Primary: Jurnal Pendidikan Guru Sekolah Dasar
journal homepage: https://primary.ejournal.unri.ac.id/
contents lists available at SINTA and DOAJ

Vol. 15 No. 2 (2026): April
http://dx.doi.org/10.33578/jpfkip.v15i2.386-402

Development of a moodle-based "*siparti*" (participatory synergy) academic supervision model to enhance elementary school teachers' pedagogical competence

Maria Magdalena Deti Irmawanti [1]*, Listyani [1], Sophia Tri Satyawati [1]

[1] Universitas Kristen Satya Wacana, Salatiga, Indonesia, 50711

Article info

Keywords: academic supervision, moodle, pedagogical competence, siparti.

Abstract

This study aims to develop a Moodle-based Academic Supervision Model, "SiParti" (Participatory Synergy), to enhance elementary school teachers' pedagogical competence. The research employed a Research and Development (R&D) approach adapted from Sugiyono's model, with the stages limited to the first product revision phase. The research subjects consisted of five teachers (ranging from junior to senior levels), one principal, one school committee member, and two expert validators (a supervision expert and an ICT expert). The research instruments included validation sheets, feasibility questionnaires, and user satisfaction surveys. The results of the material expert validation indicated a feasibility percentage of 88.3%, categorized as "Highly Feasible," while the ICT expert validation obtained 80%, categorized as "Feasible." Field testing demonstrated a user satisfaction rate of 95.1%, categorized as "Very High," particularly in aspects of collaboration, system security, and ease of use. The SiParti model integrates the stages of Si (Preparation), Par (Observation), and Ti (Follow-up) digitally through a role-based access control (RBAC) system to ensure data security and teacher professionalism. These findings indicate that the Moodle-based SiParti Academic Supervision Model is valid, feasible, and effective as a digital collaborative supervision innovation in supporting the sustainable improvement of elementary school teachers' pedagogical competence.

* Corresponding Author.
E-mail address: 942022006@student.uksw.edu (Maria Magdalena Deti Irmawanti)
DOI: http://dx.doi.org/10.33578/jpfkip.v15i2.386-402
Received 19 February 2026; Received in revised form 11 April 2026; Accepted 12 April 2026
Available online 28 April 2026
e-ISSN 2598-5949 | p-ISSN 2303-1514 © The Authors.

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1. Introduction

Improving the quality of education in elementary schools largely depends on teacher quality, particularly pedagogical competence, which includes lesson planning, effective instructional implementation, and assessment and reflection practices (Sidik, 2020). Academic supervision is one of the primary strategies in teacher professional development aimed at enhancing these competencies (Setiyo et al., 2026). However, various studies indicate that current academic supervision practices remain conventional and have not yet had an optimal impact on improving elementary school teachers' pedagogical competence. For example, supervision practices are often unsystematic and lack continuity, resulting in less optimal improvement outcomes (Mekarsari et al., 2025). Furthermore, Information and Communication Technology (ICT)-based academic supervision is effective in improving teachers' skills in managing technology-based instruction (Sodikun et al., 2023).

In the digital era, Learning Management Systems (LMS) such as Moodle have been widely used to support learning and professional training in a flexible, collaborative, and sustainable manner (Ostrovska et al., 2023). Moodle enables both asynchronous and synchronous instruction, as well as the provision of learning materials, quizzes, discussions, and digital feedback, which can support a more systematic academic supervision process. Research indicates that Moodle-based professional development programs can enhance teachers' Technological Pedagogical Content Knowledge (TPACK), including pedagogical aspects of digital learning (Gamage et al., 2022).

Conventional academic supervision models often rely solely on face-to-face observation without the support of digital platforms, making it difficult to reach teachers continuously and respond effectively to individual needs (Haryanto, 2024). Therefore, a participatory and collaborative technology-based supervision approach is needed so that supervision becomes not merely an evaluative activity, but a sustainable professional development process (Puspitasari et al., 2025).

