

MAPPING IDEA & LITERATURE FORMAT | RESEARCH ARTICLE

Digital Instructional Leadership: A Conceptual Framework for Teacher Performance Monitoring Based on a Systematic Literature Review

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ABSTRACT

This study synthesizes the literature on digital instructional leadership and teacher performance monitoring in school management and proposes a conceptual framework for technology-supported monitoring. A Systematic Literature Review (SLR) was conducted in line with the PRISMA 2020 guidelines. Searches in Scopus, Google Scholar, ScienceDirect, and ERIC covered peer-reviewed articles published between 2020 and 2025, and fifteen studies were retained after four selection phases (identification, screening, eligibility, and inclusion). Data were extracted with a structured form and analyzed through thematic synthesis with inductive coding. The synthesis identified five dimensions that form the Instructional Leadership Digital (ILD) framework: Digital Leadership Competency, Digital Monitoring System, Innovative School Management, Data-Driven Decision Making, and Teacher Professional Development Loop. The reviewed studies mostly examine these dimensions separately, and few connect leadership, monitoring, data-based decisions, and professional development in one cycle; evidence on digital monitoring systems and on data-driven decision making is comparatively thin within the school-based studies. The ILD framework is therefore offered as a conceptual proposal, organized as a Plan-Do-Check-Act cycle, which has not yet been tested empirically. The study contributes to research on digital educational leadership by clarifying how the five dimensions may relate to one another, and it gives principals, system developers, and policymakers a structured basis for designing and evaluating digitally supported monitoring. The conclusions are limited by the small corpus, the use of a screening-level quality appraisal, and the conceptual nature of the framework.

Keywords: Digital Instructional Leadership, Teacher Performance Monitoring, Innovative School Management, Digital Transformation in Education, Data-Driven Decision Making.

I. Introduction

The rapid development of digital technologies has changed educational management; it affects not only teaching and learning but also leadership, supervision, evaluation, and decision-making in schools. In the Society 5.0 era, school principals who act as instructional leaders can no longer rely on a supervision approach that is episodic, administrative, and manual. Teacher performance monitoring has consequently become a key responsibility of school leadership, because it has a direct bearing on the quality of instruction and on the achievement of educational goals (Hallinger et al., 2020; Karakose et al., 2021; Nurfadila, 2024). Instructional leadership has long been associated with teacher capacity and instructional quality, and it has become one of the most influential models guiding research, policy, and practice in school leadership (Bellibaş et al., 2021;

Hallinger et al., 2020). At the same time, studies that bring digital dimensions into instructional leadership are scattered, especially with regard to teacher performance monitoring and evaluation (Dexter & Richardson, 2020; Rasdiana et al., 2024). The problem is that the development of educational leadership research has taken place separately from research on educational technology. This separation results in conceptual fragmentation, which makes it difficult to develop an integrated and operational framework.

In the Indonesian context, digital-based teacher performance monitoring is becoming increasingly important because of the Merdeka Belajar policy, which defines the teacher's role as that of a learning facilitator rather than a transmitter of knowledge. Such a reform calls for a supervisory system that evaluates not only teachers' compliance with administrative regulations but also their instructional quality, innovativeness, interaction with students, and learning outcomes. Recent Indonesian studies indicate that principals' instructional e-supervision, technology leadership, and school digital culture are jointly related to teachers' professional digital competence (Rasdiana et al., 2024), and that supervisors' digital competencies can be measured with a validated instrument (Ansar et al., 2025). Nevertheless, continuous, objective, and evidence-based monitoring still appears to be limited in many schools, and it is rarely examined as a connected cycle. Learning management systems (LMS), mobile-based supervision applications, analytical dashboards, and artificial intelligence (AI)-based feedback tools offer new opportunities to make teacher performance monitoring more efficient. These technologies make it possible to collect data in real time, to keep documentation systematically, and to analyze information quickly (Demszyk et al., 2023; Schwendimann et al., 2017). The value of such technologies depends strongly on the ability of school principals to manage organizational change, to build an innovative culture, and to use data effectively in decision making (Mandinach & Schildkamp, 2021; Taani et al., 2026).

Previous studies usually consider each of these issues independently. They pay attention to digital leadership, technology adoption, data-driven decision making, or platform-based teacher supervision (Berkovich & Hassan, 2023; Karakose et al., 2021; Mandinach & Schildkamp, 2021). Only a small number of studies attempt to integrate all of these aspects within one framework. A review of this literature is also timely because digital monitoring raises questions that are not purely technical. Digital recording and automated feedback may support formative improvement, but they may also create observation anxiety and weaken relational trust when teachers perceive them as surveillance (Taani et al., 2026). A framework that treats monitoring as part of a developmental cycle, rather than as an instrument of control, is therefore needed, and this review is designed to examine how far the existing literature supports such a framework. The study aims at achieving four goals: (1) identifying and mapping current trends in the literature on digital instructional leadership and teacher performance monitoring; (2) analyzing the main dimensions of the identified trends; (3) identifying research gaps; and (4) formulating the concept of Instructional Leadership Digital (ILD) as a contribution to the development of educational management science. These goals are translated into three research questions, which are presented in the Research Method section. The novelty of this study lies in its presentation of an integrative framework which connects digital leadership skills, teacher performance monitoring systems, innovations in school management, data-driven decisions, and teachers' professional development in a continuous cycle. Throughout the article, findings drawn from the reviewed studies are reported as evidence, whereas the ILD framework itself is presented as the authors' conceptual proposal.

The remainder of the article is organized as follows. The Literature Review outlines the conceptual and theoretical background. The Research Method describes the SLR procedure, including the search strategy, selection process, quality appraisal, and synthesis. The Results present the mapping and synthesis of the fifteen included studies. The Discussion interprets the findings, compares them with previous research, presents the ILD framework, and discusses implications, limitations, and a research agenda. The Conclusion summarizes the contribution of the study.

