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Principal Supervision Management in Enhancing Teachers' Information and Communication Technology Competence

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ABSTRACT

This study aims to explore how principals' supervision management contributes to improving teachers' information and communication technology (ICT) competence in elementary schools. Using a qualitative case study design, the research was conducted in two public elementary schools in Tambora District, Jakarta. Data were collected through in-depth interviews, participant observation, and document analysis involving principals, teachers, and school supervisors. The findings reveal that supervision management, implemented through the functions of planning, organising, actuating, and controlling (POAC), plays a strategic role in strengthening teachers' ICT competence. Participatory planning based on teachers' needs, collaborative organisation of supervision teams, practice-oriented implementation through coaching and mentoring, and continuous monitoring and evaluation collectively foster teachers' confidence, creativity, and ability to integrate digital technologies into classroom instruction. This study highlights that effective supervision management goes beyond administrative control and serves as a systemic approach to professional development. The findings have practical implications for school leaders in designing adaptive, sustainable supervision strategies to support digital transformation in elementary education.

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1. INTRODUCTION

In responding to the global challenges of the 21st century, primary education must produce graduates who not only master foundational knowledge but also possess critical, creative, and collaborative thinking skills, as well as adequate digital literacy [1], [2]. The rapid development of information and communication technology (ICT) has transformed learning paradigms, shifting the teacher's role from a mere transmitter of knowledge to a learning facilitator who is capable of integrating technology effectively into the teaching and learning process [3], [4]. Therefore, teachers' competence in mastering and utilising ICT has

become an essential prerequisite for achieving learning that is relevant, interactive, and aligned with the needs of 21st-century learners [5].

Primary schools, as the foundation of formal education, bear a strategic responsibility for ensuring the quality of the learning process, including teachers' readiness to face digital transformation [6]. In this context, the school principal plays a crucial role as an instructional leader responsible for managing and developing teachers' professional competencies [7]–[9]. One of the main instruments available to principals for promoting the improvement of teachers' ICT competence is well-planned, sustainable academic supervision [10]–[12].

Academic supervision is no longer understood merely as an administrative monitoring activity, but rather as a systematic, collaborative, and development-oriented professional guidance process [13], [14]. Effective supervision positions the principal as a professional partner for teachers in identifying needs, providing mentoring, and facilitating the enhancement of teachers' abilities to utilise ICT as both learning media and learning resources. In line with this view, Rusdiana emphasises that supervision is a series of coaching activities designed to help teachers continuously improve their professional competence [15].

Nevertheless, in practice, the implementation of academic supervision by principals still faces various challenges. Preliminary observations at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District indicate that some teachers continue to experience difficulties in utilising ICT devices, digital learning platforms, and technology-based instructional media. Limited training opportunities, insufficient intensive mentoring, and poorly managed supervision constitute major obstacles to enhancing teachers' ICT competence. These conditions highlight a gap between the ideal demands of educational policies and the realities of implementation in the field.

Various national policies have emphasised the principal's role in improving teacher competence, including in ICT. Regulation of the Minister of National Education (Permendiknas) Number 13 of 2007 on Principal Competency Standards affirms the principal's role as an academic supervisor, while Regulation of the Minister of Education and Culture (Permendikbud) Number 16 of 2007 mandates technological mastery as part of teachers' professional competence. In addition, the Pancasila Student Profile policy encourages innovative, context-based learning using digital technology. However, the effectiveness of these policies largely depends on the principal's capacity to manage supervision systematically and with a strong orientation toward teacher development [16], [17].

A number of previous studies have shown that academic supervision contributes to improving teacher competence. Various supervision models, such as collaborative supervision, clinical supervision, and coaching, have been proven to enhance teacher performance. However, most existing studies tend to focus on the technical aspects of supervision. In contrast, the managerial dimension of principal supervision, as a process encompassing planning, organising, implementation, and evaluation, has not been extensively examined, particularly in relation to improving teachers' ICT competence.

The urgency of this study lies in the need to develop integrated and sustainable principal supervision management as part of a strategic effort to enhance teachers' ICT

competence in primary schools. Referring to George R. Terry's management functions, Planning, Organising, Actuating, and Controlling (POAC), this study seeks to analyse how principals plan, manage, implement, and evaluate supervision in order to improve teachers' ability to integrate ICT into learning [18].

