IT-Based Learning Management and Student Motivation in Resource-Constrained Elementary Schools: A Comparative Case Study from Indonesia

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Abstract
The integration of Information and Communication Technology (ICT) in elementary education represents a critical strategy for enhancing learning quality, yet implementation in resource-constrained contexts remains underexplored. This study examined IT-based learning management implementation and its relationship to student learning motivation in elementary schools with limited infrastructure. A qualitative multiple case study was conducted at two elementary schools in Campaka District, Cianjur Regency, Indonesia. Data were collected through participatory observations, semi-structured interviews with principals, teachers, and students, and documentary analysis. Data analysis employed Miles et al.'s (2014) framework incorporating data reduction, display, and conclusion drawing, with triangulation ensuring validity. Findings revealed that both schools enhanced student engagement and motivation through IT integration despite infrastructure disparities. SDN Margasari demonstrated systematic management across planning, organization, implementation, and evaluation functions, while SDN Hegarmanah exhibited emergent practices aligned with early adoption stages. Key obstacles included equipment limitations, internet connectivity issues, and variable teacher competencies. Adaptive solutions encompassed phased infrastructure development, targeted professional development, and pedagogical innovation. Results confirm that systematic IT-based learning management can effectively increase elementary students' learning motivation even within resource constraints when calibrated to institutional capacity. Findings extend Terry's management theory and motivational frameworks while illuminating developmental progressions in technology integration requiring differentiated support strategies for schools at varying implementation stages.

INTRODUCTION

The accelerating integration of Information and Communication Technology (ICT) into educational systems represents one of the most transformative shifts in contemporary pedagogy, fundamentally reshaping how knowledge is delivered, accessed, and constructed (Ghavifekr & Rosdy, 2015). At the elementary school level, where foundational learning attitudes and motivational patterns are established, the strategic integration of ICT-based learning management has emerged as particularly critical (Akçay et al., 2021). However, this integration presents unique challenges in schools with limited infrastructure.

Recent meta-analytic evidence indicates that ICT interventions in primary education can yield favorable learning outcomes, particularly when implemented within optimal timeframes of 6 to 18 weeks (Huang et al., 2020). Research demonstrates that technology-incorporated teaching assists educators in enhancing instructional practices while making learning more engaging and interactive, thereby sustaining learner motivation (Lasut & Bawengan, 2020). However, a critical gap exists in understanding how ICT-based learning management functions in resource-limited contexts, particularly in suburban and rural elementary schools where infrastructure inadequacies, limited

teacher competencies, and insufficient managerial support create implementation barriers distinct from well-resourced urban settings.

Previous studies have predominantly focused on technological effectiveness in ideal conditions. Surbakti & Chantrin (2025) documented that interactive digital media significantly enhances elementary students' learning motivation, while Imansyah & Silviana (2025) demonstrated that systematic IT-based learning management planning positively impacts student participation. However, these investigations were largely conducted in urban schools with adequate technological infrastructure. While Mustafa et al. (2024) identified 29 distinct challenges related to technology integration in rural schools, comprehensive examinations of how elementary schools navigate these challenges through adaptive management strategies remain scarce.

This study addresses these knowledge gaps by examining IT-based learning management as a holistic, systematically-implemented strategy. The research focuses on two elementary schools in Campaka District—SDN Margasari and SDN Hegarmanah—which represent contexts of limited technological facilities yet face imperatives for digital transformation. By employing George R. Terry's (1958) management theory alongside Maslow's (1943) and McClelland's (1961) motivation theories, this investigation provides theoretical grounding for analyzing how systematic management approaches can optimize technology integration despite infrastructural constraints.

The primary objective is to explore and analyze IT-based learning management implementation at both schools, specifically examining how planning, organization, implementation, and evaluation processes function within contexts of limited technological infrastructure. Additionally, the study aims to identify obstacles encountered and document solutions developed to enhance student learning motivation through technology integration.

