



Development and Feasibility of an LMS-Supported Collaborative Project-Based Learning Model for Classroom Action Research

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Abstract

Received : July 2, 2026
Revised : August 1, 2026
Accepted : August 31, 2026

This study aims to develop a collaborative project-based learning model supported by a Learning Management System (LMS) to enhance students' scientific reasoning skills in the Classroom Action Research (CAR) course within the Pre-service Teacher Professional Education Program (PPG Prajabatan) at Universitas Negeri Malang. Employing the ADDIE development model, the research indicates that the instructional model was validated by experts and considered feasible for implementation in the Teaching of Classroom Action Research course. The validation process confirmed the model's relevance, feasibility, effectiveness, and sustainability. Expert validation yielded a feasibility score of 90% and the results from the lecturers likewise indicate a high level of feasibility; Respondent 1 obtained a total of 82.5%, which is categorized as highly feasible, while Respondent 2 obtained a total of 77.5%, which is categorized as feasible, indicating that the model is highly suitable for implementation. This article provides a detailed discussion of the model's design, implementation outcomes, challenges encountered, and recommendations for further development.

Keywords:

collaboration, project-based learning, scientific reasoning

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How to Cite: Oktaviani, H. I., Sari, Z. N., Yuniawatika, Kurniawan, C., Nahri, M. H. A., & Kusuma, P. W. F. (2026). Development and Feasibility of an LMS-Supported Collaborative Project-Based Learning Model for Classroom Action Research. *JTP - Jurnal Teknologi Pendidikan*, 28(2), 838-852. <https://doi.org/10.21009/jtp.v28i2.69930>

INTRODUCTION

The Pre-service Teacher Professional Education Program (PPG Prajabatan) is a professional education program intended to prepare a new generation of Indonesian teachers who possess a genuine calling to teach, professionalism, a commitment to serving as role models, a love for the profession, and a disposition as lifelong learners. To produce professional teachers, the program offers core, selective, and elective courses. Elective courses are optional courses designed and developed by each higher education institution. As a provider of the PPG Prajabatan program, Universitas Negeri Malang (UM) has developed elective courses comprising Professional Ethics, Learning Innovation, and Classroom Action Research. These courses are developed in accordance with the needs of UM's PPG students. The Classroom Action Research (CAR) course aims to strengthen educators' professionalism and to foster a proactive attitude toward the continuous improvement of instructional quality. The project for this course produces scholarly work employing the classroom action research method. Such



scholarly work is expected to serve as a reference for enhancing instructional quality that can be applied across various educational institutions.

Learning activities in the PPG Prajabatan program are conducted both offline and online. Offline activities take the form of two-credit-hour face-to-face sessions for each course, whereas online activities are carried out asynchronously through the LMS. Meanwhile, the elective courses are still being developed by UM's PPG study program in the form of modules following the Self-directed flow. The online activities for this course have not yet been developed, which results in a lack of student autonomy and engagement in project development (Al Mamun & Lawrie, 2023). Through self-directed learning, students can tailor their learning experiences to their learning styles, interests, and needs, and can explore topics and complete tasks independently (Shamsuddin & Kaur, 2020).

A preliminary study of the implementation of the Classroom Action Research (CAR) course within the PPG Prajabatan program conducted through observation as well as interviews with the course instructors and students revealed that many students still experience difficulty in independently producing CAR-based scholarly work. Common obstacles include a limited understanding of the CAR cycle, minimal experience in designing research instruments, and weak data-analysis skills. These conditions indicate that more intensive mentoring is required, particularly during the planning and implementation stages of CAR. CAR-based learning itself holds considerable potential for enhancing educators' professionalism, as it directly involves teachers in a reflective cycle aimed at continuously improving classroom practice. In practice, however, many PPG students struggle to develop CAR-based scholarly work. This is attributable to students' limited autonomy, which in turn affects the quality of their scholarly output. Studies show that students require a more flexible and interactive learning approach to motivate them in completing CAR projects (Shamsuddin & Kaur, 2020). Furthermore, the collaborative methods applied to date have been less effective in encouraging students to contribute optimally to the completion of group projects (Mertler, 2021).