This study offers novelty by positioning principal supervision not merely as a technical coaching activity but as a systematic and strategic managerial practice for addressing the challenges of educational digitalisation. Through a case study at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, this research is expected to provide both theoretical and practical contributions to the development of principal supervision management that is adaptive, collaborative, and oriented toward the sustainable improvement of teachers' ICT competence.

2. METHOD

This study employed a qualitative case study design. The qualitative approach was chosen because it allows researchers to gain an in-depth understanding of phenomena within their natural contexts and to explore the subjective meanings derived from the experiences and practices of educational actors [19], [20]. The case study design was used to comprehensively examine the phenomenon of principal supervision management in efforts to enhance teachers' information and communication technology (ICT) competence, particularly when the boundaries between the phenomenon under investigation and the institutional school context cannot be clearly separated [21], [22].

The research was conducted in two public primary schools, namely SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, West Jakarta. The research sites were selected purposively because both schools are in the process of developing technology-based learning and have implemented academic supervision programs led by the school principals. The research subjects consisted of the principals as key informants, teachers as supporting informants, and school supervisors as triangulation informants. Informants were selected through purposive sampling based on their involvement in and relevance to the implementation of supervision and the development of teachers' ICT competence.

Data were collected through methodological triangulation, including in-depth interviews, participant observation, and document analysis. Semi-structured interviews were conducted to gather data on principals' and teachers' perceptions, experiences, and strategies for implementing ICT-based supervision. Participant observation was carried out to directly observe supervision practices, ICT mentoring activities, and the use of digital media in the teaching and learning process. Document analysis involved examining supervision planning and implementation documents, such as School Work Plans, academic supervision programs, teacher activity reports, and ICT-based instructional materials [23]–[25].

In this qualitative study, the researcher served as the primary instrument (human instrument), directly involved in data collection, processing, and analysis [26]. To support systematic data collection, auxiliary instruments were used, including interview guides, observation checklists, document analysis frameworks, and field notes. These instruments were developed based on indicators of supervision management functions—planning,

organising, actuating, and controlling—so that the collected data aligned with the study's focus and objectives.

Data trustworthiness was ensured by applying four criteria: credibility, transferability, dependability, and confirmability [26]. Credibility was established through source, technique, and time triangulation, as well as member checking with informants to ensure the accuracy of the researcher's interpretations. Transferability was supported by providing thick descriptions of the research context and field findings. Dependability and confirmability were strengthened through systematic documentation of the research process and the provision of an audit trail from data collection through data analysis.

Data analysis was conducted using the interactive analysis model proposed by Miles, Huberman, and Saldaña [27], which consists of three main stages: data reduction, data display, and conclusion drawing/verification. Data reduction involved selecting and focusing on data relevant to principal supervision management in enhancing teachers' ICT competence. Data were presented in descriptive narratives and thematic matrices to identify patterns, relationships, and trends. Conclusions were drawn inductively and verified continuously throughout the research process.

This study was conducted over six months, from March to August 2025. The initial phase involved developing research instruments and obtaining research permits, followed by field data collection through interviews, observations, and document analysis from April to June. The final phase focused on data analysis, conclusion drawing, and the preparation of the research report from July to August 2025. Within this timeframe, the study is expected to provide a comprehensive depiction of principal supervision management practices in enhancing teachers' ICT competence in primary schools.

3. RESULTS AND DISCUSSION

3.1. Principal Supervision Planning for Enhancing Teachers' ICT Competence

Based on the research findings at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, the principals have implemented an academic supervision plan systematically oriented toward improving teachers' information and communication technology (ICT) competence. The planning stage began with an analysis of teachers' competency needs in utilising instructional technology. Initial observations indicated that some teachers still faced limitations in using digital learning applications such as Google Workspace for Education, Canva, Quizizz, and Wordwall as instructional media and assessment tools.

The principals identified these needs through classroom observations, informal discussions, and reflections on the results of supervision conducted in the previous year. Based on these findings, the principals then developed academic supervision programs that emphasised training and mentoring in the use of ICT for teaching and learning. The supervision programs were designed as annual plans that outlined objectives, supervision focus areas, activity schedules, and indicators for achieving teachers' ICT competence.

Supervision planning was carried out in a participatory manner by involving teachers through school work meetings. This collaborative approach is reflected in the following interview excerpt with one of the teachers:

"The principal always invites us to discuss matters before the supervision program is formulated. We are asked to express the difficulties we experience when using technology in teaching, so the program developed truly meets our needs." (Grade IV teacher, interview, April 18, 2025)

Documentation of the supervision program for the 2024–2025 academic year demonstrates structured planning, including ICT-based supervision scheduling matrices, lists of instructional technology training materials, and observation instruments containing indicators for the use of digital media in the teaching and learning process. This planning indicates that supervision was not merely focused on administrative aspects but was directed toward strengthening teachers' professional competence in technology.