The significance of this research extends across theoretical, practical, and policy dimensions. Theoretically, it contributes to technology-based education management literature by demonstrating how established management frameworks operate within resource-constrained contexts. Practically, findings offer implementable recommendations for elementary schools facing similar infrastructural challenges. From a policy perspective, the research illuminates specific support mechanisms that governmental and institutional stakeholders can prioritize to facilitate equitable digital transformation in basic education.

METHODS

This investigation employed a qualitative research approach utilizing a multiple case study design to examine IT-based learning management implementation and its influence on student learning motivation. The case study methodology was selected because it enables comprehensive, contextualized understanding of complex phenomena within real-world settings, particularly when investigating "how" and "why" questions (Baxter & Jack, 2008; Stake, 1995). The multiple case study design enabled cross-case comparison between institutions at different stages of digital transformation (Yin, 2003).

The research was conducted at two purposively selected elementary schools in Campaka District, Cianjur Regency, West Java: SDN Margasari and SDN Hegarmanah. These schools were deliberately chosen based on criterion sampling to represent contrasting levels of technological readiness and infrastructure availability. Research participants were selected through purposive sampling techniques (Creswell & Poth, 2017). The participant pool comprised school principals, classroom teachers from grades 4 through 6, and students from upper elementary grades (4-6). The inclusion of multiple stakeholder perspectives enabled comprehensive data source triangulation, strengthening validity and credibility (Carter et al., 2014).

Data collection employed three complementary techniques to achieve methodological triangulation. Participatory observation documented actual implementation of IT-based learning activities, teacher facilitation behaviors, student engagement patterns, and technological resource utilization within authentic classroom environments. Semi-structured interviews were conducted with

principals, teachers, and selected students to elicit in-depth perspectives regarding experiences with, perceptions of, and challenges related to IT-based learning implementation. Documentary analysis complemented these primary data sources through systematic examination of lesson plans incorporating IT elements, curriculum documents, technology infrastructure inventories, student learning records, and visual documentation.

To establish trustworthiness, multiple validation strategies were employed. Credibility was enhanced through prolonged engagement at research sites, persistent observation, and triangulation across data sources, methods, and participant perspectives. Member checking procedures verified accuracy of representations. Dependability and confirmability were addressed through detailed audit trails documenting methodological decisions, data collection procedures, and analytical processes. Transferability was facilitated through thick description of research contexts (Lincoln & Guba, 1985).

Data analysis followed systematic procedures outlined by Miles et al. (2014), proceeding through three interconnected phases. Data reduction involved careful review of all collected materials followed by coding to identify meaningful units and patterns relevant to research questions. Data display involved organizing reduced data into matrices, charts, and narrative summaries that facilitated pattern recognition and comparison both within and across case study sites. Conclusion drawing and verification represented the culminating analytical phase, wherein emerging themes, relationships, and patterns were synthesized into coherent findings, with interpretations continuously verified against original data sources and through triangulation procedures.

RESULTS AND DISCUSSION

Results

The findings from this investigation reveal comprehensive insights into IT-based learning management implementation across two elementary schools operating under distinct resource contexts. Data collected through observations, interviews, and documentary analysis illuminate how these institutions approach technology integration despite facing different levels of infrastructural readiness and support systems.

IT-Based Learning Planning

Analysis of planning documentation and interview data revealed substantial differences in how the two research sites approached IT integration into their instructional designs. At SDN Margasari, planning demonstrated systematic integration of digital resources into formal lesson plans, with teachers deliberately incorporating specific technological tools including computers, projectors, internet-based resources, and rudimentary learning management systems into their instructional frameworks. Documentary evidence from lesson plan analysis showed that teachers at this school explicitly outlined technology utilization objectives, specifying how digital tools would support learning outcomes and enhance student engagement. One teacher explained during interviews that "we design our lessons thinking about how technology can make abstract concepts more concrete for students, so planning includes identifying which videos, simulations, or interactive presentations will work best for each topic." This approach reflected deliberate pedagogical integration where technology served specific instructional purposes rather than functioning as supplementary add-ons.

