Data and Metadata. 2026; 5:1305
doi: 10.56294/dm20261305

ORIGINAL

Development of IT Project Management Learning Media Using YOLO and Reinforcement Learning

Desarrollo de medios de aprendizaje para la gestión de proyectos de TI mediante YOLO y aprendizaje de refuerzo

Anggun Fergina[1], Lusiana Sani Parwati[1], RR. Amanna Dzikrillah LAH[2], Zaenal Alamsyah[1], Muhammad Fadhli Nurdiansyah Rangkuti[1], Axa Rajandrya[1], Muhammad Rizki Akbar[1]

[1]Nusa Putra University, Informatics Engineering. Sukabumi, Indonesia.
[2]Nusa Putra University, Management. Sukabumi, Indonesia.

Cite as: Fergina A, Parwati LS, Dzikrillah LAH RA, Alamsyah Z, Nurdiansyah Rangkuti MF, Rajandrya A, et al. Development of IT Project Management Learning Media Using YOLO and Reinforcement Learning. Data and Metadata. 2026; 5:1305. https://doi.org/10.56294/dm20261305

Submitted: 11-08-2025 **Revised:** 16-09-2025 **Accepted:** 10-12-2025 **Published:** 01-01-2026

Editor: Dr. Adrián Alejandro Vitón Castillo

Corresponding Author: Anggun Fergina

ABSTRACT

This study addresses the gap in traditional project management education by developing a web-based learning platform for the Information Technology Project Management course. The platform integrates YOLO technology for real-time visual detection and Reinforcement Learning (RL) for automated decision-making. The development process adopted a Research and Development (R&D) approach using the ADDIE model, which consisted of five phases: Analysis, Design, Development, Implementation, and Evaluation. This research is significant as it offers a solution to the challenge of bridging the gap between theoretical knowledge and practical application in project management. The primary objective is to enhance students' understanding of project dynamics and improve their decision-making skills through real-time project monitoring and data-driven recommendations. The development process adopted a Research and Development (R&D) approach using the ADDIE model, consisting of five phases: Analysis, Design, Development, Implementation, and Evaluation. Evaluation results demonstrated that the developed learning media achieved an average validity score of 87,7 %, a practicality score of 85,7 %, and an effectiveness score of 86,4 %, confirming that the platform is valid, practical, and effective in improving student engagement and conceptual understanding of project management. The integration of YOLO and RL technologies proved effective in helping students comprehend project dynamics and support data-driven decision-making.

Keywords: Learning Media; Project Management; Information Technology; YOLO; Reinforcement Learning.

RESUMEN

Este estudio aborda la brecha en la educación tradicional de gestión de proyectos mediante el desarrollo de una plataforma de aprendizaje basada en la web para el curso de Gestión de Proyectos en Tecnología de la Información. La plataforma integra la tecnología YOLO para la detección visual en tiempo real y el Aprendizaje por Refuerzo (RL) para la toma de decisiones automatizada. El proceso de desarrollo adoptó un enfoque de Investigación y Desarrollo (I+D) utilizando el modelo ADDIE, que consta de cinco fases: Análisis, Diseño, Desarrollo, Implementación y Evaluación. Esta investigación es significativa ya que ofrece una solución al desafío de cerrar la brecha entre el conocimiento teórico y la aplicación práctica en la gestión de proyectos. El objetivo principal es mejorar la comprensión de los estudiantes sobre la dinámica de los proyectos y mejorar sus habilidades para tomar decisiones mediante el monitoreo en tiempo real de los proyectos y recomendaciones basadas en datos. Los resultados de la evaluación demostraron que los medios

de aprendizaje desarrollados lograron un puntaje de validez promedio del 87,7 %, un puntaje de practicidad del 85,7 % y un puntaje de efectividad del 86,4 %, lo que confirma que la plataforma es válida, práctica y efectiva para mejorar el compromiso de los estudiantes y la comprensión conceptual de la gestión de proyectos. La integración de las tecnologías YOLO y RL demostró ser efectiva para ayudar a los estudiantes a comprender la dinámica de los proyectos y apoyar la toma de decisiones basada en datos.

Palabras clave: Medios de Aprendizaje, Gestión de Proyectos; Tecnología de la Información; YOLOl; Aprendizaje por Refuerzo.

INTRODUCTION

The rapid advancement of information technology over the past few decades has profoundly influenced nearly every sector, including education. This development, which began with the introduction of personal computers and the internet in the late 20th century, accelerated with innovations such as cloud computing, big data, and artificial intelligence (AI). In higher education, the Outcome-Based Education (OBE) framework has gained widespread adoption to ensure that learning outcomes emphasize both theoretical knowledge and practical skills aligned with industry needs.[1] One of the key implementations of this approach is the Capstone Design project, which engages students in solving real world problems using the knowledge and skills they have acquired throughout their studies.

In the Informatics Engineering curriculum, the Information Technology Project Management course serves as a Capstone Design component, where students apply the knowledge and skills gained throughout their studies to solve a real-world problem through a final project.[2] Technology-based learning media are integral to this process, supporting practical, industry-relevant learning and helping students develop solutions that align with real-world challenges. One such effective media is a project monitoring system, which ensures that each phase of a project progresses according to the established plan, schedule, budget, and objectives. Despite this, many projects still face persistent challenges, such as delays in risk identification, difficulties in estimating time and cost, and a lack of real-time visibility into team productivity.[3] These limitations create a gap between ideal project management principles and the practical realities encountered by project managers.