The findings of this study indicate that the principals have applied the planning function of supervision in a focused and contextual manner. Supervision planning based on an analysis of teachers' needs reflects the principals' understanding of supervision as a strategic instrument for professional teacher development. This finding is consistent with the views of Glickman, Gordon, and Ross-Gordon, who emphasise that systematic, needs-based supervision planning constitutes a fundamental foundation for the sustainable improvement of teacher competence [28].

Teacher involvement in the supervision planning process also demonstrates the application of participatory leadership principles. This strategy contributes to a greater sense of ownership among teachers in the designed supervision programs. Such an approach aligns with the concept of shared decision-making within professional learning communities, which emphasises collaboration between school leaders and teachers in educational decision-making [29].

Thus, the findings at the planning stage indicate that principal supervision management has been strategically directed to address the challenges of enhancing teachers' ICT competence. Needs-based, participatory, and well-documented planning serves as a crucial foundation for the successful implementation of subsequent supervision stages in supporting the transformation of technology-based learning in primary schools.

3.2. Organising Principal Supervision for Enhancing Teachers' ICT Competence

Based on the research findings at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, the principals have implemented the organising function of academic supervision in a structured manner to support the improvement of teachers' information and communication technology (ICT) competence. Supervision was organised by establishing a supervision implementation team comprising various school stakeholders, including vice principals, senior teachers, and school operators. The formation of this team was intended to ensure that ICT-based supervision could be implemented effectively and in accordance with teachers' needs.

The principals distributed tasks and responsibilities proportionally based on each team member's competencies and experience. Senior teachers served as mentors and facilitators in the use of digital instructional media, while school operators were responsible for the technical management of ICT devices and applications. Vice principals functioned as coordinators of supervision implementation and as liaisons between the principals and

teachers. This pattern of task distribution reflects an effort to optimally empower the school's human resources optimally.

This is reinforced by the principal's statement in the following interview:

"We established a supervision team so that ICT coaching does not depend solely on the principal. Everyone has a role according to their expertise, allowing teachers to receive more optimal mentoring."(Principal, interview, April 22, 2025)

In addition to forming an internal school team, the principals also coordinated the supervision process with school supervisors. Supervisors were used as a source of feedback and reinforcement for the implementation of technology-based learning. This coordination was conducted through regular meetings and evaluative discussions regarding supervision results and the development of teachers' ICT competence. This approach indicates that the organisation's supervision was not inward-looking but open to relevant external support.

The analysed documentation indicates a flexible, adaptive organisational structure for supervision. This structure allows for adjustments in roles and supervision strategies in response to the dynamic needs of teachers and developments in instructional technology. Such organisational flexibility supports the success of supervision by providing space for innovation and collaboration among teachers in developing ICT competence.

The findings of this study indicate that the organising function of supervision has been implemented effectively by emphasising principles of collaboration and empowerment. A clear, well-planned organisation contributes to the smooth implementation of supervision and increases the intensity of teacher mentoring in the use of instructional technology. This finding is consistent with the perspective of Hallinger and Heck, who assert that the effectiveness of instructional leadership is strongly influenced by the principal's ability to organise resources and build strong teamwork [30].

Furthermore, the organisation of supervision involving multiple school actors reflects the concept of distributed instructional leadership, in which leadership and teacher development responsibilities are shared [31]. This approach not only reduces the burden on principals but also strengthens the school's institutional capacity to manage sustainable teacher competence development.

Thus, the findings from the organising stage demonstrate that principals have managed ICT-based academic supervision collaboratively and adaptively. An effective organisation is a crucial foundation for the successful implementation of supervision to enhance teachers' ICT competence in primary schools.

3.3 Implementation of Principal Supervision for Enhancing Teachers' ICT Competence

Based on the research findings at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, the implementation of academic supervision by principals was manifested through various professional development activities focused on improving teachers' information and communication technology (ICT) competence. The implementation stage of supervision was conducted continuously and contextually, adjusted to teachers' needs and levels of ability in using instructional technology.

The principals played an active role as facilitators and motivators in supervision activities. Forms of supervision implementation included ICT training, individual mentoring, classroom observations, and reflective discussions with teachers. ICT training focused on using digital learning applications such as Google Workspace for Education, Canva, Quizizz, and Wordwall to develop instructional media and online assessments. These activities were carried out gradually to enable teachers to understand and directly practice technology in their teaching.