The CAR method focuses on solving concrete classroom problems and improving teaching practice directly through actions that are planned, implemented, observed, and evaluated by the teacher (Mertler, 2021). Because it is carried out in repeated cycles, this type of research requires an observer in practice to offer suggestions for improvement and to evaluate the instruction. For this reason, learning activities in the CAR course become more meaningful when carried out collaboratively on the projects being developed (Aldridge et al., 2021). Such collaboration can assist in collecting data, providing feedback, and supporting the implementation of the proposed actions.

The innovation of the Collaborative Project learning model in the CAR course helps students and lecturers collaborate to produce scholarly project work based on classroom action research. This model is LMS-supported so that it can be implemented flexibly. Students can study according to their own schedules and adjust their study time around other obligations, namely their internship or teaching practicum (PPL). In addition, lecturers can monitor individual progress by tracking learning advancement, thereby identifying aspects that require improvement or supplementation. The diverse features of the LMS support the

collaborative project-based learning process without diminishing the essence of the course, even when it is conducted online. Collaborative project-based learning is more meaningful and more relevant to the real world (Ramli et al., 2021).

Accordingly, this study develops a collaborative project-based learning model and is supported by a Learning Management System (LMS). The elements developed relate to the learning steps aligned with the objectives of the Classroom Action Research course, the learning content, and the collaborative, project-based online activities. This development aims to produce a Collaborative Project-Based Learning Model designed to facilitate students in developing scientific papers through collaborative project completion. This model integrates project-based learning activities with the use of a Learning Management System (LMS) as a medium to support collaboration, monitoring project progress by lecturers, providing feedback, and ongoing mentoring processes. This research focuses on model development and evaluating its feasibility and suitability based on learning components through expert validation. The validation results are expected to provide an overview of the quality of the model design and its potential as a learning alternative in supporting the collaborative scientific paper preparation process.

METHODS

This research uses the Research and Development (R&D) method with the aim of developing a Collaborative Project-Based Learning Model for the Classroom Action Research course in the Pre-Service Teacher Professional Education Program (PPG). The method employed follows the ADDIE development model, which stands for Analysis, Design, Development (or Production), Implementation (or Delivery), and Evaluation (Aldoobie, 2015). The ADDIE model is applied to develop learning products that are performance-based, student-centered, innovative, authentic, and inspiring, owing to its comprehensive framework (Branch, 2009). The development of this model was carried out in September 2025 and continued with a validation stage involving experts and lecturers in October 2025. The entire process was conducted with the participation of 368 students in the Pre-service Teacher Professional Education Program (PPG Prajabatan) at Universitas Negeri Malang from the 2023 intake to conduct a needs analysis. In the development stage of this research, expert validators and PPG teaching lecturers were involved to determine the feasibility of the model.

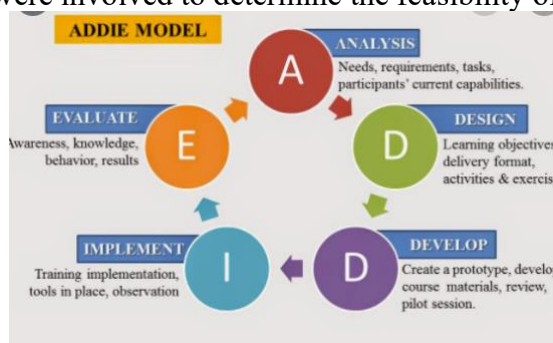


Figure 1. The ADDIE Model Flow Source: Aldoobie (2015)

The development steps of the ADDIE model are as follows.