In contrast, SDN Hegarmanah exhibited planning characteristics consistent with early-stage technology adoption. Teachers at this school incorporated technology into lessons more sporadically, primarily utilizing basic projection equipment, television displays, and personal devices when available. Lesson plan documentation showed technology integration noted as optional enhancements rather than integral components. The principal characterized their approach as "gradual familiarization," stating that "we're working to help teachers become comfortable with basic technology use first before expecting sophisticated integration into every lesson." Planning at this school prioritized introducing students to digital learning environments and building foundational digital literacy, reflecting pragmatic adaptation to resource constraints rather than comprehensive technology integration.

Organizational Structures for IT Management

Organizational approaches to managing IT-based learning revealed how institutional structures either facilitated or constrained effective implementation. SDN Margasari established a dedicated technology management team comprising teachers with varying levels of technical expertise who assumed responsibility for different aspects of IT integration. Documentary evidence indicated clearly defined roles including a technology coordinator who maintained equipment, scheduled resource access, and provided peer support. The principal described functioning as a "policy director" who established vision and secured resources while empowering teachers as primary implementers. Observational data confirmed that teachers collaborated regularly to share successful technology applications and troubleshoot challenges collectively. This structured organizational approach created systematic pathways for resource allocation, technical support, and knowledge sharing.

SDN Hegarmanah's organizational structure operated more informally, characterized by flexible resource sharing among teachers without dedicated technology roles. Teachers negotiated device access through informal arrangements, with the principal directly facilitating scheduling and encouraging collaborative problem-solving. While lacking formal structure, this approach demonstrated adaptive capacity, with teachers supporting one another through challenges despite limited organizational infrastructure. The principal acknowledged that "we don't have the luxury of specialized positions, so everyone helps however they can, and we make adjustments as situations arise." This informal organization reflected pragmatic responses to resource scarcity while maintaining functional, if less systematic, technology management.

Implementation Practices and Student Engagement

Classroom observations and student interviews provided detailed insights into how IT-based learning actually unfolded in practice and how students responded to technology-enhanced instruction. At SDN Margasari, implementation demonstrated consistent integration of varied digital resources across multiple subject areas. Observational records documented teachers utilizing educational videos to introduce concepts, interactive PowerPoint presentations incorporating animations and embedded questions, online assessment tools enabling immediate feedback, and collaborative platforms facilitating group projects. Students exhibited active participation behaviors including voluntarily raising hands to respond to questions, independently searching for supplementary information online when permitted, and demonstrating sustained attention during technology-enhanced activities. Student interview data revealed motivational impacts, with one student stating "I like when we use computers because I can see things moving and changing, not just words in books, and I remember better." Another noted "games that teach us make learning feel less like work." These responses indicated that technology implementation at SDN Margasari successfully engaged students and supported positive learning attitudes.

At SDN Hegarmanah, implementation reflected earlier developmental stages, with teachers primarily incorporating instructional videos and occasionally utilizing personal devices for demonstrations. Observational data showed students displaying initial enthusiasm when technology appeared in lessons, characterized by heightened attention, excited reactions, and increased questioning behaviors. However, interview data suggested that student motivation stemmed largely from novelty rather than deep instructional engagement. Students described technology use as "fun" and "different from usual," but struggled to articulate specific learning benefits beyond general enjoyment. This pattern indicated that while technology introduction generated immediate interest, systematic integration supporting sustained intrinsic motivation remained under development.

An unexpected finding emerged regarding differential student responses based on prior technology exposure. Students with regular home access to digital devices demonstrated greater confidence navigating educational technology and required less instructional scaffolding, while students with limited home exposure initially displayed hesitancy and required additional support. Teachers at both schools noted this digital divide, with one remarking "some children jump right in because they use tablets at home, while others need patient guidance even for basic operations." This

finding illuminates equity considerations often overlooked in technology integration literature focused primarily on infrastructure availability.