II. Literature Review

2.1. Instructional Leadership in the Digital Era

Instructional leadership places the principal in a position of responsibility for defining the school mission, managing the instructional program, and fostering a climate that supports learning. A science mapping of 1,206 Scopus-indexed articles shows that the knowledge base on instructional leadership has grown in both size and geographic scope, and that recent work concentrates on the effects of leadership on teachers and students, on the contexts of leadership practice, and on ways of developing instructional leaders (Hallinger et al., 2020). At the classroom level, research has examined how instructional leadership and distributed leadership relate to instructional quality (Bellibaş et al., 2021), which indicates that leadership practices are relevant to what teachers actually do in their lessons.

Digital leadership extends this tradition. Principals' digital transformational leadership has been examined in relation to teachers' commitment and school effectiveness (Berkovich & Hassan, 2023), and teachers' accounts of their principals' digital leadership have been organized into five themes: the use of digital technology, support for digital transformation, support for technology-based professional development, support for a digital learning culture, and digital leadership skills (Karakose et al., 2021). Transformational leadership has also been studied as a condition that empowers teachers to use technology in a more demanding way (Schmitz et al., 2023), the effect of principals' digital leadership on teachers' technology integration has been investigated during the COVID-19 pandemic (AlAjmi, 2022), and principals' technology leadership practices have been analyzed in relation to a learning organization culture in K-12 schools (Banoğlu et al., 2023). A review of technology integration research, however, points to a gap between research on technology integration and the leadership practices needed to support it (Dexter & Richardson, 2020). Reviews of digital leadership in higher education exist (Jameson et al., 2022), but they address a different institutional setting, and the present review is therefore limited to school contexts. In Indonesia, digital leadership is studied alongside the national emphasis on principal competence. Darwis et al. (2025), for example, designed an assessment tool for the teacher leadership competencies of aspiring elementary school principals, while Rasdiana et al. (2024) and Ansar et al. (2025) examined digital supervision and supervisors' digital competencies in senior high schools. Together, these studies show growing interest in the topic, although each addresses only part of the monitoring process.

2.2. Digital Teacher Performance Monitoring

Digital teacher performance monitoring covers a range of tools, including LMS platforms, dashboards, e-supervision applications, digital portfolios, and AI-assisted feedback. Research on learning dashboards has examined how visual displays of learning data can make learning processes visible to teachers and learners, which supports awareness and decision making (Schwendimann et al., 2017). Automated feedback based on natural language processing has also been tested as support for teachers' professional development: in a randomized controlled trial with 1,136 instructors in an online course, an automated tool improved instructors' uptake of student contributions by 13% (Demszky et al., 2023). This evidence comes from an online course rather than from school-based monitoring, and its transferability to schools remains to be demonstrated. At the leadership level, a recent systematic review of digital technologies in principal supervision reports that e-supervision and virtual coaching can increase the frequency of feedback and reduce geographical barriers, but that they also introduce challenges such as the digital divide, observation anxiety, and a possible erosion of relational trust (Taani et al., 2026). Mentoring and coaching of school leaders through virtual professional learning communities has likewise been investigated with a mixed-methods design (Irby et al., 2023). In Indonesia, principals' instructional e-supervision, technology leadership, and school digital culture have been examined together as influences on teachers' professional digital competence (Rasdiana et al., 2024), and a four-dimension scale of supervisors' digital competencies, covering strategic digital

leadership, digital culture promotion, teacher digital development, and digital learning facilitation, has been validated with 318 principals and teachers from 78 senior high schools (Ansar et al., 2025).

Teachers' own digital competence is a further condition for digital monitoring. The teacher digital competency framework distinguishes digital literacy from digital competence (Falloon, 2020), dimensions of teachers' digital competence have been reviewed systematically (Smestad et al., 2023), and factors that affect the level of teachers' digital competence have been examined in a nationwide mixed-methods study (Althubyani, 2024). Studies of vocational teachers (Cattaneo et al., 2022) and of teachers' ICT integration (Peng et al., 2024) point in the same direction: attitudes, self-efficacy, and competence shape how teachers use digital tools. Technology acceptance models, which have been mapped in this journal (Banjarnahor, 2021), offer a useful lens for understanding why teachers may accept or resist digital monitoring. These strands suggest that the acceptance of monitoring tools is likely to depend on teachers' competence and perceptions as well as on the tools themselves.

2.3. Data-Driven Decision Making and Innovative School Management

Data-driven decision making refers to the systematic collection and analysis of data to inform educational decisions. An exploration of the literature on data-based decision making in education addresses common misconceptions and underlines the need for a clear understanding of what data use in schools actually involves (Mandinach & Schildkamp, 2021). For principals, this means that collecting data is not enough; the data must be interpreted and linked to concrete action. Ethical considerations also shape how administrators use data and AI in decisions: the impact of AI ethics on school administrators' decision-making has been examined together with sustainable leadership behaviors and diversity management skills (Aldighrir, 2024). Innovative school management is closely related to digital transformation. Vial (2019) describes digital transformation as a process in which digital technologies create disruptions that trigger strategic responses from organizations, which must also manage structural changes and organizational barriers. For schools, this implies that technology adoption is inseparable from culture, collaboration, and managerial support. Evidence on digital platforms in education is encouraging; a meta-analysis reports that digital platforms are associated with improved learning outcomes (Alshammary & Alhalafawy, 2023), but the benefits depend on how platforms are embedded in school routines. The reviewed Indonesian study on digital culture (Rasdiana et al., 2024) and the work on learning organization culture (Banoğlu et al., 2023) both indicate that culture mediates the value of technology.

2.4. Teacher Professional Development and Feedback Loops

Monitoring becomes meaningful for improvement when its results return to teachers as feedback and support. A meta-analysis of the causal evidence on teacher coaching found that coaching improves instructional practice and, to a smaller extent, student achievement (Kraft et al., 2018). In vocational schools, motivation and professional development have been shown to mediate the determinants of teacher performance (Kholifah et al., 2024), and human resource practices in education, including performance management and professional development, have been linked to teacher performance and learning outcomes (Permatasari & Tandiayuk, 2023). Taken together, these studies support the idea that monitoring should feed a professional development loop instead of ending with assessment.

