in this study began with identifying students’ low levels of digital literacy competence based on classroom observations and pretest results.*



*This condition was further analyzed by examining the limitations of the direct instruction learning model in fostering digital literacy skills, highlighting the need to explore the potential of Artificial Intelligence in supporting the PjBHL model. Accordingly, this study aims to determine the feasibility, practicality, and effectiveness of the AI-assisted PjBHL model in enhancing students' digital literacy competence. To achieve these objectives, a development research design employing the ADDIE model—Analysis, Design, Development, Implementation, and Evaluation—was applied. Based on the five stages of the ADDIE framework, the AI-assisted PjBHL model was found to be feasible, practical, and effective in improving students' digital literacy competence. The model also received positive responses from students and was evaluated as relevant by experts in learning, ICT, and educational technology. Overall, the average increase in students' digital literacy competence reached 24.4 points across all indicators.*

**Keywords:** *Project-Based Hybrid Learning Model, Artificial Intelligence, Digital Literacy, Students*

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## INTRODUCTION

Within the Merdeka Belajar–Kampus Merdeka (MBKM) curriculum framework, higher education learning has increasingly shifted toward internet-based digitalization. The internet, as a product of human civilization, should be utilized by students to support productive and meaningful academic activities (Directorate General of Higher Education, 2021). Consequently, students are required not only to access digital information but also to critically select, evaluate, and utilize it effectively, particularly in the context of rapid technological advancement and emerging communication patterns. In this regard, education plays a strategic role in responding to the challenges of the Society 5.0 era by fostering intelligent, ethical, and human-centered individuals (Nastiti & Abdu, 2020).

In line with these demands, the curriculum framework issued by the Directorate General of Learning and Student Affairs emphasizes the formulation of graduate profiles as the foundation of curriculum development, which are subsequently translated into Program Learning Outcomes (PLOs). Higher education institutions are therefore required to continuously review and align graduate profiles, learning outcomes, course content, and instructional strategies within an Outcome-Based Education (OBE) framework. OBE focuses on ensuring that students acquire clearly defined competencies upon graduation, rather than merely completing instructional activities (Rao, 2020).

One instructional approach that aligns with OBE principles is Project-Based Learning (PjBL). PjBL provides learners with opportunities to actively manage their learning through project work involving complex, authentic tasks grounded in real-world problems. These projects require students to design solutions, make decisions, conduct investigations, and work independently while producing measurable learning outcomes (Ni Made Rai Dwi Lestari et al., 2022). Within this framework, instructors function as facilitators and mentors rather than direct knowledge transmitters, allowing them to observe and support students' cognitive processes more effectively.

To further enhance flexibility and engagement, hybrid learning has emerged as an instructional approach that combines online and offline learning modes implemented concurrently (Raval, 2019). Hybrid learning is considered effective in addressing time inefficiencies in conventional instruction and in providing authentic learning experiences that support knowledge retention through the integration of technology (Mustaji & Pradana, 2022). As such, hybrid learning represents a strategic

innovation in designing future-oriented education systems capable of responding to ongoing digital disruption and advancing toward Society 5.0.

Parallel to these pedagogical developments, Artificial Intelligence (AI) has gained increasing prominence in educational contexts. Introduced by John McCarthy in 1954, AI was conceptualized as the ability of machines to simulate aspects of human learning and intelligence (Entezari et al., 2023). AI refers to machine capabilities that mimic human cognitive functions, such as learning, reasoning, and problem-solving (Saab, 2023). Currently, AI applications span numerous sectors, including education, where AI has the potential to support decision-making processes, personalize learning experiences, and enhance instructional effectiveness.

Despite the rapid growth of digital technology and AI integration, challenges persist in the development of students' digital literacy competencies. In Indonesia, the digital literacy index has reached 3.84 out of 5 (Hadiyanto et al., 2025); however, gaps remain in critical areas such as information evaluation, digital security, and effective AI utilization. These challenges are particularly evident among students from non-technical disciplines, such as English Literature, who are increasingly required to master digital competencies to remain competitive in the labor market, including in socially inclusive sociopreneurship contexts.