Academic supervision that incorporates collaborative approaches and peer evaluation has also been shown to significantly improve pedagogical competence when implemented systematically (Singerin, 2021). However, LMS-based academic supervision models in the elementary school context remain underexplored, even though this technology has the potential to optimize supervision by providing real-time feedback, continuous monitoring, and context-specific training tailored to teachers' needs. Therefore, developing the Moodle-based Siparti (Participatory Synergy) Academic Supervision Model represents an innovative effort to integrate academic supervision and learning technology within a single framework that supports the effective, efficient, and participatory enhancement of elementary school teachers' pedagogical competence. This model is expected to facilitate collaborative, well-documented, data-driven supervision that supports teacher professional development in accordance with individual and contextual needs in elementary schools.

Despite the growing body of literature on digital-based academic supervision and the integration of Learning Management Systems (LMS), the articulation of distinctive model characteristics remains limited. Existing studies predominantly highlight the effectiveness of LMS platforms in facilitating communication, documentation, and feedback within supervision practices (Alenezi, 2021; Martin et al., 2020). However, these studies tend to emphasize technological functionality rather than conceptual innovation in supervision models. Consequently, many LMS-supported supervision practices remain instrumentally oriented,

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[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

without fundamentally transforming the structure, roles, and processes of academic supervision (Trust & Whalen, 2020; Rapanta et al., 2020).

In this regard, the SiParti (Participatory Synergy) model presents a conceptual advancement by embedding participatory, collaborative, and role-integrated principles into a structured supervision cycle. Unlike conventional LMS-based approaches that primarily function as delivery tools, this model operationalizes a tripartite interaction among supervisors, teachers, and school committees within the Si–Par–Ti framework. This approach resonates with recent research emphasizing collaborative and reflective professional development as a key driver of pedagogical improvement (Darling-Hammond et al., 2017; Postholm, 2018), while extending these perspectives through a digitally structured governance system supported by role-based access control (RBAC), which remains underexplored in digital supervision literature.

Therefore, the novelty of this study lies not merely in adopting an LMS platform, but in developing an integrated supervision model that combines participatory pedagogy, digital system design, and collaborative governance. This study addresses a significant research gap by advancing beyond the instrumental use of technology toward a model that redefines academic supervision as a continuous, data-driven, and co-constructed professional learning process. Such a perspective aligns with recent calls for more sustainable and transformative models of teacher professional development in the digital era (Philipsen et al., 2019; Koehler et al., 2019). Thus, the SiParti model provides a clearer, more theoretically grounded framework for the evolving field of digital academic supervision, particularly in elementary education contexts.

2. Literature review

2.1 Academic supervision in improving the pedagogical competence of elementary school teachers

Academic supervision is a systematic professional development process conducted to help teachers improve the quality of instruction (Suarniti, 2023). In the context of elementary schools, academic supervision functions not only as an evaluative activity but also as a means of reflection and the development of teachers' pedagogical competence (Suryani, 2025). Pedagogical competence includes the ability to understand students' characteristics, design instruction, implement educational learning processes, utilize instructional technology, and conduct assessment and follow-up activities (Prayogo et al., 2025).

Various studies indicate that academic supervision carried out in a planned, continuous, and needs-based manner can enhance lesson planning, the use of innovative instructional strategies, and assessment quality (Muhsin, 2021). Effective supervision is typically implemented through a cycle of planning, observation, feedback, and reflection. Through this approach, teachers not only receive evaluation but also gain professional guidance that supports the improvement of their pedagogical competence (Fadhilah & Wasliman, 2026). However, in many elementary schools, academic supervision practices remain administrative in nature and are not yet fully oriented toward teacher professional development. Supervision is often conducted periodically without systematic follow-up, resulting in less optimal impact on the enhancement of pedagogical competence.

2.2 Siparti approach in academic supervision

The Siparti approach in academic supervision emphasizes collaboration among principals, supervisors, and teachers in the professional development process. Supervision is no longer top-

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down in nature but is based on dialogue, shared reflection, and collective problem-solving (Maulidia & Masfini, 2025). The participatory synergy model encourages teachers' active involvement in identifying professional development needs, designing instructional improvement strategies, and conducting self-evaluation (Muhsin et al., 2023).