Analysis

The analysis phase aims to identify the needs for developing a learning model for the Classroom Action Research course in the Pre-Service Teacher Training Program (PPG). The model targets Pre-Service Teacher Training students, who are generally recent undergraduate graduates preparing to become professional teachers. The analysis revealed that students still experience difficulties in identifying learning problems in schools, formulating research focuses, developing PTK proposals, and developing scientific papers systematically. Furthermore, the conventional mentoring process has not been able to provide ongoing guidance and feedback throughout the research process. Analysis of the instructional objectives, or the general learning objectives, is conducted to determine the desired end results, including a reference for formulating the learning evaluation. The objectives are formulated after the instructional analysis, in the form of specific learning objectives aligned with the previously formulated Course Learning Outcomes (SCPL). Learning objectives are a detailed elaboration of the instructional objectives that indicate how the achievement of the objectives is to be measured. They are designed using the Audience, Behavior, Condition, and Degree (ABCD) criteria.

Design

At the design stage, the researchers design the research product based on the analysis previously conducted. The design activities are: (1) creating the design of the collaborative project model; (2) designing collaborative project-based learning; and (3) creating a storyboard of the online learning activities that apply collaborative projects using the LMS.

Development or Production

Having designed the product, at this stage the researchers develop it. The series of activities at this stage are: (a) developing the collaborative project-based learning model; (b) developing collaborative project-based online activities through the LMS platform; (c) creating the research instrument sheets, namely the instrument for the instructional design expert and instrument responses for PPG lecturers and (d) compiling the teaching materials.

Implementation and Evaluation

The research only reached the development stage. This model was developed for Pre-Service PPG students as target users. In this study, 368 students were involved only in the needs analysis phase to identify learning problems in the Classroom Action Research course. Validation was conducted by three validators, selected purposively based on their competency and experience in relevant fields: an instructional design expert and a PPG lecturer experienced in learning development. The validators were not involved in the model development process, and therefore, the assessment was conducted independently.

RESULTS & DISCUSSION

Results

Needs Analysis

The learners are PPG students whose scholarly writing output remains limited. Many of the assignments completed by PPG students are not based on scholarly work. Yet PPG students are at the postgraduate level, at which producing scholarly writing should be mandatory as a form of responsiveness to the scholarship of the teaching profession that can be shared with others. However, according to a survey conducted by the publication division of the PPG management team, of a target of 1,000 published articles, only 50% reached the publication stage. Even this figure was achieved through an Article Writing Mentoring program involving training and review by several selected article reviewers.

If this program were designed within an elective CAR course, it would help students produce their scholarly writing. The projects produced to date have stemmed from various assignments, including Field Experience Practicum (PPL) activities in schools. The learning process undertaken by PPG students follows a clinical-study approach, in which coursework is reinforced by PPL activities in schools and supported by an LMS to facilitate both online and offline learning. For this reason, a learning model that supports these aims needs to be developed.

A needs analysis was conducted on 368 students of the Pre-Service Teacher Professional Education Program (PPG) through a survey to identify problems in learning implementation. The analysis results revealed several key needs. First, students require a more systematic learning flow in the Learning Management System (LMS), particularly in organizing project stages, assignments, and evidence of learning outcomes. Second, students expect more intensive guidance through ongoing monitoring and feedback mechanisms during the preparation of Classroom Action Research proposals and reports. Third, students expect more structured learning management, including clarity of academic information, synchronization of lecture schedules with Praktik Pengalaman Lapangan (PPL), and the delivery of information through a single integrated system.

The learning outcome of this course is to enable prospective teachers to develop and strengthen their competence in producing Classroom Action Research scholarly writing based on the results of instructional research—which encompasses the learning process and the learning environment of students—and in designing, implementing, and evaluating instruction contextually. This competence is developed in stages: (1) understanding the fundamental concepts of writing Classroom Action Research; (2) developing CAR scholarly writing based on its implementation during PPL activities; and (3) publishing the resulting scholarly writing in national or international journals.

Design

The design of the Collaborative Project model is formulated as follows.

