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ICT Management in Education in the Era of Digital Disruption: Analysis of the Challenges of Digital Divide, Teacher Competence, and Data Security as Urgent Issues in Indonesian Education

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ABSTRACT

The development of information and communication technology (ICT) has brought significant changes to the education system, especially following the era of digital disruption and the widespread adoption of online learning during the pandemic. In the context of Indonesian education, the use of ICT not only creates new opportunities for improving the quality of learning but also introduces various challenges that require strategic management. This scientific article analyzes ICT management in education by highlighting three pressing issues: the digital divide between regions, the low level of teachers' digital competence, and the increasing threats to educational data security. This study employs a literature review method to collect and analyze references related to ICT management, digital learning theories, government policies, and technology integration models such as TPACK and SAMR. The analysis shows that the implementation of ICT in schools remains uneven due to limited infrastructure, insufficient teacher training, and weak data protection systems. Furthermore, the findings indicate that well-planned, organized, and sustainable ICT management is essential for building an educational ecosystem that is responsive to technological advancements. The article concludes that ICT can only have a significant impact when supported by strategic planning, strong digital security policies, improved human resource competence, and enhanced government support.

Therefore, ICT management serves as a crucial foundation for realizing an inclusive, secure, and sustainable digital education system in Indonesia.

Keywords: Digital Divide, Digital Education, ICT Management, Teacher Competence

INTRODUCTION

The development of information and communication technology (ICT) has fundamentally changed the face of education over the past two decades. Modern education is now undergoing a rapid transformation, especially after the COVID-19 pandemic, which forced schools, teachers, and students to make massive adaptations to various digital applications, online learning systems, and other technological devices (Rachmi et al., 2024). Changes that were initially emergency-driven have now become a permanent necessity, where the integration of technology is considered a crucial step for management efficiency (Khumaidi, Hamdani, & Apriliantoni, 2024). This makes ICT no longer just a tool, but a core foundation in educational organization, learning, academic interaction, and school management to achieve the maturity of the electronic government system in the education sector (Yulistiawan et al., 2025; UNESCO, 2023).

However, the utilization of ICT in Indonesia still faces various significant problems. The digital disparity between urban and rural areas is still very clear, especially concerning internet infrastructure, device availability, and technical support (Sianipar et al., 2025). Many schools in remote areas still struggle to access stable networks, so technology-based learning cannot run properly due to geographical and socio-economic disparities (Rahmadi & Muhammad, 2025).

In addition, teachers' competence in operating technology and integrating it into learning is still relatively low, mainly due to a lack of relevant training, minimal facility support, and high workloads that hinder their adaptation to the digital era (Azri & Raniyah, 2024).

A growing issue is the matter of educational data security. Various digital systems such as Learning Management Systems (LMS), school management applications, and online learning platforms store sensitive student and teacher data that are vulnerable to cyberattacks if not managed with strict security standards (Sugiyantoro, 2024; Mawa, 2024). Without good data security management, this personal information is prone to leakage or misuse by irresponsible parties. This condition is exacerbated by the fact that many schools do not yet have a digital security system or personal data protection standards as required by the latest regulation, the Personal Data Protection Law (UU PDP), whose implementation still faces technical constraints and low security literacy at the school level (Nugroho & Ramadhani, 2023; Suryanto & Riyanto, 2024).

Given these major challenges, ICT management in education has become a very urgent need. ICT management is not only related to technical aspects such as the procurement of devices or internet networks, but also includes strategic planning for effective technology integration (Khumaidi et al., 2024). This encompasses the development of human resource competence, the formulation of digital policies, data security, system evaluation, and ensuring the sustainability of technology implementation to align with the school's digital transformation vision (Asari et al., 2023; Harini et al., 2023). Therefore, this scientific article aims to comprehensively examine the concept of ICT management in education,

focusing on current critical issues. This article also provides an analysis of the challenges faced by schools and teachers and offers strategic solutions that can be implemented in the world of education.

LITERATURE REVIEW

The study of ICT management in education must be based on fundamental theories of management, technology, digital learning, and education policy. Henry Fayol's classic management theory, consisting of planning, organizing, commanding, coordinating, and controlling (often simplified to planning, organizing, leading, and controlling), provides an essential framework for explaining how ICT should be managed in education (Fayol, 2016; Syafaruddin et al., 2023). Effective ICT management must start with mature planning, organizing the digital work structure, implementation involving all stakeholders, and continuous evaluation to ensure program effectiveness (Machali & Hidayat, 2024).

In addition to management theory, constructivism learning theory provides a philosophical basis for the use of technology in learning. Technology can help students construct knowledge through exploration, collaboration, digital experimentation, and interactive experiences (Piaget, 1976; Vygotsky, 1978). Technology also supports the principle of active learning where students play a greater role in building their own understanding, a concept that is now central to the implementation of the Kurikulum Merdeka (Independent Curriculum) in the digital era (Lestari & Ahyani, 2023; Nuryana et al., 2024).