2.5. Theoretical Foundations of the ILD Framework

The ILD framework draws on three theoretical perspectives, which are summarized in Table 1. Instructional leadership theory explains why principals are responsible for the quality of teaching and for the development of teachers (Hallinger et al., 2020). Organizational digital transformation theory explains why the adoption of digital tools requires strategic leadership and attention to organizational barriers (Vial, 2019).

Distributed cognition proposes that cognitive work is shared among people, artifacts, and the environment (Hollan et al., 2000); in the school setting, dashboards, records, and shared reports can be understood as artifacts that extend what a school can know about teaching quality. The three perspectives are combined in a Plan-Do-Check-Act (PDCA) cycle adapted to the school context, which gives the framework its sequential logic.

Table 1. Theoretical Foundations of the ILD Framework

Theoretical perspective	Core proposition	ILD dimensions supported	PDCA phase
Instructional leadership	Principals shape teaching quality by defining the mission, managing instruction, and developing teachers (Hallinger et al., 2020).	D1, D5	Plan; Act
Organizational digital transformation	Digital technologies trigger strategic responses that require managing structural change and organizational barriers (Vial, 2019).	D1, D3	Plan; enabling context in all phases
Distributed cognition	Cognitive work is shared among people, artifacts, and the environment, so shared records and dashboards extend what a school can know about teaching (Hollan et al., 2000).	D2, D4	Do; Check
Continuous improvement (PDCA)	An iterative cycle of planning, doing, checking, and acting, adapted by the authors to the digital school context.	D1-D5	Plan-Do-Check-Act

Table 1 shows that each ILD dimension is supported by at least one theoretical perspective. Digital Leadership Competency (D1) rests on instructional leadership and on digital transformation theory; Digital Monitoring System (D2) and Data-Driven Decision Making (D4) rest on distributed cognition, because they concern how information about teaching is captured, shared, and interpreted; Innovative School Management (D3) rests on digital transformation theory; and the Teacher Professional Development Loop (D5) rests on instructional leadership, which assigns the principal a developmental role. The PDCA logic ties these perspectives together by placing D1 and D3 in the planning and enabling context, D2 in the doing phase, D4 in the checking phase, and D5 in the acting phase, which in turn informs the next planning round.

III. Research Method

3.1. Research Design and Rationale

For this study, the Systematic Literature Review (SLR) method is used according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 (Page et al., 2021). This method was selected because of the need to obtain a comprehensive, transparent, systematic, and reproducible synthesis of the literature, which reduces selection and interpretation bias in contrast to a narrative review (Snyder, 2019). Qualitative systematic reviews that synthesize empirical studies have also been published in this journal (Abbas, 2026). The review focuses on studies devoted to digital instructional leadership, digital teacher performance monitoring, data-driven decisions, and teacher professional development within the context of school management. Because the aim is to map existing evidence and to build a conceptual framework, rather than to estimate effect sizes, a thematic synthesis was chosen instead of a meta-analysis.

3.2. Research Questions

Three major research questions guided this research. They were: (RQ1) What models of digital leadership are connected with teacher performance monitoring? (RQ2) What indicators and digital

monitoring systems are used in the modern literature? (RQ3) How can the dimensions of digital instructional leadership be incorporated into a functional framework for monitoring teacher performance?

3.3. Search Strategy

The systematic search was performed in Scopus, Google Scholar, ScienceDirect, and ERIC. The search used keywords related to instructional leadership, digital leadership, teacher performance, teacher monitoring, and school management, combined with Boolean operators and adapted to the syntax of each database. Table 2 reports the search strings and limits. The publication period was limited to 2020-2025 to reflect current trends in the digital transformation of education. Because the databases differ in their search functions, the strings were simplified where a database restricts the number of Boolean operators (for example, ScienceDirect), and Google Scholar was searched with phrase combinations within the same date range.

Table 2. Database Search Strategy

Database	Search string (adapted to database syntax)	Limits applied
Scopus	TITLE-ABS-KEY(("instructional leadership" OR "digital leadership" OR "technology leadership") AND ("teacher performance" OR "teacher monitoring" OR "teacher evaluation" OR "teacher supervision") AND ("school management" OR "school principal" OR "school leadership"))	2020-2025; journal articles; English or Indonesian
ScienceDirect	("instructional leadership" OR "digital leadership") AND ("teacher performance" OR "teacher supervision") AND "school principal"	2020-2025; research articles
ERIC	("instructional leadership" OR "digital leadership") AND ("teacher performance" OR "teacher monitoring" OR "teacher evaluation") AND ("school management" OR "school principal")	2020-2025; peer-reviewed
Google Scholar	Phrase combinations of "digital leadership", "instructional leadership", "teacher performance", "teacher monitoring", and "school management"	Custom range 2020-2025

3.4. Eligibility Criteria

The following inclusion criteria were applied to the articles: (1) peer-reviewed journal articles; (2) studies related to instructional leadership, digital leadership, or technology leadership within the school education context; (3) studies addressing at least one of the following in relation to school leadership or digital technology: teacher performance monitoring or supervision, evaluation, data use in decision making, or teacher professional development; (4) articles in English or Indonesian; and (5) articles available in full text. The exclusion criteria were as follows: conference proceedings, thesis papers, studies in the context of higher education, studies irrelevant to the focus of the review, and papers lacking the full text. Criterion (3) is formulated as an alternative ('at least one') because few studies cover the whole monitoring cycle, which is the very gap that this review addresses.

3.5. Study Selection

The selection process was based on the PRISMA principles, including identification, screening, eligibility assessment, and inclusion, and is shown in Figure 1. Starting from a total of 487 records, 312 unique articles remained after the removal of 175 duplicates. At the screening stage, 189 records were excluded on the basis of titles and abstracts, and 123 articles were considered relevant. After the full-text examination and eligibility assessment against the criteria above, 108 articles were excluded and 15 articles were selected for further analysis. The counts of excluded records are derived from the reported flow and are shown in Figure 1.