Evaluation Mechanisms and Continuous Improvement

Both schools implemented evaluation processes to assess IT-based learning effectiveness, though with differing levels of formality and systematicity. SDN Margasari conducted structured evaluation incorporating multiple data sources including classroom supervision by the principal and senior teachers, formal teacher reflection sessions following technology-integrated lessons, and student feedback gathered through brief surveys and informal discussions. Documentary evidence showed that evaluation findings informed subsequent planning cycles, with teachers adjusting technology applications based on identified strengths and weaknesses. However, evaluation data also revealed persistent challenges, particularly the tendency among some teachers to utilize technology primarily for content presentation rather than active learning facilitation. One evaluation report noted that "several teachers continue using PowerPoint as digital lectures rather than interactive tools, suggesting need for additional pedagogical training." This finding indicated that technology access alone proved insufficient without corresponding pedagogical innovation.

SDN Hegarmanah employed simpler evaluation approaches centered on informal discussions between teachers and administration following technology-integrated lessons. These conversations focused primarily on logistical considerations—equipment functionality, time management, student behavioral responses—rather than deep pedagogical assessment. The principal explained that "right now we're still learning what works and what doesn't at a basic level, so our evaluations focus on whether the technology helped the lesson go smoothly." While less sophisticated than SDN Margasari's approach, these evaluations served the developmental needs of an institution in early implementation stages, providing actionable feedback for incremental improvement.

Obstacles and Adaptive Solutions

Both schools encountered substantial obstacles to effective IT-based learning implementation, though the nature and severity of challenges differed considerably. Table 1 summarizes the primary obstacles identified across both research sites.

At SDN Margasari, infrastructure obstacles manifested primarily as unreliable internet connectivity disrupting streaming video and online assessment activities, and aging equipment requiring frequent maintenance. Teachers reported frustration when "planned activities fail because the internet drops or a projector stops working," highlighting how technical unreliability undermined instructional planning. Teacher competence challenges centered on pedagogical integration rather than basic operational skills, with teachers possessing sufficient technical ability to operate equipment but lacking sophisticated understanding of how to leverage technology for active learning rather than passive consumption.

Table 1. Primary Obstacles to IT-Based Learning Implementation

Obstacle Category	SDN Margasari	SDN Hegarmanah
Infrastructure	Occasional internet instability; aging equipment requiring maintenance	Severe equipment shortage; unreliable internet access; inadequate electrical capacity
Teacher Competence	Variable technology skills; pedagogical integration knowledge gaps	Fundamental digital literacy limitations; minimal training in educational technology
Student Readiness	Digital divide among students based on home access	Limited prior technology exposure; basic operational skills undeveloped
Managerial Support	Sustained but resource-constrained	Supportive but lacking strategic capacity

SDN Hegarmanah confronted more fundamental obstacles including severe equipment shortages limiting which classes could access technology on any given day, electrical infrastructure inadequate to support multiple devices simultaneously, and basic internet connectivity too unreliable for regular

instructional use. Teacher competence challenges were correspondingly fundamental, with several teachers admitting discomfort with basic technology operations. One teacher shared that "I grew up without computers, so even turning everything on and connecting properly makes me nervous." These profound infrastructure and capacity limitations constrained what implementation strategies the school could realistically pursue.

Solutions implemented reflected each school's resource context and capacity for intervention. SDN Margasari addressed obstacles through intensive teacher training sessions facilitated by technically proficient staff and occasional external trainers, systematic equipment maintenance schedules ensuring devices remained functional, and pedagogical innovation initiatives encouraging teachers to experiment with interactive technology applications. The principal emphasized that "we invest our limited professional development budget in technology training because we know that's our biggest lever for improvement."

SDN Hegarmanah adopted phased solutions matched to their resource constraints, including gradual equipment procurement prioritizing the most versatile devices, basic teacher training focused on operational fundamentals before pedagogical sophistication, and consistent familiarization activities normalizing technology presence in learning environments even when full integration remained aspirational. The school also cultivated community partnerships yielding occasional equipment donations and explored resource-sharing arrangements with neighboring institutions. These adaptive strategies demonstrated how schools with severe constraints could pursue meaningful progress through incremental, contextually appropriate interventions.