The collaborative approach has been shown to enhance teachers' motivation and commitment to improving instructional quality (Danial et al., 2022). Teachers feel valued as professional partners rather than merely objects of evaluation (Rosalina et al., 2025). In addition, coaching- and mentoring-based supervision provides deeper opportunities for reflection on classroom teaching practices (Fauziah & Ramadan, 2025). In this study, the Siparti model was designed as an innovative form of academic supervision that emphasizes cooperation, openness, continuous reflection, and the utilization of technology as a supporting medium for supervision.

2.3 Digital transformation in academic supervision

The development of digital technology has driven transformation in various aspects of education, including academic supervision (Idris et al., 2025). Digital-based supervision enables professional development processes to be carried out flexibly without limitations of space and time (Iskandar, 2022). The use of digital platforms facilitates documentation, monitoring, feedback provision, and analysis of teachers' competency development (Hernita et al., 2022). Information and Communication Technology (ICT)-based supervision also helps improve teachers' digital literacy (Fetria et al., 2025). Through technology integration, the supervision process becomes more transparent, systematic, and data-driven (Hurriyati et al., 2024). In addition, digital platforms allow supervisors and teachers to engage in reflective discussions both asynchronously and synchronously, making the professional development process more sustainable.

2.4 Moodle as a learning management system in teacher professional development

Moodle is one of the widely used Learning Management Systems (LMS) in education due to its open-source nature, flexibility, and adaptability to institutional needs (Asri et al., 2025). Moodle provides various features, including learning material management, discussion forums, quizzes, online assessments, progress reports, and feedback tools (Lailie et al., 2025). In the context of teacher professional development, Moodle can function as a platform for training, reflection on teaching practices, submission of instructional materials, and evaluation of pedagogical performance (Sahudi, 2024). The use of Moodle in professional development programs has been proven to enhance teachers' pedagogical competence and digital literacy (Elianur, 2022). The integration of Moodle into academic supervision enables systematic and well-documented classroom observation records, instructional reflection, and follow-up actions.

3. Method

3.1 Research design

This study employed a Research and Development (R&D) approach adapted from Sugiyono's (2019) model. The original model consists of eleven stages; however, this study was explicitly limited to the eighth stage, namely initial product revision. The stages implemented in this study included: (1) identification of potentials and problems, (2) data collection, (3) product design, (4)

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design validation, (5) design revision, (6) product development, (7) limited product testing, and (8) initial product revision.

To ensure methodological coherence, it is important to clarify that the field testing conducted in this study was limited (small-scale testing) aimed at examining product feasibility and user acceptance, rather than measuring effectiveness in a causal or experimental sense. Therefore, the term "effective" in this study is interpreted cautiously as perceived effectiveness based on user responses, rather than as a statistically tested impact. Accordingly, this study is positioned as an early-stage development study focused on the model's validity, feasibility, and practicality.

3.2 Participants and validators

The participants in the limited field testing were seven individuals selected through purposive sampling, including five elementary school teachers (categorized by years of experience into junior, intermediate, and senior levels), one principal serving as a supervisor, and one school committee representative. The selection criteria emphasized active involvement in academic supervision practices and familiarity with basic digital tools. The validation process involved two expert validators: (1) a supervision expert with academic and practical experience in educational supervision and school management, and (2) an Information and Communication Technology (ICT) expert specializing in educational technology and multimedia systems. These validators were selected based on their expertise, academic qualifications, and relevance to the research focus. The product trial subjects consisted of five teachers (selected based on years of service, categorized as Junior with 0–5 years of experience, Intermediate with 6–10 years, and Senior with more than 10 years), one principal, and one representative of the School Committee (who has an educational background and a strong concern for educational development). The design validation involved an IT expert and an education practitioner with expertise in academic supervision (Supervision Expert).

3.3 Instruments and data collection

Data were collected using three main instruments: (1) expert validation sheets, (2) product feasibility questionnaires, and (3) user satisfaction surveys. The validation instruments were developed based on key dimensions of academic supervision, including procedural feasibility, interaction quality, and professional development effectiveness. Meanwhile, the ICT validation instrument adopted a modified Learning Object Review Instrument (LORI) framework, covering presentation design, usability, accessibility, and system security.