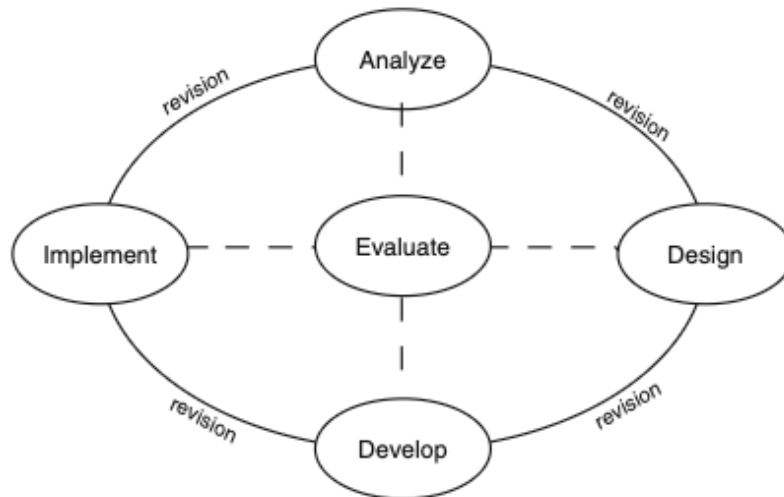
Digital literacy, first introduced by Paul Gilster in the 1990s, is defined as the ability to understand and use information from multiple digital sources accurately and effectively (Gilster, 1997). This concept encompasses critical thinking skills, the ability to locate and evaluate information, and the capacity to manage digital content meaningfully. Bawden (2001) further conceptualized digital literacy as an extension of computer and information literacy, emphasizing technical and cognitive competencies related to accessing, assembling, and disseminating information. Mayes and Fowler (2013) proposed a hierarchical model of digital literacy development consisting of digital competence, digital usage, and digital transformation, highlighting the increasing complexity of digital engagement in learning contexts.

At present, the ICT Media course in the English Literature Study Program at Universitas Wijaya Putra continues to employ a predominantly conventional instructional approach that emphasizes theoretical understanding over practical application. Preliminary survey data involving 50 students revealed that 72% experience difficulties applying digital tools such as Canva, content management systems, and AI applications in real-world projects; 85% lack adequate training in verifying AI-generated information (e.g., ChatGPT); and only 30% have utilized digital platforms for sociopreneurial purposes.

A review of prior studies identified through bibliometric analysis using Publish or Perish and VOSviewer (Harzing, 2023; Ajinegara & Soebagyo, 2022) indicates that Project-Based Learning has been effective in enhancing students' digital and media literacy by encouraging critical evaluation of multiple information sources (Friesem, 2019). Moreover, hybrid learning and PjBL have been shown to support the development of complex skills (Mergendoller & Thomas, 2000). However, empirical studies examining the systematic integration of PjBL, hybrid learning, and Artificial Intelligence for digital literacy development remain limited. Although AI-assisted PjBL has been explored as a developmental approach (Ito et al., 2021), and recent studies have emphasized AI's role in fostering digital skills and ethical technology use (Ng et al., 2023), comprehensive instructional models integrating these components are still underexplored (Figure 1).



The development approach adopted in this study was the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because it provides a systematic, flexible, and effective framework for designing complex learning products that are responsive to users' needs (Branch, 2010). The ADDIE development flow applied in this study is illustrated in Figure 2.



**Figure 2. ADDIE Model Development Flow**

Operationally, the stages of the ADDIE model in this study are described as follows.

1. Analysis, which involved identifying students' needs related to digital literacy competence through a pretest covering knowledge, skills, and attitudinal aspects in the ICT Media course.
2. Design, which focused on designing the AI-assisted PjBHL model by determining learning objectives, selecting AI-based media and technologies, and structuring project-based learning activities for each course topic.
3. Development, which involved developing the AI-assisted PjBHL model along with digital learning materials tailored to students' characteristics.
4. Implementation, which entailed applying the AI-assisted PjBHL model in the instructional process of the ICT Media course.
5. Evaluation, which involved assessing the achievement of learning objectives through posttest results and analysis of students' learning outcomes.