Individual mentoring became one of the main strategies during the supervision implementation stage. The principals and supervision teams provided direct guidance to teachers who had difficulty integrating ICT into their lesson plans. This approach enabled supervision to be delivered in a personalised, tailored manner to the specific needs of each teacher. This is reflected in the following statement from one of the teachers:

> *"The mentoring provided by the principal was very helpful. We were not only given theoretical explanations, but were directly guided on how to use digital applications for teaching and assessment."*(Grade II teacher, interview, May 5, 2025)

In addition to mentoring, the principals also conducted supervision through classroom visits to directly observe the implementation of ICT in teaching and learning activities. Observations were conducted using supervision instruments based on indicators of digital media use, instructional interaction, and student engagement. Following the observations, the principals held reflective discussions with teachers to provide constructive feedback and solutions to the challenges encountered.

Observation results indicated an increase in teachers' motivation and participation in the use of instructional technology. Teachers began to demonstrate greater confidence in using digital media and in developing varied ICT-based learning activities. The principal's interview statement further supported this condition:

> *"After several rounds of mentoring and classroom supervision, teachers have become more confident in trying digital media. They are starting to be more creative and are no longer afraid of using technology in their teaching."*(Principal, interview, May 12, 2025)

The findings of this study indicate that active, collaborative, and practice-based supervision implementation contributes significantly to the improvement of teachers' ICT competence. This approach is consistent with the concept of instructional leadership, which emphasizes the principal's direct involvement in improving instructional quality through professional teacher development [32]. Moreover, supervision conducted through coaching and reflective mentoring has been shown to be effective in promoting sustainable changes in teachers' instructional practices.

Thus, the findings at the implementation stage demonstrate that intensive and contextual principal supervision is capable of enhancing teachers' skills, confidence, and creativity in integrating ICT into instruction. Effective supervision implementation serves as a bridge between planning and the achievement of the objectives of improving teachers' ICT competence in primary schools.

3.4 Monitoring and Evaluation of Principal Supervision for Enhancing Teachers' ICT Competence

Based on the research findings at SDN Jembatan Besi 03 Pagi and SDN Tanah Sereal 03 in Tambora District, the monitoring and evaluation (controlling) function of academic supervision was implemented continuously to ensure the achievement of the objectives of improving teachers' information and communication technology (ICT) competence. Supervision was not limited to administrative aspects but also focused on evaluating teachers' effectiveness in integrating technology into the teaching and learning process.

The principals conducted monitoring of supervision implementation through classroom observations, reviews of ICT-based instructional materials, and evaluations of teacher mentoring outcomes. The monitoring instruments used included indicators of digital media use, student engagement, and alignment of technology use with instructional objectives. This approach enabled principals to obtain an objective picture of teachers' ICT competence over time.

Monitoring was also carried out through periodic reporting and reflective reviews of supervision outcomes. Teachers were asked to submit brief reports on their use of digital media in instruction, including the challenges encountered and the strategies they had applied. The results of this monitoring were then discussed in joint evaluation forums involving the principals and supervision teams. This is reflected in the following statement from the principal:

> *"After supervision, we always conduct joint evaluations. Teachers share what has worked well and what remains challenging, so that we can determine appropriate follow-up actions."*(Principal, interview, June 3, 2025)

The findings indicate that supervision evaluation was used as a basis for decision-making to improve and further develop subsequent supervision programs. Teachers who continued to experience difficulties in using ICT received additional mentoring, while those who demonstrated strong competence were given opportunities to share best practices with their colleagues. This strategy fostered a culture of reflection and collaborative learning within the school environment.

One teacher stated:

> *"From the supervision evaluation, we understand which areas need improvement. The principal does not place blame, but provides guidance and solutions so that we can perform better in the future."*(Grade V teacher, interview, June 10, 2025)

Continuous monitoring also enabled principals to assess the impact of supervision on instructional quality. Observation results showed increased use of varied, interactive digital media and greater student engagement in the learning process. These findings indicate that the controlling function was not merely corrective, but also oriented toward strengthening and continuously developing teachers' competencies.

The findings of this study are consistent with Terry's management theory, which emphasises that the controlling function is crucial to ensuring activities are implemented in accordance with established plans and objectives. Furthermore, a reflective, constructive evaluation approach supports the development of a culture of continuous quality improvement within schools.