All instruments used a Likert scale ranging from 1 to 5. Before use, the instruments underwent content validation by experts to ensure relevance and clarity. To enhance reliability, internal consistency was assessed using Cronbach's Alpha (≥0.70), which indicated acceptable reliability for exploratory development research.

3.4 Validation and data analysis techniques

The validation data were analyzed using descriptive quantitative techniques, with scores converted to percentages and interpreted against predetermined feasibility criteria. Qualitative feedback from validators was also analyzed descriptively to support product revision. User response data from limited field testing were analyzed using descriptive statistics (mean scores and percentage categories) to assess usability, feature satisfaction, and collaborative aspects of

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the model. The triangulation of expert validation and user responses was employed to strengthen the credibility of findings.

It is important to note that this study does not employ inferential statistical analysis or experimental design; therefore, claims regarding effectiveness are limited to indicative and perceptual findings. Future research is recommended to conduct large-scale implementation and experimental studies to examine the impact of the SiParti model on teachers' pedagogical competence. A validity standard is required to determine whether the developed product is feasible for implementation. Arikunto (2006) formulated the feasibility criteria of a product as follows:

Table 1. Product assessment criteria

Percentage (%)	Validation	Eligibility	Effectiveness
76-100	Valid (no need to revise)	Eligible (no need to revise)	Effective (no need to revise)
56-75	Quite valid (no need to revise)	Good enough (no need to revise)	Quite effective (no need to revise)
40-55	Less valid (revised)	Less suitable (revised)	Less effective (revised)
0-39	Invalid (revised)	Not suitable (revised)	Ineffective (revised)

4. Results

The researcher designed a digital academic supervision framework to be implemented using the Moodle platform. The design outlines the workflow of the "SiParti" Academic Supervision model. The workflow is structured in a linear yet flexible manner, represented through three main phases: Si, Par, and Ti.

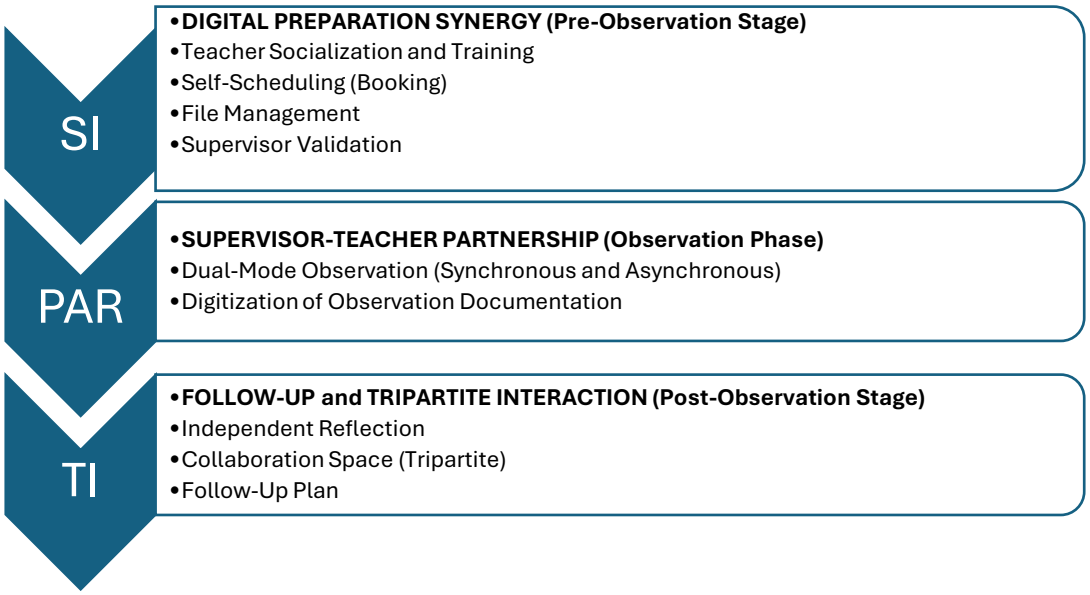


Figure 1. "SiParti" framework development chart

After completing the design of the SiParti workflow, the researcher developed a Moodle LMS framework to implement digital academic supervision activities. The digital academic

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supervision system was designed with a staged mechanism. This means that the Principal/Supervisor must first initiate the academic supervision activity by providing available time slots for teacher reservations before it can be accessed. For example, teachers are required to upload their teaching documents and obtain the principal's approval before proceeding to the next stage.