### **Trial Design**

The trial procedures in this development research were conducted in three stages: expert validation, small-group trial, and field trial.

Expert validation was carried out to assess the content and construct validity of the developed learning model and instructional media. The evaluation involved three categories of experts: subject-matter experts, instructional design experts, and instructional media experts. Subject-matter experts evaluated conceptual accuracy, content depth, and alignment with the intended learning outcomes. Instructional design experts examined the coherence among learning objectives, instructional strategies, and learning activities, while instructional media experts assessed visual presentation, language clarity, and the effectiveness of AI utilization. The evaluation employed Likert-scale validation instruments accompanied by qualitative feedback and revision suggestions. The validation results served as the basis for the initial revision of the product prior to student trials.

The small-group trial involved 6–12 students who shared characteristics similar to those of the target population. This stage aimed to examine the practicality of the model, the implementation of PjBL syntax, and students’ collaborative interactions in authentic learning situations. Data were collected through observations of learning activities, practicality questionnaires, and open discussions to identify technical constraints, clarity of instructions, and the suitability of content with respect to instructional time allocation. The results of the small-group trial were used to refine the product before proceeding to the field trial.

The field trial was conducted to examine the effectiveness of the AI-assisted PjBHL model in improving students’ digital literacy competence. The experimental design employed was a Non-Equivalent Control Group Design, as presented in Table 1.

**Table 1. Non-Equivalent Control Group Design**

Group	Pretest	Treatment	Posttest
Experimental	O1	X1	O2

### **Types of Data and Data Collection Techniques**

The data collected in this study consisted of both quantitative and qualitative data. Quantitative data were obtained from the results of feasibility, practicality, and effectiveness testing of the developed model, while qualitative data comprised feedback, comments, and suggestions provided by experts, lecturers, and students. Data collection techniques included validation sheets, observation sheets, questionnaires, and a digital literacy competence test.

The feasibility instruments assessed in this study included the Semester Learning Plan (Rencana Pembelajaran Semester / RPS) and the digital literacy competence test instrument. The blueprint of the RPS feasibility instrument is presented in Table 2, while the blueprint of the digital literacy competence instrument is shown in Table 3. An observation instrument was used to examine the implementation of the model to measure the practicality of the AI-assisted PjBHL model (Table 4), and a test instrument was employed to assess the effectiveness of the model in improving students’ digital literacy competence (Table 5).

**Table 2. Blueprint of the RPS Feasibility Evaluation Instrument**

Aspect	Indicators
RPS Structure and Format	1. The RPS includes Program Learning Outcomes (PLOs), Course Learning Outcomes (CLOs), Sub-CLOs, assessment components, learning activities, instructional methods, learning modalities, time allocation, student learning experiences, and learning materials. 2. The RPS format complies with the prescribed template.
Content Components	1. The percentage weighting is appropriately aligned with the Sub-CLOs. 2. Learning materials are aligned with the intended learning outcomes. 3. The instructional model is consistent with the AI-assisted Project-Based Hybrid Learning (PjBHL) model.
Language Use	1. Standard and formal Indonesian language is used. 2. Abbreviations and acronyms are used appropriately and are easily understood.
Time Allocation	1. Time allocation is consistent with the credit unit (SKS) requirements. 2. The distribution of time between practicum activities and project-based tasks aligns with the model syntax. 3. Sentence structure adheres to Indonesian language standards (EBI).

**Table 3. Blueprint of the Digital Literacy Competence Feasibility Instrument**

Aspect	Indicators
Internet Searching	1. Ability to conduct effective information searches on the internet. 2. Ability to perform online activities and fulfill information needs through internet resources. 3. Ability to access and utilize digital learning materials.
Hypertextual Navigation	1. Knowledge of how hypertextual navigation functions. 2. Ability to understand the characteristics of webpage menus and navigation structures. 3. Ability to distinguish between digital learning materials and general internet content.
Information Content Evaluation	1. Ability to analyze the background and credibility of information sources. 2. Ability to distinguish between visual presentation and informational content. 3. Ability to understand and utilize Frequently Asked Questions (FAQs) and discussion groups.
Knowledge Assembly	1. Ability to create personalized notifications or information feeds. 2. Ability to analyze and synthesize obtained information. 3. Ability to organize and construct knowledge based on acquired information.