Recent advancements in artificial intelligence (AI) offer new opportunities to enhance project monitoring and bridge the gap between theory and practice in project management. One relevant AI technology is You Only Look Once (YOLO), which enables real time visual detection and monitoring of project environments, including worker activities, equipment usage, and project status.[4] This capability enables project managers to identify potential delays or risks quickly and with greater accuracy.

Furthermore, Reinforcement Learning (RL) can be applied to provide automated recommendations for optimizing resource allocation and mitigating risks based on real time project data. RL based systems can adapt to dynamic project conditions and deliver more efficient decision making solutions, thereby improving project management effectiveness.[5] Previous studies have demonstrated that integrating AI technologies into project management not only enhances productivity but also significantly reduces operational costs.[6,7]

Given the gap between existing project management teaching practices and emerging technological solutions, this study aims to develop web-based learning media for the Information Technology Project Management course that integrates YOLO and Reinforcement Learning technologies. Traditional project management education often relies on theoretical approaches, case studies, and classroom-based simulations, which may not adequately prepare students for the real-time dynamics of managing complex projects in rapidly changing environments. This study proposes an interactive and industry-relevant approach by integrating YOLO for real-time project activity tracking and Reinforcement Learning for data-driven recommendations.

METHOD

Type of Study

This study used a Research and Development (R&D) approach based on the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE model has been applied in recent studies as a systematic and adaptive framework for instructional design in learning environments.[8,9,10,11] This research selected the R&D approach grounded in the ADDIE framework because it is the most suitable method for developing technology-based learning media, which requires a structured process for needs analysis, system design, implementation, and evaluation of effectiveness.

The model was applied to produce a project monitoring system as a learning medium for the Information Technology Project Management course, integrating artificial intelligence concepts into project management systems. The final product, a web based project monitoring system was designed to help students understand the application of intelligent technologies in efficient and measurable project management, while enhancing

the overall effectiveness of technology supported learning. The complete flow of the research process is illustrated in the following figure.

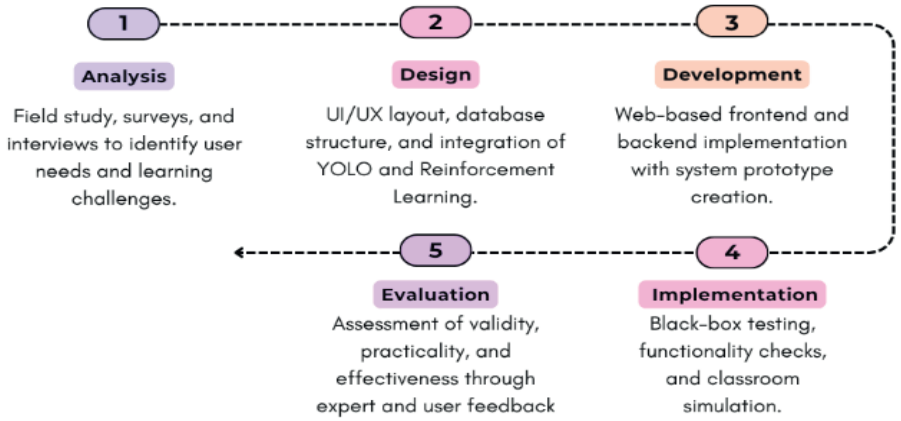


Figure 1. Research Stages Based on the ADDIE Model

Sample

The sample of this study consist of all 330 students and 11 lecturers enrolled in the Information Technology Project Management course at Nusa Putra University during the academic year 2025. The study involved all students taking the course, as well as the lecturers teaching the course across various sections.

Variables

This study evaluated the practicality and effectiveness of the developed learning media based on feedback from lecturers and students.

- Practicality: measured by how easy the system was to use, how clear the instructions were, and how accessible the features were.
- Effectiveness: assessed based on how well the system improved students' understanding of project management concepts, their engagement with the learning process, and the system's ability to help manage projects.

Data Collection and Processing

In the analysis stage, a field study was conducted involving data collection through surveys, questionnaires, and interviews with key stakeholders, including students and industry practitioners in information technology project management. This stage aimed to identify user needs, learning challenges, and real world issues encountered during the learning process. The results of this analysis served as the foundation for defining the system requirements to be developed.

The design stage involved developing the user interface (UI/UX) design, database structure, and the integration of the YOLO algorithm for visual detection and Reinforcement Learning for automated decision making support. The primary focus at this stage was to produce a functional and user-relevant system design aligned with the needs identified in the previous phase.

Next, in the Development stage, the system design was implemented into a web-based application using Visual Studio, MySQL, Pyhton and Laravel. The system was developed based on the predetermined system architecture and learning flow, resulting in a prototype ready for testing and classroom deployment.

The Implementation stage consisted of testing the system through black-box testing, functionality assessments, and classroom simulations in the Information Technology Project Management course. This phase aimed to ensure that the developed system functioned as designed, performed properly, and could be effectively utilized as an interactive learning medium.