The theory of connectivism, introduced by George Siemens, states that learning in the digital age is no longer purely individual but occurs through information networks (Siemens, 2005). In this context, the teacher's task is no longer as the sole source of knowledge, but as a facilitator who helps students access and verify information from various digital sources, a role that is increasingly crucial amidst the flood of information due to artificial intelligence (Siemens, 2005; Huda & Yuliana, 2024).

The TPACK (Technological Pedagogical Content Knowledge) Model is another relevant integrative framework. This model explains that teachers need three main competencies in digital learning: mastery of technology, understanding of pedagogy, and mastery of content (Mishra & Koehler, 2006; Nurfadilah & Nuryani, 2023). When these three are integrated harmoniously, ICT-based learning becomes effective and meaningful, and capable of addressing the challenges of an adaptive curriculum (Valtonen et al., 2024).

The SAMR (Substitution, Augmentation, Modification, Redefinition) Model emphasizes the transformation of learning through technology. At the highest stage, redefinition, technology enables the creation of new learning experiences that cannot be achieved with traditional methods (Puentedura, 2006; Putri & Sudarmin, 2024).

From a policy perspective, the implementation of ICT has a strong legal basis, such as the National Education System Law, the Ministerial Regulation on facilities and infrastructure, the Personal Data Protection Law (UU PDP), and the UNESCO ICT Competency Framework (Kemdikbud, 2023; UNESCO, 2018). This confirms that the use of ICT in education is not just an option, but a

regulatory mandate that must be complied with to ensure the quality and security of education services (Suryanto & Riyanto, 2024).

METHOD

This study uses the library research method. This method involves the process of collecting, selecting, and analyzing various literature related to ICT management, digital education, technology policy, and education management theory. Data sources were obtained from national and international journals, reference books, government regulations, and reports from global institutions such as UNESCO and the OECD. Data analysis was carried out using content analysis techniques, which allowed researchers to identify main themes, interpret the meaning of the text, compare theories, and draw conclusions based on the relationships between concepts. The results of the literature analysis were then interpreted to answer the research problems.

RESULTS AND DISCUSSION

The results of the study indicate that ICT management in education faces three main problems: the digital divide, low teacher digital competence, and educational data security threats (Rachmi et al., 2024; Rahmadi & Muhammad, 2025).

The digital divide is very striking between schools in advanced and underdeveloped regions (Sianipar et al., 2025). Limited internet access is a major obstacle to optimizing digital learning. Many rural schools still rely on unstable networks, so technology-based learning activities are not running effectively (APJII, 2024). This lack of infrastructure readiness not only hinders learning but also impacts the school's ability to keep up with the latest technological developments (OECD, 2021; Yulistiawan et al., 2025).

Furthermore, teacher competence is an important factor affecting the success of ICT utilization. Teachers who do not have good digital skills tend to find it difficult to use applications or learning devices (Azri & Raniyah, 2024). This results in technology not being used optimally and only becoming a mere formality in administration (Nurfadilah & Nuryani, 2023). Existing ICT training has not been carried out regularly and is often irrelevant to the needs of teachers in the field, so technology adoption proceeds slowly (UNESCO, 2023).

The issue of data security is becoming increasingly relevant with the increased use of digital platforms. The absence of security policies, weak password management, lack of data encryption, and the use of third-party platforms without risk evaluation are causes of the vulnerability of educational data (Mawa, 2024; Sugiyantoro, 2024). Data security is not just a technical issue, but an ethical and legal issue concerning the protection of students' personal information as regulated in the UU PDP (Nugroho & Ramadhani, 2023).

Nevertheless, the implementation of ICT offers great opportunities. Learning can be flexible, interactive, and resource-rich (Arsyad, 2020). Teachers can use videos, simulations, digital modules,

and collaboration platforms to reinforce learning (Putri & Sudarmin, 2024). School administration becomes more efficient with academic information systems, digital attendance, and cloud-based data management (Harini et al., 2023). ICT also enables schools to increase the transparency and accountability of public services (Khumaidi et al., 2024).

To overcome these challenges, integrated and sustainable ICT management is needed. Schools must build long-term planning and formulate clear policies on the use of technology (Machali & Hidayat, 2024). Digital literacy training for teachers must be prioritized, and infrastructure development must receive government support (Kemdikbud, 2023). Data security must be managed through encryption, firewalls, data audits, and digital awareness among all school members (Suryanto & Riyanto, 2024).

CONCLUSION

ICT management in education is an urgent necessity in the digital era. ICT has great potential to increase the effectiveness of learning, the efficiency of school management, and the quality of education services. However, this benefit can only be achieved through strategic planning, good organization, needs-based implementation, and continuous evaluation. Challenges such as the digital divide, low teacher competence, and data security threats must be the main focus of attention. Therefore, schools need to build a well-managed digital ecosystem supported by government policies and increased competence of all educational resources.

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