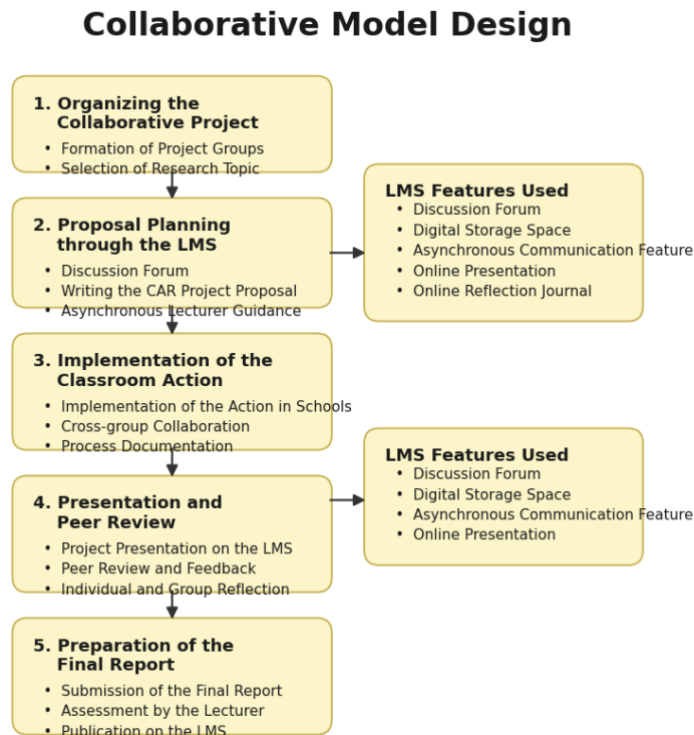


Figure 2. Design of the Collaborative Project Model (Source: Personal Documentation)

1. Stage of Organizing the Collaborative Project

- a. Formation of Project Groups: Students are divided into small groups (3–5 members) with the aim of forming collaborative teams. Each group works on a different CAR project according to the problem identified in the field.
- b. Selection of the Research Topic: Each group selects a CAR research topic relevant to real problems in the school or internship site. This selection is made independently by the students, in line with the MERDEKA-flow approach.

2. Stage of Proposal Planning through the LMS

- a. Discussion Forum: Each group creates a dedicated discussion space on the LMS to discuss and formulate the research problem, the hypotheses, and the planned course of action.
- b. Writing the CAR Project Proposal: Students upload their CAR proposals to the LMS. The proposal must include the research objectives, the problem formulation, the action method, the research instruments, and the planned evaluation steps.
- c. Asynchronous Lecturer Guidance: Lecturers provide feedback and suggestions asynchronously on the LMS regarding the submitted proposals. This communication takes place through discussion forums or private messages within the LMS.

3. Stage of Implementing the Classroom Action

- a. Implementation of the Action in Schools: Students implement the actions in accordance with the approved research plan in their respective schools or in a teaching simulation.
- b. Cross-group Collaboration: Each group collaborates with other groups through the LMS to share progress, interim results, and the challenges encountered during implementation. This activity can be conducted through the open-forum feature of the LMS.
- c. Process Documentation: Each group is required to document every stage of the CAR through videos or written reports uploaded to the LMS as evidence of the action's implementation.