**Table 4. Blueprint of the Model Implementation Observation Sheet**

No.	Indicators
1	Implementation of Instructional Syntax a. Introduction b. Core learning activities c. Closing activities
2	Instructional Effects
3	Nurturant and Supporting Effects
4	Social System
5	Principles of Reaction

**Table 5. Blueprint of the Digital Literacy Competence Test Instrument**

Aspect	Indicators
Internet Searching	1. Students are able to conduct effective information searches on the internet. 2. Students are able to perform online activities and fulfill information needs through internet resources. 3. Students are able to access and utilize digital learning materials.
Hypertextual Navigation	1. Students possess knowledge of how hypertextual navigation functions. 2. Students are able to understand the characteristics of webpage menus and navigation structures. 3. Students are able to distinguish between digital learning materials and general internet content.
Information Content Evaluation	1. Students are able to analyze the background and credibility of information sources. 2. Students are able to distinguish between visual presentation and informational content. 3. Students are able to understand and utilize Frequently Asked Questions (FAQs) and discussion groups.
Knowledge Assembly	1. Students are able to create personalized notifications or information feeds. 2. Students are able to analyze and synthesize the information obtained.

Aspect	Indicators
	3. Students are able to organize and construct knowledge based on acquired information.

**Data Analysis Techniques**

Data analysis in this study was conducted using both qualitative and quantitative approaches. Qualitative data were analyzed through data reduction, data display, and conclusion drawing, following the procedures proposed by Sugiyono (2015). Quantitative data were analyzed using descriptive and inferential statistical methods.

The validity of the developed model was calculated using the validity percentage formula as follows equation 1.

$$V = \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100\% \quad (1)$$

The feasibility category of the model was determined based on the criteria proposed by Andhini (2017), as presented in Table 6. The model was considered feasible if it achieved at least the fairly feasible category and was revised according to validators’ feedback. The practicality of the model was analyzed based on students’ responses using a practicality percentage formula adapted from Wulandari (2022). The model was considered practical if it achieved the practical or very practical category (Ismanto et al., 2022), in accordance with the criteria presented in Table 7.

**Table 7. Model Practicality Score Criteria**

Score Range (%)	Category
$80 \leq \text{score} \leq 100$	Very Practical
$60 \leq \text{score} < 80$	Practical
$40 \leq \text{score} < 60$	Moderately Practical
$20 \leq \text{score} < 40$	Less Practical
$0 \leq \text{score} < 20$	Not Practical

The effectiveness of the model was analyzed by comparing students’ digital literacy competence pretest and posttest scores using an independent statistical test with the assistance of SPSS software version 25. The AI-assisted PjBHL model was considered effective if a statistically significant difference was found between the pretest and posttest scores (Sig < 0.05), with the mean posttest score being higher than the mean pretest score.

**RESULT AND DISCUSSION**

**Model Implementation**

Based on initial observations of the ICT Media course at Universitas Wijaya Putra, the learning process was predominantly dominated by a direct instruction model, resulting in limited opportunities for students to engage in hands-on project development. This condition contributed to low levels of active student involvement in developing digital literacy skills. Accordingly, this study involved 20 students from the English Literature Study Program who were enrolled in the ICT Media course during the even semester of the 2024/2025 academic year. The implementation of the Artificial Intelligence (AI)–assisted Project-Based Hybrid Learning (PjBHL) model was conducted over four instructional meetings.

Prior to implementation, the developed model underwent expert validation involving three experts: a subject-matter expert, an instructional design expert, and an instructional media expert. The validation results indicated that the AI-assisted PjBHL model was classified as highly feasible, with

an average score of 4.5 on a five-point scale. The subject-matter expert evaluated conceptual accuracy, content depth, and alignment with learning outcomes; the instructional design expert assessed the coherence among learning objectives, instructional strategies, and learning activities; while the instructional media expert evaluated interface clarity, language use, and the effectiveness of AI integration in the learning process.