The evaluation stage represented the final phase of the ADDIE model, aiming to assess the quality, practicality, and effectiveness of the developed learning media. The evaluation process was conducted to ensure that the web based learning media integrating YOLO and Reinforcement Learning technologies was feasible for instructional use in Information Technology Project Management. In the context of development research, learning media are considered of high quality if they meet three main criteria: validity (appropriateness), practicality (ease of use), and effectiveness (positive impact on learning outcomes).[12] The system was validated through expert reviews and user feedback from students and lecturers, focusing on practicality and effectiveness. Subject matter experts (SMEs) were selected based on their extensive experience in Information Technology Project Management and educational technology. Specifically, three subject matter experts (course lecturers) with expertise in project management and teaching were chosen, along with two instructional media

experts who specialized in educational technology and system usability. These experts were selected to provide comprehensive evaluation across both content accuracy and technical usability.

Ethical Standards

This study was conducted in accordance with the ethical standards of Nusa Putra University. All participants, including students and lecturers, were informed about the nature and purpose of the study. Ethical considerations were taken into account when designing the data collection tools, ensuring that no personal or sensitive information was collected without consent.

RESULTS

The development of the web based learning media for the Information Technology Project Management course was carried out through five main stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. Each stage was conducted systematically to ensure that the resulting media met both user requirements and the established pedagogical and technological standards.

Findings from the Analysis Stage

The analysis stage was conducted to obtain a factual understanding of user needs and learning challenges in the Information Technology Project Management course. Based on field observations and surveys involving 11 lecturers and 330 students, it was found that most students experienced difficulties in understanding project management in a group context. A total of 78 % of student respondents reported the absence of digital tools that support real time project activity monitoring, while 64 % of lecturers indicated that the existing learning media had not yet integrated data driven analytic systems.

The survey was administered online through Google Forms, and included both closed-ended questions for quantitative analysis and open-ended questions to gather qualitative feedback. The questions focused on identifying challenges related to project management, the effectiveness of current learning media, and the need for digital tools to support learning.

Furthermore, interviews with information technology industry practitioners revealed that students' project management skills remain relatively low, particularly in the areas of scheduling, risk control, and project documentation. This condition highlights a gap between the competencies taught in the classroom and the skill requirements demanded by the industry. Therefore, innovative learning media are needed to stimulate students' understanding of project dynamics through an artificial intelligence (AI)-based technological approach.

The needs analysis also identified that both lecturers and students expect the learning media to include visualization features capable of automatically displaying work progress, team status, and target achievements. Based on these findings, the developed learning system was designed to integrate the You Only Look Once (YOLO) algorithm to detect and classify visual activities within the project environment, and Reinforcement Learning (RL) to generate adaptive decision-making recommendations in response to project dynamics.

Findings from the Design and Development Stages

The design and development stages formed the core of the web based learning media creation process, integrating You Only Look Once (YOLO) and Reinforcement Learning (RL) technologies to support learning in the Information Technology Project Management course. Based on the results of the prior needs analysis, the media were designed to bridge the gap between project management theory and its practical implementation through an interactive, measurable, and adaptive digital simulation aligned with students' project dynamics.

The learning design was structured in a modular format to ensure ease of use and adaptability for both lecturers and students. The module structure consists of four main components:

1. Project Initialization, which includes project planning and group task allocation.
2. Project Monitoring, which visualizes task progress and team performance through a web based interface.
3. Visual Analysis and Automated Evaluation, utilizing YOLO to detect project activities and RL to generate optimization recommendations based on monitoring results.
4. Reflection and Reporting, encouraging students to analyze project outcomes and conduct self-assessment.

This modular approach aims to foster learner autonomy, promote collaboration, and enhance students' critical thinking skills within the context of digital project management.

During the development phase, the conceptual design was transformed into a functional web based product. The development process applied principles of user centered design and interactive learning environments. The main focus was on both the algorithmic implementation and the ways in which integrating these technologies could enhance the learning experience.

In this context, YOLO functioned as a visual analytics component, providing real time feedback on students' project activities, such as task progress and team engagement. Meanwhile, Reinforcement Learning was used to personalize learning by delivering automated, performance based recommendations, enabling students to better understand the relationship between managerial decisions and project outcomes. This adaptive approach aligns with the emerging trend of learning analytics in AI driven education.[13]

The system interface was designed to be responsive and intuitive, featuring an interactive dashboard that allows both students and lecturers to monitor project indicators, such as time, cost, and task completion visually and efficiently. Each feature was developed to align with the Outcome-Based Education (OBE) framework, ensuring that learning outcomes can be measured and evaluated. Figures 2 through 6 present the main interface layouts, illustrating the user workflow from login to project reporting.