4. Stage of Presentation and Peer Review

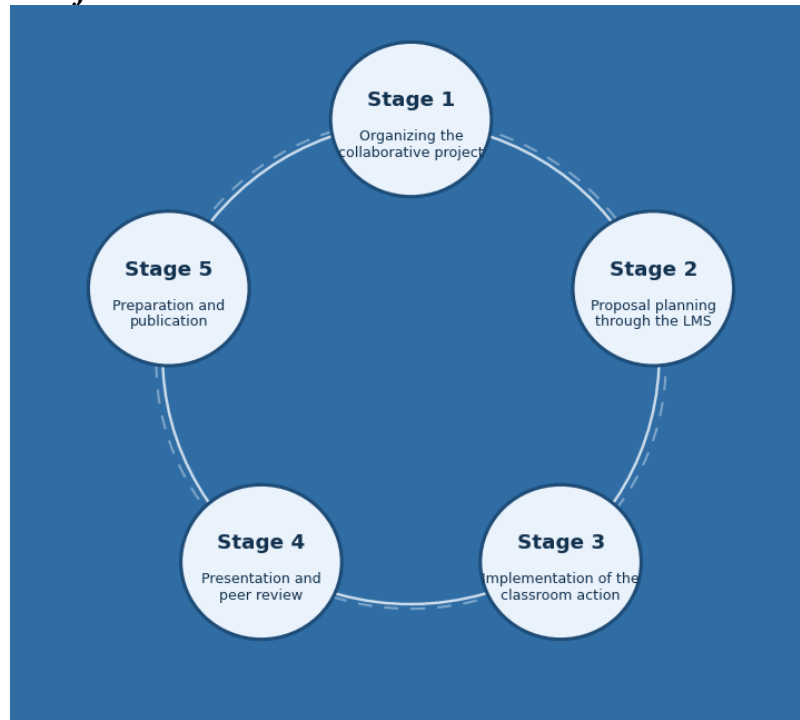
- a. Project Presentation on the LMS: Each group presents its research findings in a presentation format (video or slides) and uploads it to the LMS. The presentation must explain the problem investigated, the actions taken, the data collected, and the results of the analysis.
- b. Peer Review and Feedback: Students from other groups provide reviews of and feedback on other groups' projects through the LMS discussion feature. This enables further collaboration and peer evaluation.
- c. Individual and Group Reflection: Each student is asked to write a personal reflection on the LMS about the learning gained during the CAR project, particularly regarding scientific reasoning. Groups also conduct a joint reflection on the challenges and successes of the project.

5. Stage of Preparing the Final Report

- a. Submission of the Final Report: Each group compiles a final report covering the entire CAR cycle (planning, action, observation, and reflection) and uploads it to the LMS.
- b. Assessment by the Lecturer: The lecturer assigns grades based on the final report, the contributions to the forum, and the level of student engagement in the collaboration.
- c. Publication on the LMS: The best CAR projects are published on the LMS for the whole class to access, with the aim of motivating students and providing examples of best practice in implementing CAR.

6. LMS Features Used

- a. Discussion Forum: For group and cross-group discussions.
- b. Digital Storage Space: A space for uploading proposals, reports, and project documentation.
- c. Asynchronous Communication Feature: For lecturer guidance and feedback.
- d. Online Presentation: A space for project presentations and peer review.
- e. Online Reflection Journal: For students to write personal and group reflections on the project.

Development of the Product**Figure 3.** Syntax of the Collaborative Project Model (Source: Personal Documentation)**Table 1.** Learning Activities Using the Collaborative Project Model

Week	Learning Objective	Topic	Learning Activities	Assesment
Stage 1. Organizing the collaborative project				
1	Introduction to Classroom Action Research (CAR) and orientation to the use of the Canvas LMS.	Introduction to the CAR Course and the Canvas LMS	1. Students are divided into small groups (3–5 members) to work on a CAR project. 2. Each group determines the role of each member (coordinator, note-taker, data processor, etc.). 3. Group organization is carried out through the discussion forum on the Canvas LMS.	Performance assessment and diagnostic assessment Assessment rubric: 1. Accuracy of problem identification, 2. relevance to the learning context, 3. completeness of data, 4. argumentation based on field evidence
2	Understanding the fundamentals of CAR, including its characteristics, cycle, and methodology.	Fundamental Concepts of CAR	1. Students discuss and select a research topic based on real problems at the internship site (PPL). 2. Each group presents its initial topic idea through the online forum on the LMS. 3. The lecturer provides	