An unexpected finding concerned the critical role of teacher motivation and institutional culture in mediating obstacle impacts. At both schools, teachers who maintained positive attitudes toward technology integration despite challenges demonstrated greater persistence in seeking solutions and adapting practices. Conversely, teachers expressing skepticism about technology's educational value showed less inclination to overcome obstacles, sometimes abandoning technology integration when difficulties arose. This motivational dimension, while recognized in broader educational change literature, emerged as particularly salient in resource-constrained contexts where obstacles were numerous and sustained effort essential for progress.

Discussion

This investigation's findings illuminate critical dimensions of IT-based learning management in elementary schools operating under resource constraints. The findings reveal that systematic IT-based learning management can effectively enhance student engagement and motivation even amid substantial infrastructure limitations, provided that planning, organization, implementation, and evaluation processes remain functionally aligned with institutional capacities.

The research hypothesis posited that IT-based learning management, when systematically planned, organized, implemented, and evaluated, can increase elementary students' learning motivation despite infrastructural limitations. The empirical findings provide substantial support for this hypothesis. Both research sites demonstrated measurable increases in student engagement indicators—including voluntary participation, sustained attention, and expressed enjoyment—following technology integration, albeit at different sophistication levels.

The findings strongly align with George R. Terry's (1958) management theory framework emphasizing four fundamental functions: planning, organizing, actuating, and controlling. SDN Margasari's implementation exemplified how systematic execution of these functions facilitates effective technology integration. Conversely, SDN Hegarmanah's experience illuminated how resource scarcity can constrain full management function implementation while still permitting meaningful progress. This finding extends management theory by demonstrating that management functions can scale to organizational capacity, with simplified implementations supporting progress toward more mature systems.

The motivational dimensions resonate with both Maslow's (1943) hierarchy of needs and McClelland's (1961) achievement motivation theory. Maslow's framework suggests that basic needs must be satisfied before higher-order needs become motivating. SDN Margasari students, having progressed beyond basic access issues, demonstrated motivation patterns reflecting higher-order needs including autonomy in information seeking and collaborative project engagement. SDN Hegarmanah students, still establishing basic technological familiarity, exhibited motivation primarily through novelty and external rewards.

These findings engage productively with previous research while illuminating distinctive contributions. The confirmation that ICT integration enhances student motivation aligns with extensive prior work including Surbakti & Chantrin (2025) and Imansyah & Silviana (2025). However, this investigation extends beyond these previous studies by examining how management processes function specifically within resource-constrained contexts, revealing that motivational benefits can emerge even amid substantial limitations when systematic management approaches guide implementation.

The finding that infrastructure adequacy significantly influences implementation sophistication resonates with research documenting that ICT facilities often exist in poor condition and require continuous improvement (Ghavifekr & Rosdy, 2015). The identification that teacher expertise, pedagogical vision, and digital learning material use constitute significant support factors (Amemasor et al., 2025) aligns closely with this study's findings. The present research contributes by demonstrating how these factors interact dynamically within specific institutional contexts, with management approaches mediating relationships between infrastructure constraints and implementation outcomes.

The unexpected finding regarding digital divides among students based on home technology access extends emerging concerns in educational technology literature. This finding suggests that even when schools successfully implement technology, effectiveness may vary considerably across students depending on their prior exposure and ongoing access outside school. This equity dimension requires greater scholarly and practical attention, as technology integration risks exacerbating achievement gaps unless explicitly designed to support students with limited home access.

The critical role of teacher motivation and institutional culture in mediating obstacle impacts aligns with recent research demonstrating that teachers' motivation to transfer technology-enabled educational innovation is influenced by perceived value, personal characteristics, social practices, organizational factors, and technology-enabled innovation factors (Stumbrienė et al., 2024).