The implementation of the AI-assisted PjBHL model followed five main stages: (1) problem identification, in which students determined project topics based on current digital issues with AI support; (2) collaborative project planning, conducted through both online and offline task distribution; (3) project development, utilizing AI tools such as ChatGPT, Canva AI, and Copilot for poster design, video production, and website development; (4) project presentation and evaluation, carried out in a hybrid format using assessment rubrics and AI-based feedback; and (5) reflection and project revision, based on feedback from both instructors and AI systems. The initial interface and AI feature menus used during learning activities are illustrated in Figures 3 and 4.

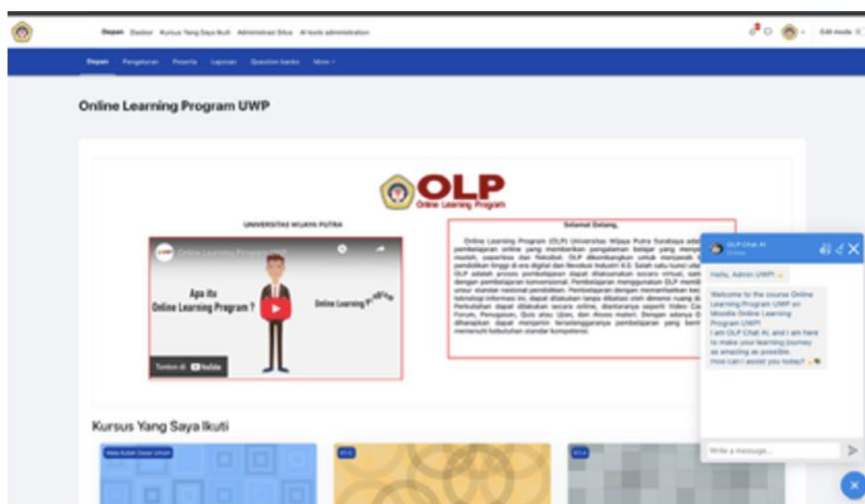


Figure 3. Initial Interface of the AI System

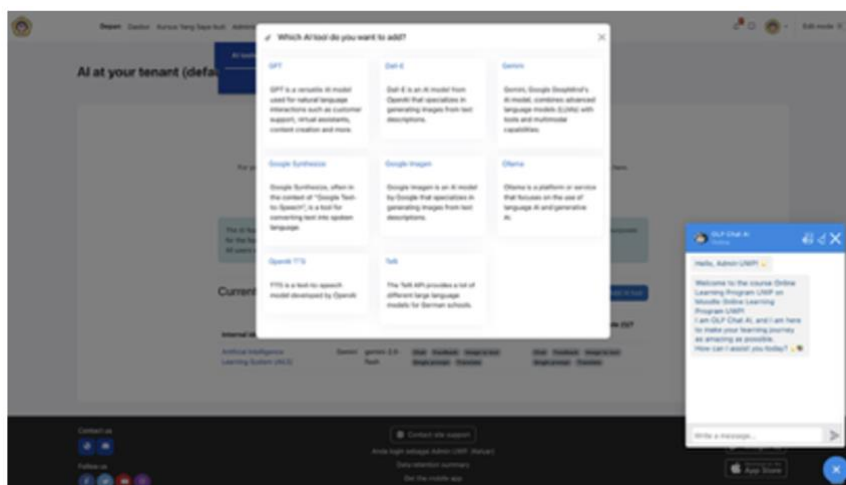


Figure 4. AI Feature Menu Interface

Prior to the research implementation, both lecturers and students received training and guidance on the use of AI applications, supported by the distribution of user manuals. The research was conducted from the 8th to the 11th meeting of the ICT Media course. Digital literacy competence was measured through a pretest administered at the 8th meeting and a posttest administered at the 11th

meeting using validated instruments. Quantitative data were obtained from questionnaire responses and digital literacy competence test results. The results of students' digital literacy competence improvement are presented in Table 8.