			asynchronous feedback on the relevance and feasibility of the topic.
3	Practice in identifying problems at the internship site as the basis for CAR.	Identification of the Research Problem	observation at school by conducting needs analysis in the form of tests, interviews and observations
Stage 2. Proposal planning through the LMS			
4	Designing a CAR proposal that includes the problem, objectives, and action plan.	Preparation of the CAR Proposal	1. Groups prepare a CAR research proposal that includes: problem identification, research objectives, an action plan (CAR cycle), and data-collection methods. 2. The proposal is uploaded to the Canvas LMS for lecturer review. 3. Guidance is communicated through forums and asynchronous messages on the LMS.
5	Provision of feedback and revision of the proposal through the Canvas LMS.	Asynchronous Proposal Guidance on the LMS	1. The lecturer reviews the proposal and provides input for improvements through the discussion forum. 2. Students revise the proposal.
Stage 3. Implementation of the classroom action			
6	Implementing the action in accordance with the CAR proposal at the internship site or in a simulation.	Implementation of the Action in the Field	1. Groups provide feedback on other groups' presentations through the comment feature on the LMS. 2. Each student writes a personal reflection on the learning gained from the project. 3. Groups prepare a joint reflection on the challenges and successes they experienced.
7	Cross-group discussion through the LMS and uploading of process	Collaboration and Documentation	1. Students discuss the implementation in the LMS discussion room. 2. Students present the results of their

	documentation.		- research conducted in class by uploading the resulting documents and photos. 3. Lecturers provide feedback on the discussion results and documentation.	improvements based on the reflection results.
8	Analyzing the action data and compiling the research results.	Analysis and Compilation of Results	1. Each group analyzes the data resulting from the action using the planned method. 2. Groups compile the research results in a presentation format (video or slides). 3. The presentation is uploaded to the LMS for review by other groups and the lecturer.	
Stage 4. Presentation and Peer view				
9	Presentation of the research results through the LMS (video/slides).	Presentation of the CAR Project	1. All students record a video presentation of their research results. 2. The lecturer provides feedback on the presentation results.	Presentation Assesment and Peer Assesment Assessment rubric: 1. communication skills, 2. mastery of material, 3. quality of argumentation,
10	Providing feedback on other groups' results and compiling reflections.	Peer Review and Reflection	1. Students from other groups view the presentation results. 2. Other groups provide evaluations and reflections to the presenting group. 3. The lecturer provides feedback on each evaluation and reflection provided.	
Stage 5. Preparation and Publication				
11	Compiling the final CAR report in the format of a scholarly journal.	Preparation of the Final Report	1. Groups compile the final CAR report in the format of a scholarly article ready for publication. 2. The final report is uploaded to the LMS for final assessment by the lecturer. 3. The article is submitted to a national or international journal.	Product Assesment Assessment rubric: 1. Suitability of article format, 2. quality of scientific substance, 3. novelty, 4. accuracy of citations, 5. coherence of

12	Uploading the best work to a suitable national or international journal.	Publication of Scholarly Work	students submit articles to journals	6.	writing, readiness for publication
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Implementation and Evaluation

The resulting product was then validated by several experts, namely one expert in the field of learning models and two PPG lecturers, in the field of Elementary School Teacher Education (PGSD). The results of the product-feasibility validation by the learning-model expert are as follows.

Table 2. Results of the Learning-Model Expert Validation

Aspect	Statement	Average Score
Relevance	The model is relevant to learning needs	5
Feasibility	The LMS features support implementation	4.5
Effectiveness	The model enhances scientific ability	4
Sustainability	The model encourages reflective learning	4.5
Total		18

Based on the results of the learning-model expert validation, the formula proposed by Kunandar (2013) is applied, as follows.

$$N = \frac{\text{Total score obtained}}{\text{Maximum total score}} \times 100\%$$

(Kunandar, 2013:126)

$$N = 18/20 \times 100\% = 90\%$$

With reference to the following feasibility criteria:

Table 3. Feasibility Criteria

No.	Score Range	Criterion
1	0–20%	Highly unfeasible
2	21–40%	Unfeasible
3	41–60%	Moderately feasible
4	61–80%	Feasible
5	81–100%	Highly feasible

Thus, the product is highly feasible for use and can be employed in the learning process. The results from the PPG lecturers likewise indicate a high level of feasibility: Respondent 1 obtained a total of 82.5%, which is categorized as highly feasible, while Respondent 2 obtained a total of 77.5%, which is categorized as feasible. These results are visualized in the following chart:

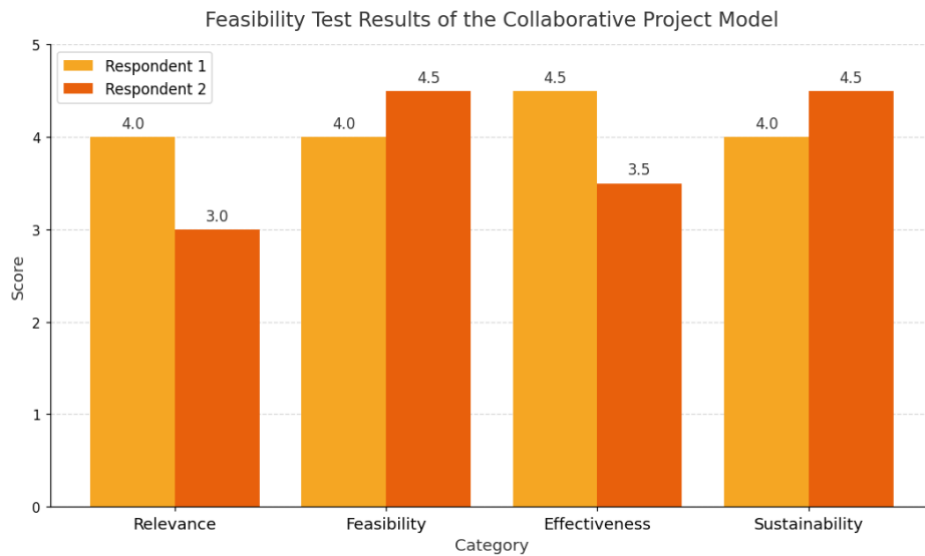


Figure 4. Feasibility-Test Chart from the PPG Lecturers (Source: Personal Documentation)

Discussion

The development of a collaborative project-based learning model supported by a Learning Management System (LMS) offers an innovative solution for enhancing students' scientific reasoning skills, particularly in the context of Teacher Professional Education (PPG). This study demonstrates that integrating collaborative projects with the MERDEKA-flow approach through the LMS can provide the flexibility and effectiveness required to support more meaningful learning. The model is specifically designed to equip students with relevant skills—such as critical thinking, data analysis, and collaboration—that are essential for producing Classroom Action Research (CAR)-based scholarly work. Implementation through the LMS enables students to design, implement, and evaluate their research systematically. Moreover, the asynchronous features of the LMS facilitate more intensive interaction between students and lecturers, so that the mentoring process can be conducted without constraints of time or place.

The validation of this model indicates a high level of feasibility (90%), with a significant contribution to enhancing students' learning autonomy. This is consistent with the findings of Herrera-Pavo (2021), who revealed that technology-supported collaborative learning increases students' active engagement and learning success. The model also supports the development of twenty-first-century skills, such as communication, collaboration, and creativity, as identified by Tang et al. (2020).

In practical terms, the application of this collaborative project model improves upon the previously more individualistic and less structured learning approach. Learning processes integrated within the LMS—such as discussion forums, peer review, and project documentation—provide students with opportunities to reflect deeply on their work. Cross-group collaboration and peer feedback also enhance the quality of the scholarly work produced, reinforcing the argument that projects based on real problems can motivate students to generate innovative solutions (Ramli et al., 2021). Collaboration between students can be

trained by applying the project-based learning (PjBL) model because it has great potential to produce meaningful learning for students by developing products together based on each individual's ideas (Sirait & Amnie, 2023).