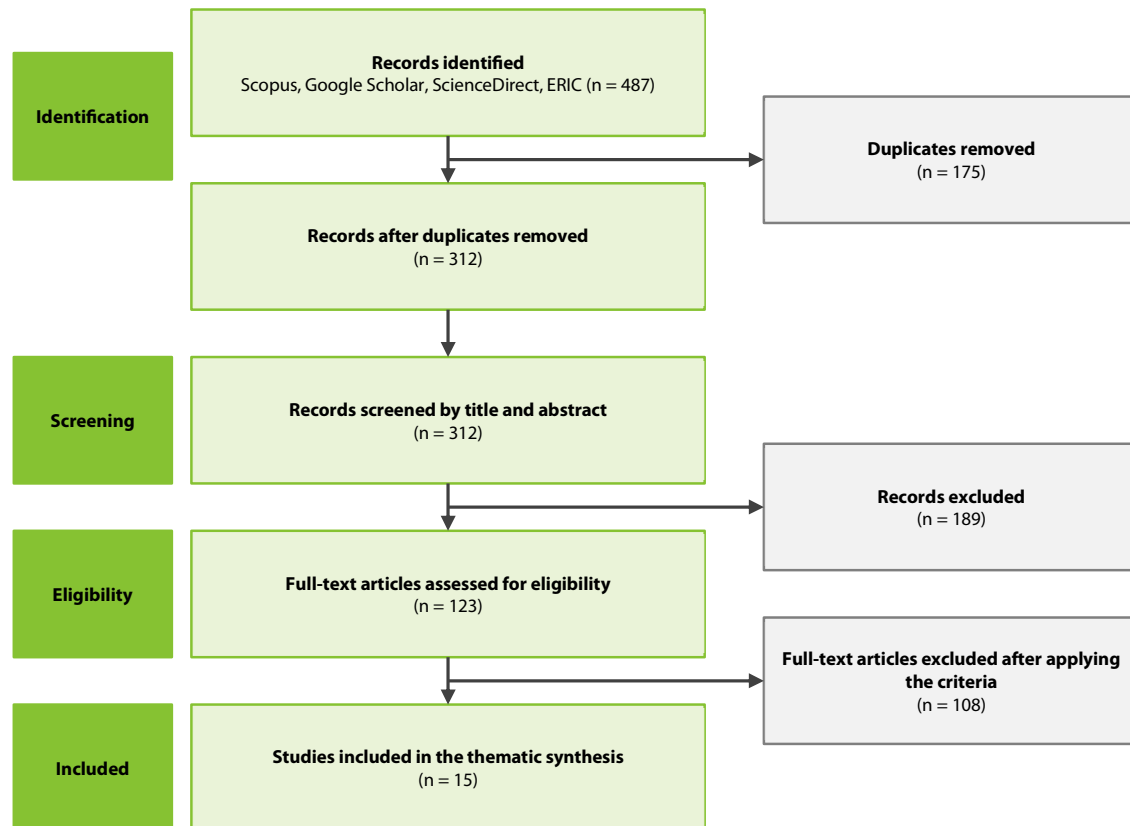


Figure 1. PRISMA Flow Diagram of the Study Selection Process

3.6. Quality Appraisal

The methodological quality of the included studies was screened with the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). The two MMAT screening questions, namely whether the study has clear research questions and whether the collected data allow these questions to be addressed, were applied to all fifteen studies, and all fifteen met them. Because the purpose of this review is to map and synthesize rather than to estimate effects, no study was excluded on the basis of further design-specific criteria. Instead, the design and context of each study were recorded (Table 3), and study quality was taken into account when judging the strength of the evidence for each dimension (see Section 4.6). Three of the included studies are literature reviews (Dexter & Richardson, 2020; Hallinger et al., 2020; Mandinach & Schildkamp, 2021), which the MMAT does not cover; for these, the transparency of the reported search and selection procedures was noted descriptively. A full risk-of-bias rating with all design-specific MMAT criteria was not carried out, which is acknowledged as a limitation.

3.7. Data Extraction and Thematic Synthesis

Data extraction was carried out using a structured extraction form which recorded the author(s), year of publication, context, focus of the study, methods used, results obtained, and research gaps identified. Thematic synthesis was used for the analysis and involved the following stages: (1) line-by-line inductive coding of the key findings of each study; (2) grouping of codes into descriptive themes; (3) generation of analytical themes by interpreting how the descriptive themes relate to leadership, monitoring, and development; and (4) mapping of analytical themes onto candidate dimensions of the framework. A theme was treated as a dimension when it appeared in the corpus and was necessary to complete the monitoring

cycle; the number of supporting studies for each dimension is reported in Table 4 so that readers can judge the strength of the evidence. Initial coding was carried out by the first author, and the codes and themes were reviewed by the other authors; disagreements were resolved through discussion until consensus was reached. The process resulted in five major themes that form the basis of the conceptual framework of Instructional Leadership Digital (ILD).

IV. Results and Discussion

Following the PRISMA selection procedure, 15 articles were included in the study and subjected to careful analysis. The studies were published between 2020 and 2025, with two studies in 2020, three in 2021, two in 2022, three in 2023, three in 2024, and two in 2025. Four studies were situated in Indonesia (Ansar et al., 2025; Darwis et al., 2025; Kholifah et al., 2024; Rasdiana et al., 2024), and the others covered a range of international contexts. Three studies are literature reviews, and the remaining twelve are empirical studies, mostly quantitative surveys, structural models, or instrument studies, together with one qualitative study (Karakose et al., 2021). As seen in the corpus, several aspects related to digital leadership, teacher supervision, technology integration, and data-driven decision making have been explored in previous research. However, the existing studies still lack a unified approach and cannot provide a holistic model that would be applicable in school settings.

4.1. Mapping of Prior Studies

Table 3 illustrates a mapping of prior studies in terms of their authors, principal findings, and research gaps. The studies are listed in chronological order, and the findings are described at the level reported in the original abstracts.