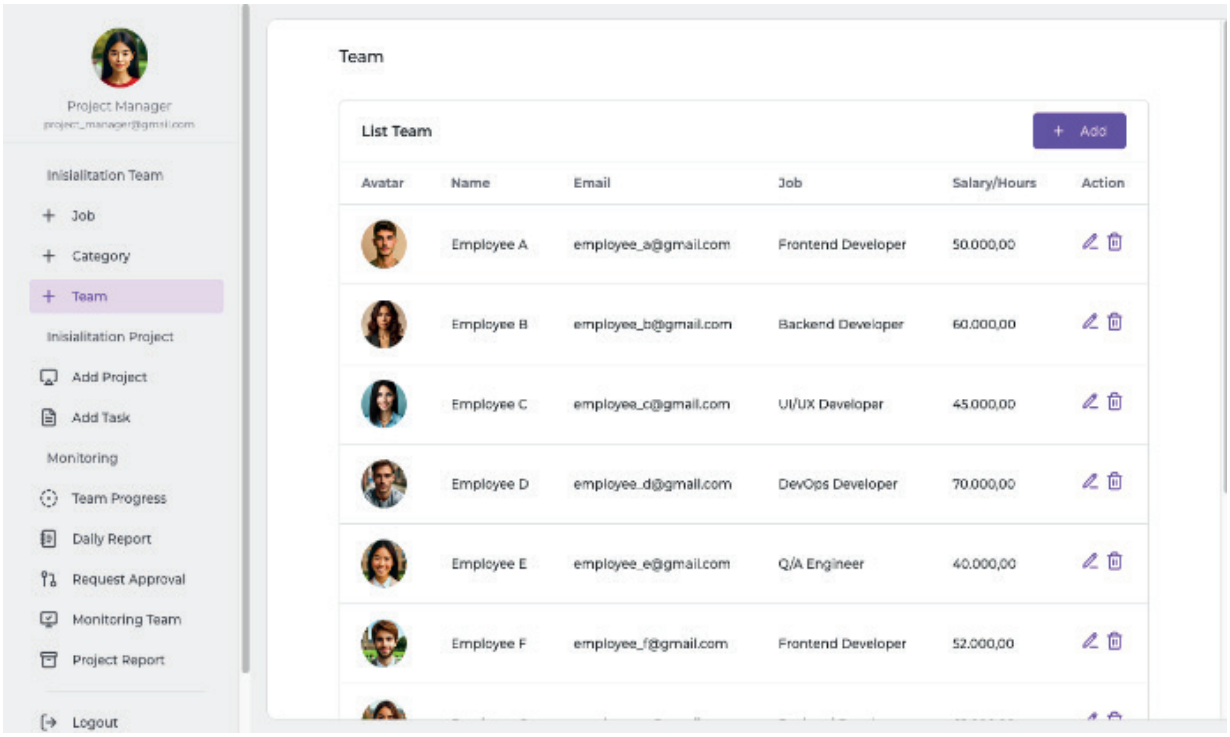


Figure 2. Team and Project Initialization Interface

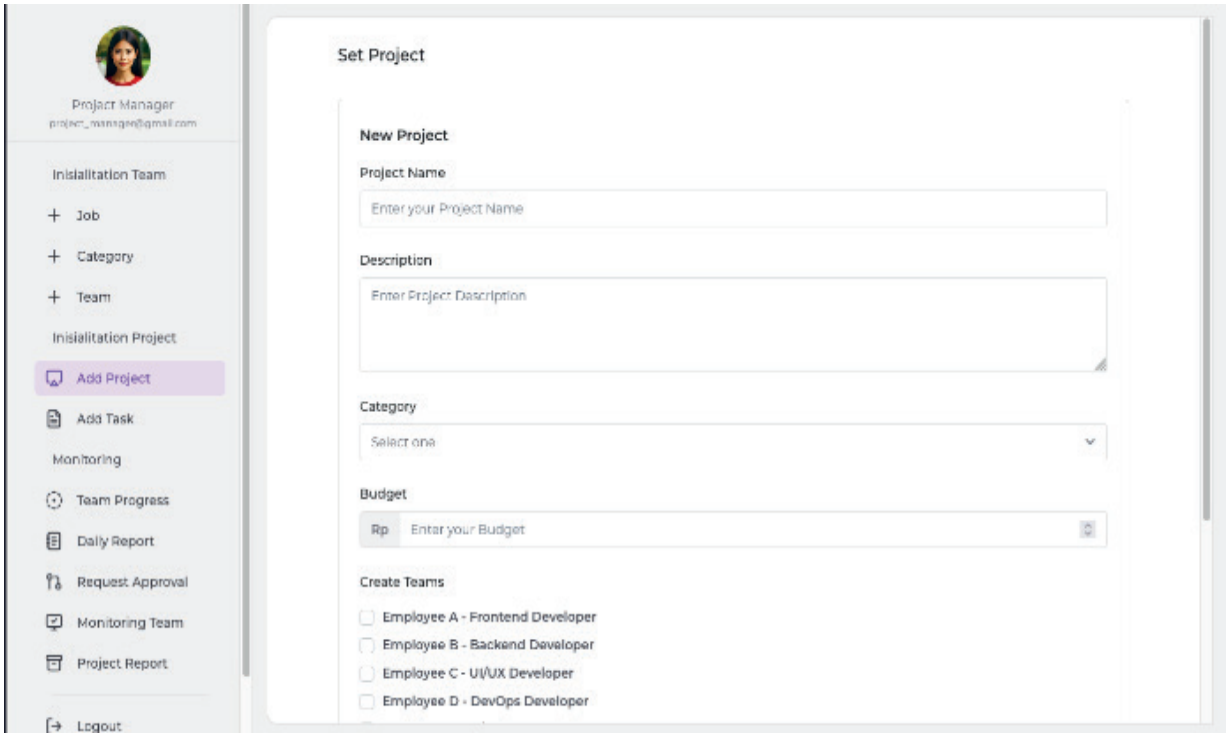


Figure 3. Project Monitoring Dashboard

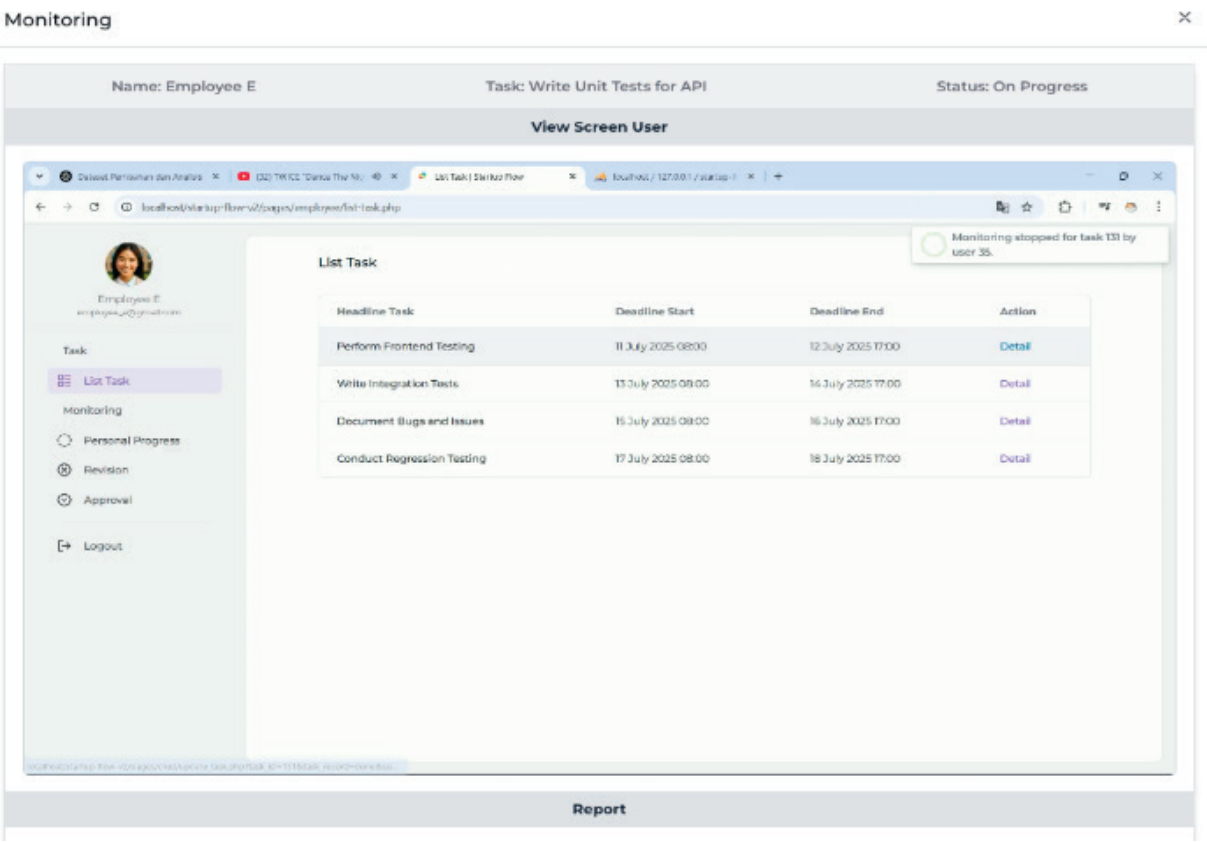


Figure 4. YOLO based Visual Analysis Display

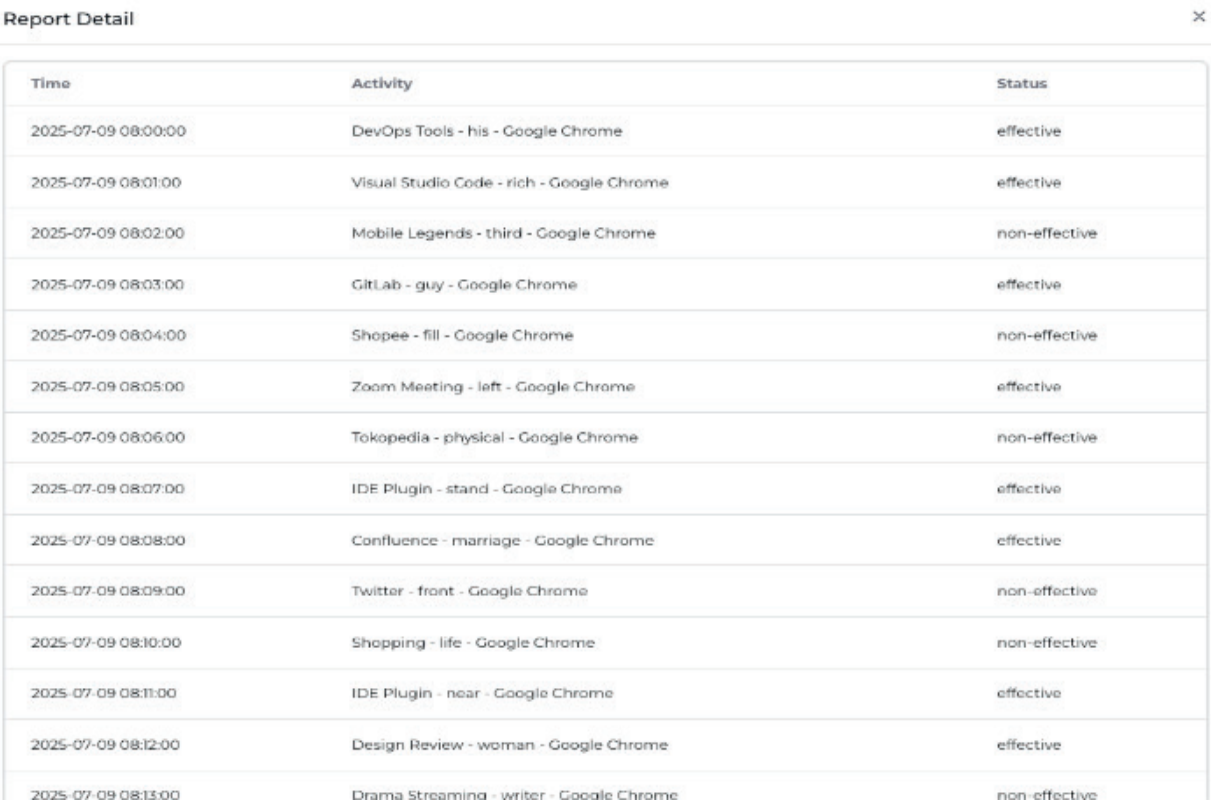
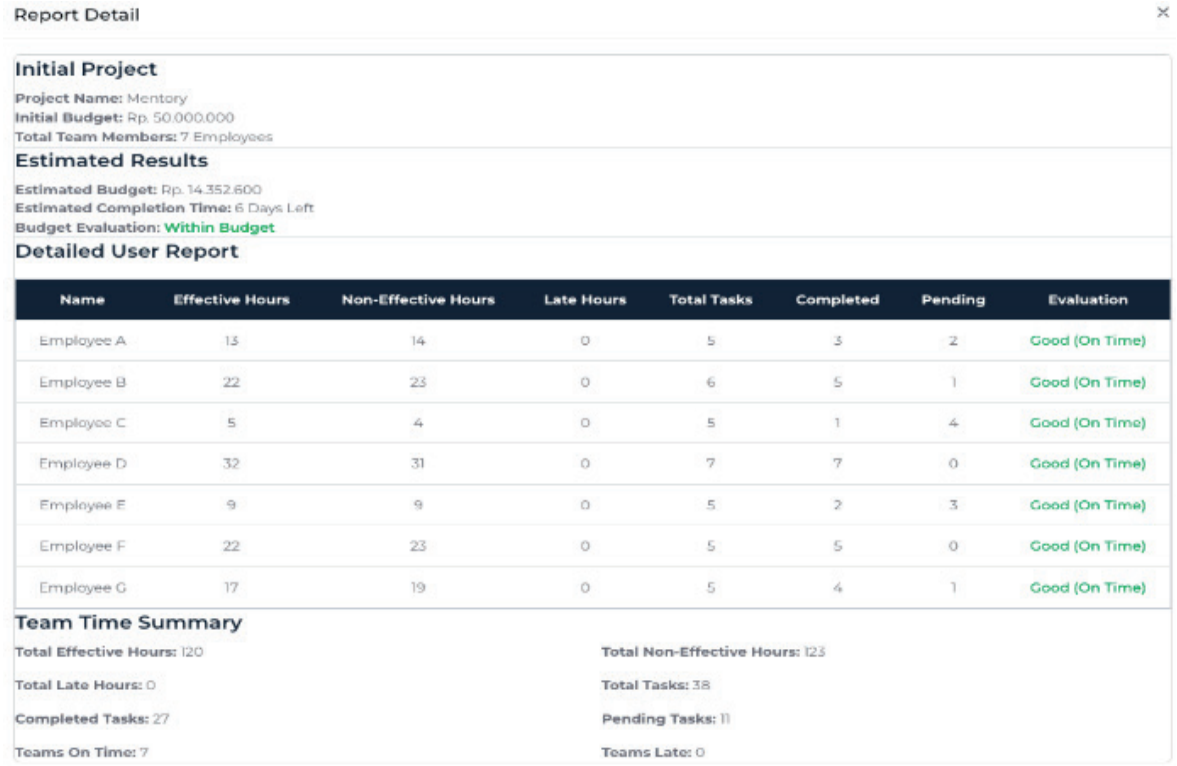


Figure 5. Reinforcement Learning Decision Recommendation Interface

The development results indicate that the integration of YOLO and RL technologies enhanced the interactivity of the learning media and also strengthened the lecturer's role as a facilitator in data-driven learning. Students were able to better understand decision making processes within real project contexts, while lecturers gained

deeper insights into student performance through data visualization and system analytics. These findings are consistent with the study by Spatioti, which emphasized the application of the ADDIE model combined with AI technologies in educational settings, showing similar improvements in interactivity and instructor facilitation. [8] This research also focuses on real-time project monitoring and adaptive learning.