Table 8. Improvement Scores of Digital Literacy Competence

Aspect	Pretest	Posttest	Gain
Internet Searching	62.1	84.3	22.2
Hypertextual Navigation	59.7	82.5	22.8
Information Content Evaluation	56.4	87.2	30.8
Knowledge Assembly	61.2	83.1	21.9

The results of the paired t-test analysis yielded a p-value of 0.000 ( $p < 0.05$ ), indicating that the increase in students' digital literacy competence following the implementation of the AI-assisted PjBHL model was statistically significant. In addition to quantitative findings, students' responses to the implementation of the AI-assisted PjBHL model revealed that 91% of students experienced more enjoyable and productive collaborative learning, 87% reported that AI significantly facilitated idea exploration and digital content production, while 14% identified limited internet access during online learning sessions as the primary challenge.

These findings suggest that the implementation of the AI-assisted PjBHL model provides more practical and efficient access to information, particularly in the context of students' high mobility and increasingly diverse reference needs. This phenomenon aligns with the characteristics of learning in the digital era, where students tend to utilize multiple technology-based information sources to support the completion of academic tasks (Priyambudi & Murdani, 2020). Therefore, the AI-assisted PjBHL model not only significantly enhances students' digital literacy competence but also supports more contextual, collaborative, and future-oriented learning aligned with the demands of the Society 5.0 era.

## Discussion

The implementation of the Artificial Intelligence (AI)-assisted Project-Based Hybrid Learning (PjBHL) model was found to significantly enhance students' digital literacy competence, particularly around information content evaluation. This finding indicates that students not only improved their ability to access digital information but also developed stronger critical skills in assessing the credibility and relevance of such information (Friesem, 2019). These results reinforce the notion that project-based learning integrated with hybrid learning environments can sustainably enhance students' cognitive engagement, learning flexibility, and higher-order thinking skills (Raval, 2019; Mustaji & Pradana, 2022).

The integration of AI within the PjBHL model functions as a cognitive partner that supports idea exploration, information processing, and digital content production, thereby distinguishing it from conventional instructional models and PjBL approaches without AI support (Ito et al., 2021; Ng et al., 2023). The observed improvement in information content evaluation further reflects the strengthening of advanced digital literacy skills, particularly content evaluation and knowledge assembly, which are essential competencies for navigating the increasing complexity of information in the Society 5.0 era (Bawden, 2001).

From a theoretical perspective, the effectiveness of the AI-assisted PjBHL model can be explained through the integration of constructivist, cognitivist, and connectivist learning theories. This integration emphasizes experiential project-based learning, systematic information processing, and the utilization of digital networks as primary learning resources (Hwang & Lee, 2019; Zabolotniaia et al., 2020). Students' positive responses toward collaborative learning and idea exploration further support the argument that technology- and AI-enhanced learning environments

can increase learner engagement and reduce cognitive load. Nevertheless, infrastructure readiness—particularly internet accessibility—remains a critical challenge in the implementation of such models (Alhumaid et al., 2020; Salloum & Al-Emran, 2018; Hu Au & Lee, 2017).

Overall, the findings of this study confirm that the AI-assisted PjBHL model represents an effective, adaptive, and relevant instructional approach for enhancing students' digital literacy competence. Moreover, the model demonstrates strong potential for adaptation across other courses, particularly within non-technical study programs, to better prepare graduates with 21st-century competencies aligned with global demands.

## SIMPULAN

Based on the implementation of the five stages of the ADDIE model, the Artificial Intelligence (AI)-assisted Project-Based Hybrid Learning (PjBHL) model was found to be feasible, practical, and effective in enhancing students' digital literacy competence in the ICT Media course at Universitas Wijaya Putra. The developed model received positive responses from most students and was evaluated as relevant by experts in the fields of pedagogy, information and communication technology, and educational technology. Quantitatively, the implementation of the model resulted in an average increase of 24.4 points across all measured digital literacy indicators.

Despite these promising results, this study has several limitations related to the number of participants and the duration of implementation. Therefore, future research is recommended to involve larger samples and longer implementation periods to examine the consistency and sustainability of the model's effectiveness. In addition, subsequent studies should explore the impact of the AI-assisted PjBHL model on other competencies, such as creativity, communication, and collaboration, by developing more comprehensive evaluation instruments. Such efforts would enable a deeper and more holistic assessment of the model's contribution to 21st-century learning.

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