Table 3. Mapping of Previous Studies (n = 15)

No	Authors	Key Findings	Gaps/Limitations
1	Dexter & Richardson (2020)	A review of technology integration research draws implications for the leadership of technology and points to a gap between integration research and leadership practice.	Teacher performance monitoring and data use were not the focus of the review.
2	Hallinger et al. (2020)	A science map of 1,206 Scopus-indexed articles shows that instructional leadership research has grown in size and geographic scope, with themes on leadership effects, contexts, and leader development.	The digital dimension of instructional leadership and monitoring was not the focus of the mapping.
3	Bellibaş et al. (2021)	Examined how instructional leadership and distributed leadership relate to instructional quality in teachers' classroom practice.	The digital dimension was not examined.
4	Karakose et al. (2021)	Teachers' accounts identified five themes of principals' digital leadership, including support for digital transformation and for technology-based professional development.	Evidence is qualitative and was not linked to a structured monitoring framework.
5	Mandinach & Schildkamp (2021)	Explored the literature on data-based decision making in education and addressed common misconceptions about data use.	Not connected to leadership-led monitoring of teacher performance.
6	AlAjmi (2022)	Examined the impact of principals' digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait.	Teacher performance monitoring and evaluation were not the outcomes examined.

No	Authors	Key Findings	Gaps/Limitations
7	Cattaneo et al. (2022)	Assessed vocational teachers' digital competence and examined the factors underlying it.	The role of school leadership and monitoring in developing digital competence was not addressed.
8	Banoğlu et al. (2023)	Examined principals' technology leadership practices in relation to a learning organization culture in public K-12 schools.	Links to teacher monitoring and data-based decisions were not examined.
9	Berkovich & Hassan (2023)	Principals' digital transformational leadership was examined in relation to teachers' commitment and school effectiveness, using data from 380 teachers in Bahrain.	Monitoring systems and data use were not examined.
10	Schmitz et al. (2023)	Transformational leadership was examined as a means of empowering teachers to use technology in a more demanding way.	Monitoring and professional development cycles were not modeled.
11	Kholifah et al. (2024)	Examined the mediating roles of motivation and professional development in determining teacher performance in vocational schools.	Leadership-led digital monitoring was not examined.
12	Peng et al. (2024)	Modeled attitudes, self-efficacy, and digital competence as influences on teachers' ICT integration using PLS-SEM.	Leadership and supervisory conditions were not included.
13	Rasdiana et al. (2024)	In Indonesia, principals' instructional e-supervision, technology leadership, and school digital culture were examined together as influences on teachers' professional digital competence.	The data-to-decision-to-development cycle was not modeled.
14	Ansar et al. (2025)	Developed and validated a four-dimension scale of supervisors' digital competencies with 318 principals and teachers from 78 senior high schools in South Sulawesi, Indonesia.	The scale measures supervisor competence, not an integrated monitoring cycle.
15	Darwis et al. (2025)	Designed an assessment tool for teacher leadership competencies among aspiring elementary school principals in Indonesia.	Digital monitoring of teacher performance was not addressed.

4.2. Synthesis of Five Key Dimensions

Using thematic analysis, five key dimensions were identified, and they became the basis for the conceptual model used to develop the ILD framework. Table 4 shows how the fifteen studies are distributed across the five dimensions. Digital Leadership Competency (D1) is addressed by eleven studies, Innovative School Management (D3) by seven, and the Teacher Professional Development Loop (D5) by eight. By contrast, the Digital Monitoring System (D2) and Data-Driven Decision Making (D4) are each addressed by only one study in the corpus. The only study that covers several dimensions at once is Rasdiana et al. (2024), which links e-supervision, technology leadership, digital culture, and teacher competence.

Table 4. Distribution of the Included Studies across the ILD Dimensions

Study	D1	D2	D3	D4	D5
Dexter & Richardson (2020)	✓		✓		
Hallinger et al. (2020)	✓				✓
Bellibaş et al. (2021)	✓				✓
Karakose et al. (2021)	✓		✓		✓
Mandinach & Schildkamp (2021)				✓	
AlAjmi (2022)	✓		✓		
Cattaneo et al. (2022)					✓
Banoğlu et al. (2023)	✓		✓		

Study	D1	D2	D3	D4	D5
Berkovich & Hassan (2023)	✓		✓		
Schmitz et al. (2023)	✓		✓		
Kholifah et al. (2024)					✓
Peng et al. (2024)					✓
Rasdiana et al. (2024)	✓	✓	✓		✓
Ansar et al. (2025)	✓				✓
Darwis et al. (2025)	✓				
Number of studies	11	1	7	1	8

Table 5 summarizes the synthesis for each dimension. Because D2 and D4 are thinly represented in the school-based corpus, the synthesis points for these dimensions are also informed by adjacent literature cited in the Literature Review, namely dashboard research (Schwendimann et al., 2017), automated feedback (Demszky et al., 2023), and research on data-based decision making (Mandinach & Schildkamp, 2021). These sources lie outside the corpus or outside the school setting and are therefore used to interpret, rather than to count as, evidence.

Table 5. Literature Synthesis: Five Dimensions of Digital Instructional Leadership

Thematic Dimension	Synthesis Point	Relevance to the Framework
Digital Instructional Leadership	School principals appear to need digital competencies to manage teaching, learning, and supervision effectively (Berkovich & Hassan, 2023; Karakose et al., 2021).	Forms the Digital Leadership Competency dimension.
Digital-Based Teacher Performance Monitoring and Evaluation	Digital supervision, dashboards, and AI-based tools are proposed to make monitoring more systematic; direct school-based evidence is limited (Rasdiana et al., 2024), and effects on objectivity and accuracy remain to be tested.	Forms the Digital Monitoring System dimension.
Digital Transformation of School Management	Digital transformation appears to require strategic leadership to reshape the organizational culture of schools (Banoğlu et al., 2023; Schmitz et al., 2023; Vial, 2019).	Forms the Innovative School Management dimension.
Data-Driven Decision Making	Teacher performance and instructional data should serve as the basis for instructional decision making, provided that data use is understood correctly and applied ethically (Aldighrir, 2024; Mandinach & Schildkamp, 2021).	Forms the Data-Driven Decision-Making dimension.
Effectiveness of Supervision and Teacher Professional Development	Continuous supervision and feedback may strengthen teacher competence and motivation (Kholifah et al., 2024; Kraft et al., 2018).	Forms the Teacher Professional Development Loop dimension.