An essential component of the system design is the implementation of a Role-Based Access Control (RBAC) system to differentiate access rights among SiParti users, namely the Supervisor (Principal), Teachers, and the School Committee. Regulating user access restrictions is crucial for addressing concerns about teacher data privacy. The following section presents screenshots of the "SiParti" interface within the Moodle platform. Academic Supervision "SiParti" can be accessed at https://siparti.id, where the home page serves as the main interface.

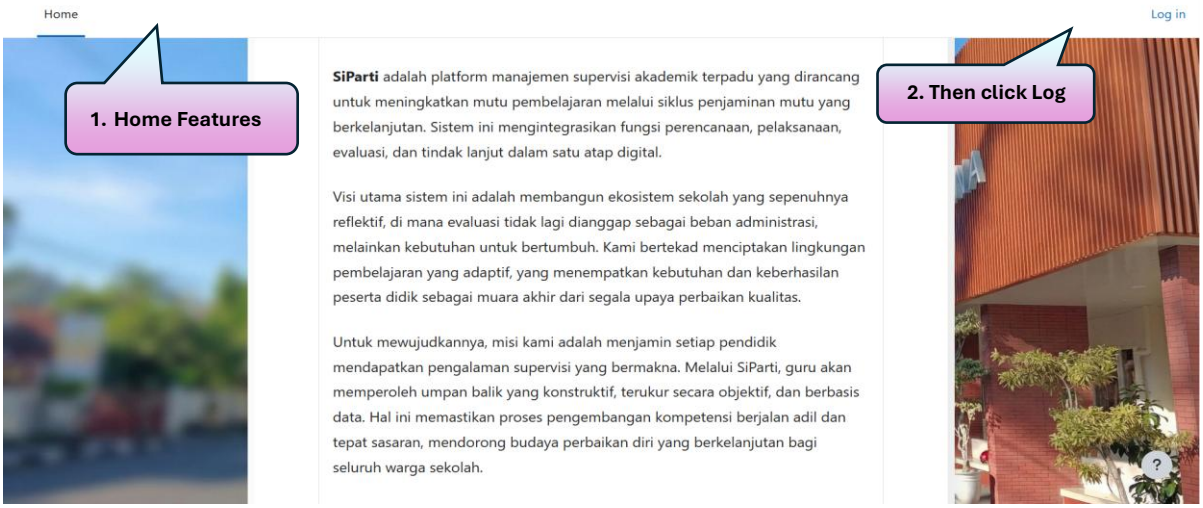


Figure 2. How to enter the "SiParti" page

Material validation is the first fundamental step in product testing. This validation focuses on assessing the substantive feasibility of the model, the procedural flow for supervision, and the relevance of the instruments integrated into the Moodle platform. The evaluation was conducted by an expert in Supervision and Educational Management with extensive competence in the dynamics of academic supervision and school management. The material validation instrument was developed based on three main dimensions that serve as the pillars of successful modern academic supervision: (1) Model Procedure Feasibility, (2) Quality of Interaction and Collaboration, and (3) Effectiveness of Professional Development. Each dimension was elaborated into specific indicators to measure the extent to which the Moodle-based "SiParti" Academic Supervision Model translates supervision theory into digital practice.

Based on the recapitulated results of the material expert evaluation documented in the validation report, the Moodle-based "SiParti" Academic Supervision Model obtained a total score of 53 out of a maximum ideal score of 60. The calculated feasibility percentage reached 88.3%. Referring to the feasibility conversion table established in the research methodology, this percentage places the Moodle-based "SiParti" Academic Supervision Model in the "Highly Feasible" category (81%–100% range). This category indicates that, substantively, the model does not require fundamental revision and has met rigorous theoretical standards. The following

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section presents a detailed breakdown of the material expert validation results by assessment aspect to provide a clearer picture of the model's strengths.