Thus, the findings from the monitoring and evaluation stage demonstrate that principals have effectively and humanely implemented the controlling function of supervision. Supervision grounded in reflection and follow-up has proven capable of strengthening teachers' ICT competence and promoting the sustainability of digital learning practices in primary schools.

3.5 Discussion

The findings of this study indicate that principal supervision management, implemented through the functions of planning, organising, actuating, and controlling (POAC), plays a significant role in enhancing teachers' information and communication technology (ICT) competence in primary schools. These findings affirm that academic supervision managed systematically and integratively functions not merely as a control mechanism but as a strategy for sustainable professional teacher development.

At the planning stage, teacher involvement in needs analysis and the formulation of supervision programs reflects a participatory approach to school leadership. This approach reinforces Sergiovanni's assertion that effective leadership is built through collaboration and a shared sense of ownership of institutional goals [33]. Needs-based supervision planning is also consistent with the perspective of Glickman et al., who emphasise that supervision achieves optimal impact when it is designed according to teachers' contextual conditions and levels of professional readiness [34]. In the context of digital transformation in education, planning that is sensitive to teachers' ICT capacities becomes a key determinant of the success of technology-based learning development.

The organising function of supervision, characterised by team formation and role distribution based on individual competencies, demonstrates the practice of distributed instructional leadership. This finding strengthens the findings of Hallinger and Heck's studies, which suggest that distributed leadership enhances schools' organisational capacity to manage change and foster instructional innovation. By involving senior teachers and school operators, supervision no longer relies solely on the principal as an individual actor but becomes a collective responsibility. This is particularly important in developing ICT competence, which requires collaboration and shared learning among teachers.

At the implementation stage, the principal's role as facilitator, coach, and role model was found to contribute to increased teacher confidence and creativity in integrating ICT into instruction. This finding aligns with the concept of instructional leadership, which emphasises principals' direct involvement in instructional practices as a key factor in improving teaching quality. Supervision conducted through practical training, individual mentoring, and collaborative reflection demonstrates that a coaching-oriented approach is more effective than purely evaluative supervision. Darling-Hammond et al. argue that professional development grounded in authentic practice and reflective processes has a more substantial impact on changes in teachers' instructional behaviour [35].

The monitoring and evaluation function in this study indicates that continuous, reflective supervision can foster a culture of professional learning within schools. Evaluation was not merely used to assess teacher performance, but served as a basis for decision-making and for improving subsequent supervision programs. This finding supports Terry's

management theory, which positions the controlling function as a feedback mechanism to ensure the sustainability and effectiveness of management processes. Furthermore, a humanistic and constructive evaluative approach aligns with Louis et al., who found that cultures of reflection and collective learning are positively correlated with improvements in instructional quality and student learning outcomes.

Overall, the findings of this study extend the discourse on academic supervision by positioning the principal's managerial role as a strategic element in the development of teachers' ICT competence. Unlike previous studies that primarily focused on specific supervision models or techniques, this study demonstrates that the success of enhancing teachers' ICT competence is strongly influenced by how principals manage supervision holistically as an integrated system. Accordingly, POAC-based supervision management can be viewed as a relevant and applicable conceptual framework for supporting digital transformation in primary education.

The theoretical implications of this study lie in strengthening the integration between classical management theory and instructional leadership practices within the context of digital education. Practically, the findings provide guidance for school principals and educational policymakers in designing academic supervision that is adaptive, collaborative, and oriented toward sustainable teacher competence development. This aligns with national and global policy directions that position teachers' digital literacy as a fundamental foundation for improving educational quality in the digital era.

4. CONCLUSION

This study concludes that principal supervision management grounded in the integrated functions of planning, organising, actuating, and controlling (POAC) plays a strategic role in supporting the development of teachers' information and communication technology (ICT) competence in primary schools. Supervision implemented as a collaborative and developmental process enables principals to foster sustainable professional learning, strengthen instructional leadership, and support teachers' readiness to integrate digital technologies into classroom practice. The study implies that adequate academic supervision should be positioned as a managerial and pedagogical strategy rather than a purely administrative function. However, this research is limited to a qualitative case study in two public primary schools, which may restrict the transferability of its findings. Future research is recommended to involve broader contexts, apply mixed or quantitative approaches, and examine the long-term impact of supervision management on instructional quality and student learning outcomes. Overall, this study contributes to the general public by highlighting the importance of school leadership in advancing digital learning and improving the quality of primary education in the digital era.

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