4.3. Digital Leadership Models in Educational Contexts

According to the synthesis results, educational leadership appears to be shifting from traditional transformational models toward a model of digital leadership that aligns with technological development. Transformational leadership plays a key role; however, studies suggest that it needs to be complemented by digital skills, data management, and the ability to create a technology-enhanced learning environment (Berkovich & Hassan, 2023; Karakose et al., 2021; Schmitz et al., 2023). Distributed leadership is also relevant, since it has been examined together with instructional leadership in relation to instructional quality (Bellibaş et al., 2021), and digital platforms may make collaboration with other members of the school community

easier, although the reviewed studies do not test this link directly. Digital skills on the part of school principals appear to be a key factor in whether school transformation succeeds. Principals with well-developed digital skills are better placed to explain the innovation vision, to manage change, and to encourage teachers to implement technology in teaching and learning (Karakose et al., 2021; Rasdiana et al., 2024). Thus, digital instructional leadership should be understood not as the use of digital devices but as a paradigm shift in the way leaders think, communicate, and make decisions.

4.4. Indicators and Digital Systems for Teacher Performance Monitoring

Another important finding is the shift from periodic administrative monitoring toward continuous monitoring facilitated by digital tools. Digital systems can allow school principals to follow teachers' performance indicators on a continuing basis, for example instructional regularity, the quality of teaching materials, timeliness of feedback, student engagement, and consistency of instructional implementation. Within the corpus, however, only one study examines digitally supported supervision directly (Rasdiana et al., 2024). The indicators listed here are therefore proposals derived by the authors from the supervisory dimensions in the reviewed studies, and they require empirical testing. The introduction of artificial intelligence can enable automated analysis of instruction, the identification of training needs, and the provision of data-based recommendations. A randomized trial of a natural language processing tool showed improved teacher uptake of student ideas (Demszky et al., 2023), but, as noted earlier, this evidence comes from an online course. Nevertheless, the effectiveness of digital systems depends not only on the degree of technological advancement. Factors such as transparency, fairness of evaluation, usability, and psychological safety play a crucial role in teachers' acceptance of digital monitoring systems (Banjarnahor, 2021; Taani et al., 2026).

4.5. Use of Dashboards and Monitoring Applications

Digital monitoring systems may include LMS platforms, performance dashboards, principal supervision applications, digital attendance systems, and learning analytics. Dashboards are intended to bring information to a single view so that patterns become visible at a glance (Schwendimann et al., 2017). In a school, such platforms could integrate information on instructional data, student attendance, feedback, and supervision results into one system that is more convenient for monitoring. Whether this integration improves monitoring in practice has not been tested directly in the reviewed school-based studies. In addition, the literature demonstrates that the process of implementing technologies in schools depends largely on the proactive attitude of school principals. Where principals are not only formulators of policy but also active users of technology, teachers appear to be more willing to use digital platforms (Berkovich & Hassan, 2023; Karakose et al., 2021). This is an association reported in the studies, and it should not be read as proof of a causal effect.

4.6. Evidence Strength and Cross-Dimensional Patterns

Three patterns follow from Tables 3 to 5. First, the evidence is concentrated on leadership (D1) and on teacher development (D5), which together account for most of the corpus. Second, evidence on monitoring systems (D2) and data use (D4) is thin, so the claim that dashboards and AI-based systems make monitoring more objective, precise, and consistent is not directly supported by the school-based studies and has to be treated as a hypothesis. Third, almost all studies treat the dimensions separately; the corpus contains no study that traces the whole path from monitoring data to decisions and then to professional development. These patterns are the basis for the research gaps discussed below.

4.7. Discussion

The findings of this study show that the concept of digital instructional leadership is relevant to school management in the 21st century. The identification of five main dimensions suggests that efficient monitoring of teacher performance is difficult to separate from the principal's ability to use technology, manage data, foster an innovative culture, and link the process of evaluation to the professional development of teachers. These interpretations are drawn from a small corpus and from a conceptual synthesis, and they should be read as implications suggested by the literature rather than as demonstrated effects.

a. Interpretation of the Findings

The Digital Leadership Competency dimension suggests that principals' competence in technology may form the basis for transforming the monitoring of teacher performance. Without digital literacy, a vision of the future, and skills in change management, the use of dashboards and supervision applications is likely to remain limited to administrative processes. This reading is consistent with studies reporting that technology alone does not lead to transformation unless it is combined with visionary and instructionally oriented leadership (Karakose et al., 2021; Rasdiana et al., 2024). The Digital Monitoring System dimension suggests that digital systems could contribute to a more systematic and traceable evaluation of teacher performance, because data can be collected, recorded, and traced. Whether this also increases objectivity, precision, and consistency is a proposition that the reviewed school-based studies do not test, and the review of e-supervision by Taani et al. (2026) cautions that digital recording can also raise observation anxiety and weaken trust. Traditional supervision may be subject to bias and carried out too rarely, but digital supervision is not free from bias either, particularly when automated tools are used (Aldighrir, 2024).

The Innovative School Management dimension suggests that effective digital monitoring is unlikely to be achieved by providing technological tools alone. It appears to need an organizational culture that promotes innovation, collaboration, and learning (Banoğlu et al., 2023; Rasdiana et al., 2024). Schools with a positive digital culture may be better able to adapt to change and to use technology to improve the quality of education. The Data-Driven Decision-Making dimension points to a shift from intuitive to evidence-based decision making. Teacher performance data produced by a digital system could allow principals to respond to emerging problems in a timely and precise way, provided that the data are interpreted correctly (Mandinach & Schildkamp, 2021). In this case, instructional leadership becomes more strategic, because principals must not only collect data but also interpret it and apply it to design interventions. The Teacher Professional Development Loop dimension emphasizes that monitoring should not end with assessment. The results of monitoring need to be translated into feedback, coaching, mentoring, and adaptive training programs, which is consistent with evidence that coaching improves instructional practice (Kraft et al., 2018). Teacher performance evaluation can thus become a part of professional development rather than an instrument of control.

b. Comparison with Previous Studies

The findings of this study support previous research that treats digital leadership as an essential condition for the successful implementation of technology in schools (Berkovich & Hassan, 2023; Karakose et al., 2021). They also agree with the Indonesian evidence that instructional e-supervision, technology leadership, and digital culture work together (Rasdiana et al., 2024). The studies differ in what they treat as the outcome: Berkovich and Hassan (2023) focus on teachers' commitment and school effectiveness, Rasdiana et al. (2024) on teachers' professional digital competence, and Ansar et al. (2025) on the measurement of supervisors' digital competencies. The ILD framework adds a data-to-decision-to-development sequence that these studies do not model.