Table 2. Details of the results of validation by material experts (educational supervision)

No	Assessment Aspects	Key Indicators	Score	Qualitative Interpretation
A	Eligibility of Procedure	Clarity of SiParti flow (Preparation, Observation, Follow-up)	4	appropriate
		Digital Lesson Plan/Teaching Module Submission Facility (Pre-Observation)	4	appropriate
		Flexibility of observation modes (Synchronous/Asynchronous)	4	appropriate
		Practicality of digital instruments (rubrics/observation sheets)	4	appropriate
B	Quality of Interaction and Collaboration	The role of the principal as a moderator of the FGD	4	appropriate
		Clarity of the boundaries of the role of the School Committee as a supporting system	4	appropriate
		Creating a collaborative and non-judgmental atmosphere	4	appropriate
		Constructive feedback mechanism	4	appropriate
C	Development Effectiveness	Relevance of the Self-Reflection feature	4	appropriate
		Preparation of a Follow-up Action Plan (RTL) based on discussion	5	Very Suitable
		Potential for increasing sustainable pedagogical competency	5	Very Suitable
		Identification of development needs and facilities	5	Very Suitable
Total Score		**53/60**	**88.30%**	**Very Worthy**

After the material component of the "SiParti" Academic Supervision Model was declared highly feasible, the next step was to ensure that the Moodle platform used to implement this digital academic supervision demonstrated reliable performance, user-friendliness, and guaranteed data security. The technological validation was conducted by an academic and practitioner expert in Information and Communication Technology (ICT) and Educational Multimedia.

Unlike material validation, which focuses on content, ICT validation emphasizes system functionality aspects. The assessment instrument adopted a modified version of the Learning Object Review Instrument (LORI) standard, covering four main domains: (A) Presentation Design, (B) Interaction & Usability, (C) Accessibility, and (D) System Security. The quantitative results from the ICT expert indicated that the supporting system for the "SiParti" Academic Supervision Model obtained a total score of 48 out of a maximum score of 60. Thus, the technical feasibility

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percentage was recorded at 80%. Referring to the feasibility category table, this percentage places the SiParti Moodle platform in the "Feasible" category within the 61%–80% range. Although the SiParti Moodle platform falls into the feasible category, the difference is approximately 8.3% lower than the material validation result of 88.3%. This gap indicates that while the conceptual model is very strong, its technical implementation on the Moodle platform still requires further refinement to achieve optimal performance.

Table 3. Details of IT expert validation results

No	Assessment Aspects	Key Indicators	Score	Qualitative Interpretation	Notes
A	Presentation Design	Clarity of the layout of the Si-Par-Ti flow navigation menu in Moodle.	4	appropriate	Needs to be tidied up
		Text readability and visual layout functionality.	4	appropriate	Needs to be tidied up
		Consistent use of color and simple/unconfusing visual elements.	4	appropriate	Needs to be tidied up
B	Interaction and Convenience	The system usage flow (Si-Par-Ti) is logical and easy for users to follow.	4	appropriate	
		Clarity of instructions or operational instructions for each feature.	4	appropriate	Instructions for each activity need to be made clear.
		Ease of navigating back and forth between features without confusion.	4	appropriate	
C	Accessibility	System display compatibility with computer/laptop screen resolution.	4	appropriate	
		The speed of the system's response time in loading pages and features.	4	appropriate	
		Ease of downloading and uploading supervision documents.	4	appropriate	
D	Safety	Accuracy of access rights restrictions (Access Role for each user (Principal, Teacher, Committee)	5	Very Suitable	
		Data protection, security and confidentiality of	3	Neutral	It is necessary to explain

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	supervision results in the database.			where the data is stored.
	System resilience to input errors or broken links (error handling)	4	appropriate	
Total Score	**47/60**	**80%**	**Feasible**	

The evaluation results of the Moodle-based Si-Par-Ti system indicate that it achieved a total score of 47 out of 60 (80%) and is therefore categorized as feasible for use. In the presentation design aspect, the system demonstrates a clear navigation layout, good text readability, and consistent use of colors and visual elements, with an average score of 4 (appropriate). However, several parts of the interface still require refinement to enhance visual appeal and overall neatness. In terms of interaction and convenience, the system offers a logical workflow and easy navigation between features; however, the clarity of operational instructions for each feature needs improvement to enhance the user experience. Furthermore, in terms of accessibility, the system performs well in terms of compatibility across various devices, response speed, and ease of uploading and downloading documents, indicating that it meets basic accessibility standards. Meanwhile, in terms of safety, the system achieves a very high rating in user access control (score of 5), but improvements are needed in data security and transparency regarding database storage (score of 3), while maintaining adequate error-handling capabilities. Overall, the Si-Par-Ti system meets the criteria for feasibility; however, further development is required, particularly in interface design, user guidance clarity, and data security measures, to achieve a higher level of feasibility.