Report Detail

Initial Project

Project Name: Mentory
Initial Budget: Rp. 50.000.000
Total Team Members: 7 Employees

Estimated Results

Estimated Budget: Rp. 14.352.600
Estimated Completion Time: 6 Days Left
Budget Evaluation: Within Budget

Detailed User Report

Name	Effective Hours	Non-Effective Hours	Late Hours	Total Tasks	Completed	Pending	Evaluation
Employee A	13	14	0	5	3	2	Good (On Time)
Employee B	22	23	0	6	5	1	Good (On Time)
Employee C	5	4	0	5	1	4	Good (On Time)
Employee D	32	31	0	7	7	0	Good (On Time)
Employee E	9	9	0	5	2	3	Good (On Time)
Employee F	22	23	0	5	5	0	Good (On Time)
Employee G	17	19	0	5	4	1	Good (On Time)

Team Time Summary

Total Effective Hours: 120
Total Non-Effective Hours: 123
Total Late Hours: 0
Total Tasks: 38
Completed Tasks: 27
Pending Tasks: 11
Teams On Time: 7
Teams Late: 0

Figure 6. Project Summary and Evaluation Display

Findings from the Implementation Stage

During the implementation stage, the developed learning media were tested using the blackbox testing method, aimed at evaluating system functionality based on predefined specifications without examining the internal code structure.[14] Additionally, functionality testing was performed to verify that each feature within the learning media functioned as intended, including project monitoring, team performance analysis, and automated recommendations generated through Reinforcement Learning.

A simulation trial followed in the Information Technology Project Management course, with students acting as direct users of the web-based learning media. Students were provided full access to the system in a real project simulation setting, which involved monitoring progress, managing time, costs, and project risks. The goal of this stage was to confirm that the developed system operated as designed and could effectively serve as an interactive learning tool for both lecturers and students.

Findings from the Evaluation Stage

The evaluation stage in the ADDIE model aimed to assess the quality, practicality, and effectiveness of the developed learning media. The purpose of this evaluation was to ensure that the web based learning system integrating YOLO for visual project detection and Reinforcement Learning (RL) for automated decision recommendations met both pedagogical and technological standards in supporting the Information Technology Project Management course. The evaluation involved subject matter experts, lecturers, and students, who assessed several key aspects of the developed media.

Table 1. Validation Assessment by Content and Media Experts

No	Assessment Aspect	Average Score	Criteria
1	Alignment of Media with Learning Objectives	88,5 %	Excellent
2	User Interface (UI/UX) Design Quality	87,1 %	Excellent
3	Feature Compatibility with OBE Curriculum	86,9 %	Excellent

The evaluation results indicate that the system is valid for instructional use. The overall average score of

87,7 % demonstrates that the media achieved the "excellent" category in terms of content relevance, interface design, and material quality aligned with the Outcome based Education (OBE) curriculum.

The practicality and effectiveness aspects were assessed using questionnaires distributed after the implementation of the YOLO and RL integrated learning media in classroom sessions. Practicality was evaluated based on interface usability, clarity of user instructions, and accessibility of key features such as project monitoring and team performance analysis. Effectiveness was measured through the media's impact on learning outcomes and student engagement in project based learning.

Table 2. Practicality Assessment by Lecturers and Students

No	Assessment Aspect	Lecturers	Students	Average	Criteria
1	Ease of Use	87,3 %	84,6 %	85,9 %	Excellent
2	Clarity of User Instructions	85,9 %	83,5 %	84,7 %	Excellent
3	Navigation and Feature Accessibility	88,1 %	85 %	86,6 %	Excellent

Table 3. Effectiveness Assessment by Lecturers and Students

No	Assessment Aspect	Lecturers	Students	Average	Criteria
1	Improvement in Understanding Project Management Concepts	87,5 %	86,2 %	86,8 %	Excellent
2	Student Engagement in Learning	88 %	87 %	87,5 %	Excellent
3	System Effectiveness in Managing Projects	86,2 %	84,9 %	85,6 %	Excellent

The evaluation results demonstrate that the developed media are highly practical, with an overall average score of 85,7 %, indicating that the system is easy to operate and effectively supports project based learning activities. Moreover, the learning media were found to be effective in enhancing student engagement and conceptual understanding, with an average effectiveness score of 86,4 %. Students reported higher involvement during the learning process and improved ability to utilize the analytical features, enabling them to manage projects more efficiently. The Reinforcement Learning–based analytics feature provided automated recommendations that significantly supported decision making within project simulations.

DISCUSSION

The findings of this study demonstrate that the developed web-based learning media, integrating YOLO for visual detection and Reinforcement Learning (RL) for decision-making, significantly improved the learning experience in the Information Technology Project Management course. The system's validity score of 87,7 % indicates that both the content and interface design align closely with the intended learning outcomes and the Outcome-Based Education (OBE) curriculum framework. These results match those of Yulia, who emphasized the importance of aligning instructional tools with learning objectives to ensure their pedagogical effectiveness.[12]

The practicality score of 85,7 % indicates that the developed media are user-friendly for both lecturers and students. This finding aligns with Kabudi, who identified practicality as a critical factor in the adoption of educational technology.[15] The system's usability and feature accessibility, including project monitoring and team performance analysis, contributed to the positive feedback from both lecturers and students, confirming that the media function well in real-world learning environments.

In terms of effectiveness, the learning media achieved an average score of 86,4 %, demonstrating its role in enhancing students' understanding of project management concepts and fostering their engagement in project-based learning. The Reinforcement Learning component was key in providing personalized recommendations, helping students refine their decision-making skills in real-time project monitoring contexts. This result supports Sajja's findings, which showed that AI and learning analytics improve learning outcomes by providing adaptive feedback based on learner performance.[13]

Furthermore, the integration of YOLO for visual project monitoring was an effective tool for enhancing students' situational awareness of project dynamics, such as task progress and team performance. The real-time feedback mechanism allowed students to gain deeper insights into project workflows and make informed decisions. This aligns with Spatioti's findings, which showed that visual analytics enhance learning by promoting active engagement and contextual understanding.[8]

While this study highlights the promising potential of AI driven learning media for project management education, future research could explore the integration of Natural Language Processing (NLP) to enhance interaction between students and the system. Such integration could enable adaptive dialogic learning

environments where students can engage with the AI system more intuitively and receive real time feedback in natural language.