The recent review by Taani et al. (2026), published after the search window of this study, proposes a model in which technological infrastructure, relational trust, and pedagogical alignment must coincide for e-

supervision to work. This is compatible with the ILD logic, in which D1 and D3 provide the leadership and cultural conditions, but it differs in focus: that review concerns the supervision of principals, whereas the ILD framework concerns principals' monitoring of teachers. A further difference concerns the evidence base. Studies of automated feedback show promising results in online settings (Demszky et al., 2023), whereas the school-based studies reviewed here offer little direct evidence on AI-supported monitoring, which may reflect the early stage of such applications in schools and the concentration of research on leadership rather than on monitoring tools. Unlike the previous studies, which tend to focus on one dimension, such as the digital competence of principals, the transformation of school culture, or AI-based evaluation, the current study provides cross-dimensional integration. This is the main value added by the ILD framework to the current research on the intersection of educational leadership and educational technology, although its validity remains to be demonstrated.

c. Research Gap

In accordance with the synthesis of fifteen articles and the evidence pattern in Table 4, several research gaps are not sufficiently covered in the current literature.

Table 6. Mapping of Research Gaps in the Digital Instructional Leadership Literature

Research Gap Area	Description of the Gap	Implications for This Study
Leadership-Technology-Monitoring Integration	Within the reviewed corpus, no study connects instructional leadership, digital platforms, and teacher performance monitoring within a single cohesive framework.	This study develops an integrated ILD framework.
Developing Country Context	Only four of the fifteen studies are situated in Indonesia, and each addresses a single part of the monitoring process.	The ILD framework considers the implementation context of Indonesian schools.
Digital Feedback Cycle	Digital feedback loop mechanisms are rarely examined systematically in school-based studies.	This framework positions the feedback loop as a core component.
Standardized Digital Teacher Performance Indicators	There is no established consensus regarding valid and reliable indicators that can be measured digitally.	This study proposes measurable indicators for each dimension.

Standardized digital teacher performance indicators remain an important unresolved issue. There is currently no consensus regarding valid and reliable indicators that can be measured through digital systems; the scale of Ansar et al. (2025) validates supervisor competencies but not teacher performance indicators. This study therefore proposes measurable indicators within each dimension. These gaps indicate that the current literature has yet to provide a model that is simultaneously cohesive, operational, and contextually relevant. Accordingly, this study positions itself as a conceptual effort to address these limitations through the development of the ILD framework.

d. Conceptual Framework of Instructional Leadership Digital

The Instructional Leadership Digital (ILD) framework is built upon three principal foundations: instructional leadership, organizational digital transformation theory, and the distributed cognition approach (Table 1). The framework is designed as a continuous cycle that illustrates the relationships among monitoring, data analysis, decision making, and teacher professional development. Table 7 presents the five dimensions, their operational components, and proposed indicators, and Figure 2 shows how the dimensions are connected.

Table 7. Conceptual Framework of Instructional Leadership Digital (ILD)

ILD Dimension	Operational Components	Measurable Indicators
D1: Digital Leadership Competency	Digital leadership vision; principals' technological competence; school digital transformation policies; digital change management	Level of principals' digital literacy; principals' involvement in technology implementation; availability of a school digital strategic plan
D2: Digital Monitoring System	LMS/performance dashboard platforms; digital attendance systems; records of digital instructional activities; data-based supervision reports	Frequency of dashboard use; scope of recorded performance data; accuracy and consistency of data
D3: Innovative School Management	Data-based management; organizational innovation culture; digital collaboration among teachers; digital reward and recognition systems	Level of innovation adoption; teacher digital collaboration index; efficiency of administrative processes
D4: Data-Driven Decision Making	Analysis of teacher performance data; instructional decisions; evidence-based reporting; learning analytics for supervision	Proportion of data-based decisions; quality of evaluation reports; response time to performance-related problems
D5: Teacher Professional Development Loop	Continuous digital feedback; data-informed adaptive training; digital mentoring and coaching; reflection through digital portfolios	Frequency and quality of feedback; improvement in competence following feedback; level of teacher satisfaction with the development system

The ILD framework operates through a PDCA (Plan-Do-Check-Act) cycle adapted to the digital context. Dimension D1 serves as the foundation that enables the remaining dimensions to function effectively, and it corresponds to the planning phase together with the school's digital strategy. Dimension D2 operates as the mechanism for continuously collecting teacher performance data (Do). These data are subsequently analyzed within D4 to generate more precise instructional decisions (Check). The resulting decisions are then translated into D5 through adaptive professional development programs (Act). Meanwhile, D3 provides the organizational context that sustains the entire process through a culture of innovation, collaboration, and managerial support. As shown in Figure 2, the cycle is closed by two feedback arrows: results of professional development feed back into decision making (D5 to D4), and the experience of development informs how the monitoring system is refined (D5 to D2).