Figure 3. Summary of the results of the user satisfaction survey for the "siparti" model

Based on the recapitulation diagram of user satisfaction with the "SiParti" Academic Supervision Model, very high results were obtained across all assessment aspects. In terms of Ease and Practicality (usability), the model achieved a score of 4.8 out of 5, which is categorized as "Very High." Respondents indicated that the workflow of Si (Preparation) – Par (Observation) –

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Ti (Follow-up) was easy to understand, the system was responsive, and it operated stably. In terms of Product Feature Satisfaction, the model received a score of 4.7 ("Very High"), indicating that features such as lesson plan/module submission and the flexibility of synchronous and asynchronous observation were perceived as practical solutions to challenges in conventional supervision. Meanwhile, the Collaboration and Pedagogy aspect received the highest score of 4.9 out of 5 ("Very High"), with the Follow-up Action Plan (RTL) discussion feature and the involvement of the School Committee considered to have make a significant contribution to improving teacher performance. These quantitative findings were reinforced by qualitative data, including testimonials and respondent feedback, which explained the strong acceptance of the model.

Qualitatively, three main reasons supported the positive reception of SiParti. First, data security and the protection of teachers' professional dignity. The role-based access control feature within the Moodle system provided psychological safety for teachers, as the School Committee had access only to supportive aspects, not to competency evaluations. This finding aligns with the ICT/Multimedia expert validation results, which awarded the highest score for appropriate access restrictions, demonstrating consistency between technical design and user experience in the field. Second, the model was considered effective in addressing principals' high mobility and limited time. Asynchronous observation features and document digitization helped bridge the principal's busy, often unpredictable schedule while also simplifying the supervision process for teachers without increasing their workload. Third, there was positive acceptance of the School Committee's involvement in academic supervision. Teachers perceived meaningful academic support, while the Committee expressed readiness to contribute constructively. Thus, SiParti functions as a collaborative bridge between teachers' needs and school resources. Overall, the triangulation of expert validation data (Material: 88.3%; ICT: 80%) and user testing results (95.1%) indicates that the SiParti Academic Supervision Model meets the feasibility criteria and is highly appropriate for implementation.

5. Discussion

The findings of this study demonstrate that the Moodle-based "SiParti" Academic Supervision Model conceptually aligns with the principles of systematic and developmental supervision. The structured flow of Preparation, Observation, and Follow-up reflects the supervision cycle emphasized in contemporary literature, where supervision is not merely an evaluative mechanism but a professional development process (Fitria, 2020; Muhsin, 2021). This perspective is consistent with studies that highlight that structured and continuous academic supervision significantly enhances teachers' pedagogical competence (Setiyo et al., 2026; Mekarsari et al., 2025). By embedding reflective dialogue and follow-up planning within a digital framework, the model supports sustained instructional improvement rather than episodic administrative review.

From a technological standpoint, integrating Moodle strengthens the digital transformation of academic supervision, as discussed by Hurriyati et al. (2024) and Idris et al. (2025). Digital supervision enables flexibility, systematic documentation, and continuous feedback mechanisms that extend beyond conventional face-to-face observation (El-Sofany, 2020). The literature emphasizes that successful LMS implementation depends on usability, clear navigation, and high-quality instructional design (Li, 2021; San-Martín, 2020). In this regard, the SiParti model illustrates how technological integration can support transparency, accountability,

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and data-driven supervision while still requiring ongoing refinement to ensure optimal functionality.