The differential implementation patterns between the two schools illuminate important theoretical considerations regarding technology diffusion and organizational change. SDN Margasari's experience reflected characteristics of later adoption stages in Rogers' (2003) diffusion of innovations framework, where technology becomes normalized and implementation focuses on optimization. SDN Hegarmanah's experience corresponded to earlier adoption stages emphasizing awareness building and basic competence development.

The research also engages critically with optimistic assumptions pervading some educational technology discourse. While technology integration yielded observable benefits at both schools, these gains remained modest relative to aspirational claims about digital transformation revolutionizing education. Students became more engaged and expressed greater enjoyment, but fundamental pedagogical relationships and learning processes changed incrementally rather than dramatically. This finding suggests that technology functions most productively as a powerful tool enhancing effective teaching rather than replacing or fundamentally transforming it.

Practically, these findings offer actionable guidance for elementary schools navigating technology integration under resource constraints. Schools at SDN Hegarmanah's developmental stage should prioritize establishing basic infrastructure, developing fundamental teacher digital literacy, and normalizing technology presence in learning environments. Schools at SDN Margasari's level should

emphasize deepening pedagogical sophistication, moving beyond technology as presentation tool toward active learning facilitation.

Policymakers and educational leaders should recognize that effective technology integration requires simultaneous investment across multiple dimensions. Infrastructure provision without corresponding teacher professional development, management system support, and ongoing technical assistance yields suboptimal outcomes. Successful digital transformation requires coordinated, sustained investment addressing infrastructure, human capital, organizational systems, and continuous improvement mechanisms simultaneously.

Several limitations qualify these findings' interpretation and transferability. First, the study's case study design focusing on two elementary schools within one district constrains generalizability to broader populations. Second, the relatively brief observation periods may not capture the full complexity of technology integration processes that unfold over extended timeframes. Third, reliance primarily on self-reported data introduces potential response bias.

The findings suggest several promising directions for future research. Large-scale quantitative studies examining relationships between management systematicity, resource availability, and implementation outcomes across diverse school contexts would test whether patterns observed here generalize broadly. Longitudinal research tracking schools through digital transformation trajectories would illuminate developmental progressions. Experimental or quasi-experimental designs comparing different professional development approaches would generate causal evidence regarding effective interventions.

CONCLUSION

This investigation demonstrates that IT-based learning management can effectively enhance elementary student learning motivation even within resource-constrained contexts when systematically approached through deliberate planning, structured organization, consistent implementation, and reflective evaluation. Comparative analysis of SDN Margasari and SDN Hegarmanah revealed that schools at different developmental stages can achieve meaningful progress by calibrating management sophistication to institutional capacity, with each advancement stage serving legitimate purposes rather than representing implementation failures. The findings confirm that Terry's management framework remains applicable to educational technology contexts when flexibly adapted, while motivational theories illuminate how different incentive mechanisms become salient as implementation matures from novelty-driven engagement toward sustained intrinsic motivation.

This research contributes to educational technology scholarship by providing empirical evidence from under-researched contexts, demonstrating that systematic management approaches can partially compensate for infrastructure limitations and that technology integration follows developmental progressions requiring differentiated support strategies. Practically, findings inform schools pursuing digital transformation under constraints, emphasizing incremental advancement, simultaneous capacity building across multiple dimensions, and explicit attention to equity considerations addressing digital divides among students.

Study limitations include restricted generalizability from the two-school case study design, relatively brief observation periods potentially missing longitudinal dynamics, and reliance on self-reported data introducing possible response bias. Future research should employ large-scale quantitative designs testing relationships between management systematicity and outcomes across diverse contexts, longitudinal investigations tracking developmental trajectories over extended periods, experimental comparisons of intervention strategies, and explicit examinations of how technology integration differentially impacts students based on background characteristics. Such investigations would advance understanding of equitable, effective technology integration pathways for elementary schools navigating digital transformation amid resource constraints characterizing many developing educational systems globally.

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