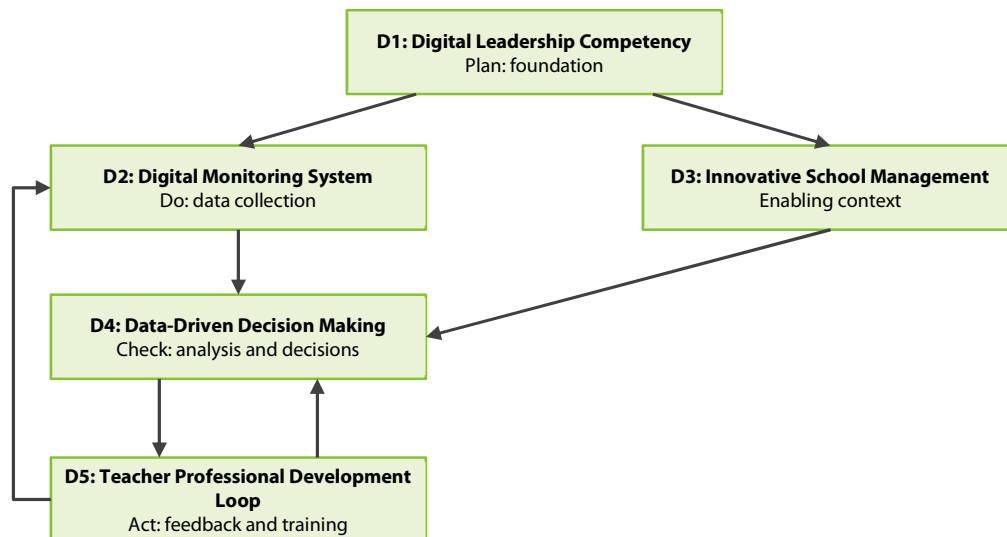


Figure 2. The Instructional Leadership Digital (ILD) Framework

Two design principles accompany the framework because of the risks identified in the literature. First, monitoring data should be used formatively, with transparent purposes and criteria, so that digital recording

is not perceived as surveillance (Taani et al., 2026). Second, any use of automated analysis should be accompanied by attention to ethics and to possible bias in the resulting decisions (Aldighrir, 2024). These principles belong to D1 and D3, which shape the conditions under which D2, D4, and D5 operate.

e. Implications

Theoretically, this study extends the literature on educational leadership by suggesting that the digital dimension should be positioned as a core element, rather than a supplementary component, of contemporary instructional leadership. Conceptually, the ILD framework offers an integrative model that can provide a foundation for future research involving instrument development, empirical testing, and construct validation. Practically, this framework can serve as an operational guide for school principals in developing digital-based teacher performance monitoring systems. For educational information system developers, the framework can provide a basis for designing dashboards, indicators, and digital feedback mechanisms that are more responsive to the needs of schools. At the policy level, the framework is relevant to strengthening principal competency standards, developing PKKS, and designing school leadership training programs oriented toward digital transformation. In the Indonesian setting, it can also be aligned with the Merdeka Belajar emphasis on instructional quality and teacher learning. These implications are suggested by the reviewed literature and by the logic of the framework; they are not demonstrated effects.

f. Research Limitations

This study has several limitations. First, the analysis was limited to 15 studies, meaning that the breadth of the synthesis depends substantially on the quality and relevance of the available literature. Second, quality appraisal was limited to the MMAT screening questions, and no full risk-of-bias rating was made, so the strength of the evidence behind each dimension can only be judged indirectly. Third, this study is conceptual and based on a literature review, and therefore does not provide direct empirical evidence regarding the effectiveness of the ILD framework in actual school settings. Fourth, evidence for the Digital Monitoring System and Data-Driven Decision-Making dimensions is thin within the corpus, so these dimensions rely partly on adjacent literature. Fifth, variations in geographical contexts, school types, and digital platforms across the reviewed studies may affect the generalizability of the findings. Finally, the search window ended in 2025, and more recent work, such as Taani et al. (2026), is discussed only as complementary evidence.

g. Directions for Future Research

Future research can be specified operationally. Table 8 identifies which relationships should be tested first and through which designs. Measurement work (priority 1) and tests of the leadership-to-monitoring path (priority 2) need only survey data and can be carried out first; the effectiveness of the full monitoring cycle (priority 3) requires an implementation design and is best attempted once the instruments are validated.

Table 8. Research Agenda for the Empirical Validation of the ILD Framework

Priority	Relationship or question to be tested	Suggested design	Indicative measures
1	Construct validity of the five ILD dimensions and their indicators	Scale development with confirmatory factor analysis or PLS-SEM, following the instrument-validation approach of Ansar et al. (2025)	Items derived from the indicators in Table 7; reliability and validity statistics

Priority	Relationship or question to be tested	Suggested design	Indicative measures
2	Does principals' digital leadership competency (D1) predict the use of monitoring systems (D2) and the quality of feedback (D5)?	Cross-sectional or longitudinal multilevel structural model with teachers nested in schools	Digital literacy of principals; dashboard use; feedback frequency and quality
3	Does a monitoring cycle linking D2, D4, and D5 improve teacher practice?	Quasi-experimental or design-based study in a small number of schools	Decision response time; competence change after feedback; teacher satisfaction
4	How do teachers accept and experience digital monitoring?	Mixed methods combining technology-acceptance measures and interviews	Perceived usefulness; psychological safety; perceived fairness
5	Does the framework hold across school levels, regions, and infrastructure conditions?	Multi-group comparison across school levels and regions	Measurement invariance; differences in path coefficients

V. Conclusion

This study developed the Instructional Leadership Digital (ILD) conceptual framework through a systematic synthesis of 15 relevant articles. The findings suggest that digital instructional leadership is becoming an important requirement for twenty-first-century education, particularly in the context of teacher performance monitoring that aims to be more objective, continuous, and evidence-based. The ILD framework comprises five principal dimensions: Digital Leadership Competency, Digital Monitoring System, Innovative School Management, Data-Driven Decision Making, and Teacher Professional Development Loop. The principal contribution of this study lies in integrating dimensions that have previously been examined separately in the literature into a cohesive and operational framework. The framework proposes that digital-based teacher performance monitoring should not end with data collection but should be systematically connected to decision making and continuous professional development. Nevertheless, this study remains limited to the conceptual level, and evidence for monitoring systems and data use is thin within the reviewed studies, indicating the need for further empirical research to examine the validity, reliability, and effectiveness of the ILD framework across diverse school contexts. Future research should empirically validate the ILD framework across different educational levels and school contexts. Measurement instruments for each dimension should first be developed and validated so that the framework can be operationalized through quantitative or mixed-method approaches. Subsequent studies may then examine the relationships among ILD dimensions, beginning with the path from digital leadership competency through monitoring to feedback quality, and later their effects on teacher performance, instructional quality, and the effectiveness of school management.

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