Moreover, the model's participatory and collaborative orientation aligns with the supervision approach advocated by Singerin (2021) and Suryani et al. (2025), which emphasizes peer interaction, reflective coaching, and shared problem-solving to enhance teacher motivation and professional commitment. Positioning teachers as professional partners rather than objects of evaluation fosters a supportive supervision climate (Rosalina et al., 2025). The incorporation of role-based access control mechanisms further aligns with recommendations for safeguarding professional integrity and psychological safety in digital supervision environments. Consistent with Kurniaman et al. (2025) and Reddy et al. (2023), technology-supported collaborative supervision contributes to a culture of reflection and sustainable pedagogical development. Overall, the SiParti model demonstrates that digital, participatory, and systematically structured supervision can function as a strategic framework for strengthening elementary school teachers' pedagogical competence in the era of educational transformation.

Based on the research results, the Moodle-based Si-Par-Ti model can be declared valid and feasible for limited implementation. This model shows potential to support the educational supervision process, particularly in terms of ease of use and the management of the digital system. However, the findings of this study are not sufficient to definitively conclude that the model is effective in improving pedagogical competence or student learning outcomes. Therefore, further research is needed with a larger sample, more diverse contexts, and a longitudinal design to test the model's effectiveness more comprehensively. Therefore, the Si-Par-Ti model has potential for further development as an innovation in educational supervision, but its implementation needs to be gradual and accompanied by ongoing evaluation.

6. Conclusion

This study concludes that the Moodle-based "SiParti" Academic Supervision Model is an innovative, conceptually sound framework for strengthening elementary school teachers' pedagogical competence. The model integrates a structured supervision cycle—Preparation, Observation, and Follow-up—within a digital environment that supports systematic documentation, reflective dialogue, and continuous professional development. By combining participatory principles with technology integration, the model shifts supervision from a predominantly administrative activity to a collaborative, developmental process.

The incorporation of digital features, such as structured workflows, asynchronous and synchronous interactions, and controlled access mechanisms, enhances transparency, accountability, and professionalism in supervision practices. Furthermore, the participatory synergy approach fosters a supportive school culture in which teachers are positioned as professional partners engaged in reflective improvement rather than passive recipients of evaluation. Overall, the SiParti model demonstrates strong potential as a sustainable digital supervision framework aligned with contemporary educational transformation and the demands of the digital era.

7. Research implications

The findings of this study carry several theoretical, practical, and policy implications. Theoretically, this research contributes to the development of digital academic supervision

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models by integrating participatory supervision principles with Learning Management System (LMS) technology. It enriches the discourse on how technology can function not only as a tool for instructional delivery but also as a strategic medium for professional supervision and teacher development.

In practice, the model offers an alternative supervision framework for schools seeking to modernize their supervision practices. It provides a structured yet flexible system that addresses common challenges such as time constraints, limited documentation, and lack of follow-up. The integration of role-based access control also highlights the importance of safeguarding teacher professionalism and data privacy in digital supervision environments.

From a policy perspective, implementing digital supervision models requires institutional support, including capacity-building programs in digital literacy, infrastructure readiness, and clear governance policies that regulate stakeholder roles in supervision processes. Future research is recommended to conduct broader-scale implementation and experimental studies to examine the long-term impact of digital participatory supervision on pedagogical competence and student learning outcomes.

Credit authorship contribution statement

The first author was primarily responsible for developing the research methodology, conducting the formal analysis, managing and organizing the data, and formulating the conceptual framework. The first author also led the preparation of the initial draft of the manuscript. The second author contributed by providing essential resources, coordinating project administration, and offering methodological guidance throughout the research process. The third author played a key role in securing research funding, supporting the formal analysis, and assisting with data management and curation. All three authors were actively involved in the critical review and revision of the manuscript and have approved the final version for submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Ethical declaration

All participants provided informed consent before their involvement in the study. They were informed about the study's purpose, procedures, and their right to withdraw at any time without consequence.

Statement of Transfer of Responsibility

The preparer/editor did not received the necessary data or information required to complete and verify the following sections: data availability statement, ethical approval/ethical declaration, acknowledgements, and AI disclosure statement. Accordingly, full academic and legal responsibility for the content and accuracy of these statements is hereby transferred to the authors, including any consequences arising from non-compliance with the target journal's policies and applicable ethical standards.

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