CONCLUSIONS

This study aimed to develop a web-based learning media for the Information Technology Project Management course, integrating YOLO for visual detection and Reinforcement Learning (RL) for decision-making. The objective was to create an interactive learning tool that enhances student engagement and decision-making capabilities in real-world project management contexts.

The developed media proved to be both practical and effective for students' learning, aligning with the Outcome-Based Education (OBE) framework. By integrating AI technologies like YOLO and RL, the system supported real-time project monitoring and adaptive learning, helping students refine their project management skills.

BIBLIOGRAPHIC REFERENCES

1. Mufanti R, Carter D, England N. Outcomes-based education in Indonesian higher education: Reporting on the understanding, challenges, and support available to teachers. Soc Sci Humanit Open. 2024;9.

2. Khakurel J, Porras J. The Effect of Real-World Capstone Project in an Acquisition of Soft Skills among Software Engineering Students. In: 2020 IEEE 32nd Conference on Software Engineering Education and Training, CSEE and T 2020. 2020.

3. Zhang L, Ma Y. A study of the impact of project-based learning on student learning effects: a meta-analysis study. Front Psychol. 2023;14.

4. Gheorghe C, Duguleana M, Boboc RG, Postelnicu CC. Analyzing Real-Time Object Detection with YOLO Algorithm in Automotive Applications: A Review. C - Comput Model Eng Sci. 2024;141(3):1939–81.

5. Sutton RS, Barto AG. Reinforcement Learning: An Introduction. IEEE Trans Neural Networks. 2005;9(5).

6. Odeh M. The Role of Artificial Intelligence in Project Management. IEEE Eng Manag Rev. 2023;51(4):20–2.

7. Salimimoghadam S, Ghanbaripour AN, Tumpa RJ, Kamel Rahimi A, Golmoradi M, Rashidian S, et al. The Rise of Artificial Intelligence in Project Management: A Systematic Literature Review of Current Opportunities, Enablers, and Barriers. Buildings. 2025;15(7):1–32.

8. Spatioti AG, Kazanidis I, Pange J. A Comparative Study of the ADDIE Instructional Design Model in Distance Education. Vol. 13, Information (Switzerland). 2022.

9. Salas-Rueda RA, Salas-Rueda ÉP, Salas-Rueda RD. Analysis and design of the web game on descriptive statistics through the addie model, data science and machine learning. Int J Educ Math Sci Technol. 2020;8(3).

10. Shakeel SI, Al Mamun MA, Haolader MFA. Instructional design with ADDIE and rapid prototyping for blended learning: validation and its acceptance in the context of TVET Bangladesh. Educ Inf Technol. 2023;28(6).

11. Zhang Z, Yue S, Wang J, Yang P. An innovative teaching model of automotive manufacturing process based on ADDIE model. Appl Math Nonlinear Sci. 2024;9(1).

12. Yulia ZNML, Triwahyudianto T, Kumala FN, Aiman WM. Interactive media based on project-based learning using Lumi Education for IPAS subjects in 4th-grade elementary school. J Environ Sustain Educ. 2025;3(1):11–20.

13. Sajja R, Sermet Y, Cwiertny D, Demir I. Integrating AI and Learning Analytics for Data-Driven Pedagogical Decisions and Personalized Interventions in Education. Technol Knowl Learn. 2023. http://arxiv.org/abs/2312.09548

14. Jorgensen PC, DeVries B. Software Testing A Craftsman's Approach. CRC Press. 2021.

15. Kabudi T, Pappas I, Olsen DH. AI-enabled adaptive learning systems: A systematic mapping of the literature. Comput Educ Artif Intell. 2021;2.

FINANCING

This research was funded by the HIBAH BIMA Regular Fundamental Research Grant 2025 from Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Anggun Fergina.

Data curation: Anggun Fergina, Muhammad Fadhli Nurdiansyah Rangkuti, Axa Rajandrya, Muhammad Rizki Akbar.

Formal analysis: Anggun Fergina, Zaenal Alamsyah.

Research: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah, Muhammad Fadhli Nurdiansyah Rangkuti, Axa Rajandrya, Muhammad Rizki Akbar.

Methodology: Anggun Fergina, Zaenal Alamsyah, Muhammad Fadhli Nurdiansyah Rangkuti, Axa Rajandrya, Muhammad Rizki Akbar.

Project management: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.

Resources: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah, Muhammad Fadhli Nurdiansyah Rangkuti, Axa Rajandrya, Muhammad Rizki Akbar.

Software: Anggun Fergina, Muhammad Fadhli Nurdiansyah Rangkuti, Axa Rajandrya, Muhammad Rizki Akbar.

Supervision: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.

Validation: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.

Display: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.

Drafting - original draft: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.

Writing - proofreading and editing: Anggun Fergina, Lusiana Sani Parwati, RR. Amanna Dzikrillah LAH, Zaenal Alamsyah.