Nevertheless, challenges arise in implementation, such as students' adaptation to using the LMS optimally and the limited face-to-face interaction that is sometimes required for more in-depth discussion. Even so, this study makes an important contribution to the development of technology-based learning that supports the professionalism of future teachers. As a next step, the sustained integration of this model into the PPG curriculum could serve as a strategic innovation for improving the quality of education in Indonesia. In implementing LMS with project-based learning design, universities must focus on improving functionality, ease of use, and engagement of features to improve user capabilities (Olugbade, Ojo & Tolorunleke, 2023).

This study not only provides a practical solution to learning problems within the PPG environment but also serves as a scholarly reference for developing collaborative learning models relevant to educational needs in the digital era. The LMS-based collaborative project model developed in this study demonstrates considerable potential for supporting students' scientific reasoning skills through the integration of the MERDEKA-flow approach. This project is consistent with research indicating that project-based learning enhances twenty-first-century skills such as critical thinking, collaboration, and creativity (Kennedy & Sundberg, 2020). In this study, the LMS enabled cross-group collaboration through features such as asynchronous discussion and peer-review evaluation, which are relevant to innovative, project-based learning approaches.

However, the implementation of LMS-based projects also faces challenges, such as students' adaptation to technology and the need to increase students' active engagement, as noted in a similar study by Ngereja et al. (2020). The suggested solutions are to enhance LMS-use training for both students and lecturers and to integrate more interactive, simulation-based learning components. A related study, namely the development of a flipped project-based learning (FPBL) model based on Moodle LMS, significantly improved communication and problem-solving skills among programming students (Ruslan, Lu'mu, Fakhri, Ahmar & Fadhilatunisa, 2024).

Collaborative project-based learning supported by a Learning Management System (LMS) has been shown to be effective in enhancing twenty-first-century skills such as critical thinking, creativity, communication, and collaboration. Research by Davidson and Major (2014) shows that this form of learning facilitates students' metacognitive development, whereby they learn to recognize and address their own misconceptions independently within a collaborative environment. The emphasis on technology-based collaborative activities also supports deeper and more flexible learning, as noted by Hernández-Sellés et al. (2019), who found that emotional and technological interaction can increase students' engagement and learning outcomes. In transforming the learning environment, it is important to redesign students' learning experiences by recognizing their prior experiences, optimizing digital technology and social media, engaging students in learning communities, and increasing their level of information literacy (Leow & Neo, 2023).

CONCLUSION

The collaborative project-based learning model supported by a Learning Management System (LMS) has proven effective in enhancing students' scientific reasoning skills, particularly in the context of Teacher Professional Education (PPG). Through a flexible approach that leverages the MERDEKA flow, students can develop their scientific skills through Classroom Action Research (CAR)-based projects, increase their active engagement, and strengthen their collaborative abilities in completing scholarly tasks. This study demonstrates that the LMS provides students with space to learn independently while also effectively supporting cross-group collaboration, which ultimately improves the quality of the scholarly work produced. Nonetheless, challenges in managing collaboration and using technology still need to be addressed in order to optimize learning outcomes. The results of this study indicate that the development of the CAR model, according to learning model experts, is very feasible to be implemented with a score of 90%. Meanwhile, according to lecturer 1, this model is very feasible with a score of 82.5% and lecturer 2 stated it is feasible with a score of 77.5%.

To optimize the success of this learning model, it is recommended that higher education institutions continue to develop and update the LMS features that support collaborative project-based learning, such as discussion forums, asynchronous guidance, and peer review. In addition, further training is needed for both lecturers and students in using technology effectively, so that collaborative learning can proceed more smoothly and technical obstacles can be reduced. Higher education institutions should also provide students with learning that stimulates active engagement in group collaboration, and clarify the roles and responsibilities of each member in the project, in order to avoid potential imbalances in group contributions.

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