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Digital Literacy of Secondary School Principals in General, Islamic, and Vocational Schools

Ridwan Hanafi[1], Dwi Esti Andriani[2], La Ode Muhammad Zuhdi Mulkiyan[3]

[1] *Universitas Negeri Yogyakarta, Indonesia*

[2] *Universitas Negeri Yogyakarta, Indonesia*

[3] *Universiti Malaysia Pahang Al-Sultan Abdullah, Malaysia*

Corresponding Author: Ridwan Hanafi, E-mail; ridwan0026fip.2021@student.uny.ac.id

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ABSTRACT

Digital literacy in this study is conceptualized based on the European Commission's *Digital Competence Framework for Citizens (DigComp)*, which includes five dimensions: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. This study aims to examine differences in the digital literacy levels of secondary school principals based on age, gender, school organizer status, school location, frequency of ICT training, and availability of ICT facilities. A comparative quantitative approach was employed using area-proportional random sampling. The population consisted of 188 high school principals in Klaten Regency and Surakarta City, with 30 principals selected as the research sample. Instrument validity was tested using product-moment correlation, and data were analyzed using a t-test at a 5% significance level. The results reveal that age has a significant effect on principals' digital literacy, with younger principals demonstrating higher levels (sig = 0.00). In contrast, no significant differences were found based on gender (sig = 0.265), school organizer status, public or private (sig = 0.109), or school location, urban or rural (sig = 0.442). Although principals who attended ICT training 1–2 times per year showed higher literacy levels, the difference was not statistically significant (sig = 0.852). Likewise, the availability of ICT-supportive facilities did not significantly influence digital literacy levels (sig = 0.650). These findings suggest that age remains the dominant factor influencing principals' digital literacy, while institutional and contextual factors show limited impact.

Keywords: *Digital Literacy, School Principal, Secondary School*

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INTRODUCTION

Digital literacy refers to an individual's awareness, attitude, and ability to use digital tools appropriately to identify, access, manage, integrate, evaluate, analyze, and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others in specific life contexts (Restianty, 2018). In the context of education, digital literacy is no longer merely a technical skill, but a strategic competence that supports school leadership and management in responding to the demands of digital transformation. For school principals, digital literacy becomes a key foundation for exercising effective leadership, making data-informed decisions, conducting academic supervision, and managing schools through digital-based systems.

Historically, digital literacy is rooted in computer literacy and information literacy that emerged alongside the rapid development of information technology (Suparyanto, 2020). Today, the acceleration of technology across sectors, including education, particularly in the transition from Industry 4.0 to Society 5.0, requires school leaders to master digital competencies to ensure organizational adaptability and sustainability (Sari, 2021). In this era, principals are expected to demonstrate digital leadership by integrating technology into school governance, administrative processes, learning management, and communication with stakeholders.

Information technology has become an inseparable part of daily life across generations (Syafii, 2022), and in schools it plays a central role in teaching and learning, academic administration, and institutional accountability. The use of digital platforms for school information systems, online supervision, performance monitoring, and collaboration highlights the importance of principals' digital literacy in strengthening managerial effectiveness and improving school quality. Therefore, principals' digital literacy is closely linked to their capacity to lead change, optimize school resources, and foster innovation in school management (Waruwu, 2021). In this regard, examining the digital literacy of school principals is essential to understanding how leadership competencies align with the demands of modern, technology-driven school management.

Based on a survey from Kominfo, the condition of digital literacy in Indonesia has not yet reached a "good" level. If the highest digital literacy index score is 5, then Indonesia is only slightly above 3. The survey research shows that those who live in urban areas and use the internet intensively tend to be more exposed to negative habits. So, it is important to overcome this by disseminating digital literacy to various sectors, especially education. Among them, by incorporating digital literacy material into the formal curriculum. As well as increasing community participation in being digitally literate and actively spreading positive content (Kominfo, 2020). One of the principal's biggest duties and responsibilities in facing the era of digital literacy is managerial and being one of the school informants, namely controlling the teaching and learning process, learning resources, school administration, education services have all changed to use digital (May, 2021).

In another study, namely about individual digital literacy skills and attitudes in Turkey, (Hamutoğlu, 2019) said that emphasis is important for someone to become digitally literate. In the literature, empirical correlational experimental studies are quite limited. This means that, even though digital literacy platforms are increasingly integrated into our lives and despite the fact that students, teachers and school principals are born into digital technology, there is no research that investigates the relationship between digital literacy skills and attitudes towards the importance of digitally savvy individuals that lead to solutions and actions. This matter is still not given enough attention, but it turns out that currently technology has entered this era by influencing society and also the world of education.

Moreover, the world of education has widely used learning-based applications to make it easier for educational institutions to interact. The problems that occur in these countries are still felt by other countries which are still considered developing countries and developed countries because most schools, including teachers, principals and their staff, are old, which makes it difficult for them to adapt to the rapid development of the times. In Indonesia itself, it is a developing country which has regulations and authority over education which are regulated by the education department, with each era the curriculum and also the concept of education will change which causes this regulation to look at the current period, therefore the importance of schools and learning tools in schools. and following developments, in this case digital literacy and scientific literacy (Limilia , 2019).

Based on several studies above, researchers tried a survey related to digital literacy in Indonesia, especially in Java, which has a large number of internet usage. Based on survey results from Kominfo 2020, especially in the Java region, it shows that the average for each region is Central Java reaching 3.61, West Java at 3.414, East Java at 3.58, DKI Jakarta at 3.266, DI Yogyakarta (DIY) at 3.64, and Banten at 3.48. Based on this data, it shows that digital literacy in Central Java is in the second highest position. However, despite the relatively good condition of digital literacy in Central Java, factors such as difficult access and lack of awareness of the importance of digital literacy are still found in the field. In this context, this research seeks to dig deeper into the extent to which individuals' understanding of digital literacy is in line with the high level of internet usage in Java. The focus of this research is on Surakarta City and Klaten Regency in Central Java, two regions with distinctive geographical and socio-educational characteristics. Parts of Klaten are characterized by hilly and semi-rural areas, which pose challenges for infrastructure development and equitable access to information and communication technology (ICT). Such conditions potentially contribute to disparities in schools' readiness to adopt digital-based management and learning systems. In this context, the digital literacy of school principals becomes a critical factor in ensuring effective leadership and school governance across diverse settings.

National and international studies emphasize that digital literacy is a key competency for educational leaders in responding to the challenges of digital

transformation. UNESCO (2018) highlights digital literacy as an essential skill for lifelong learning and institutional effectiveness in the digital era. Similarly, the OECD (2021) reports that school leaders' digital competence is closely linked to their capacity to integrate technology into decision-making, administration, and instructional leadership. In Indonesia, the Ministry of Education, Culture, Research, and Technology underscores the importance of strengthening principals' digital competencies to support digital-based school management and data-driven governance (Kemendikbudristek, 2020).

While local media reports, such as *Berita Solo* (2021), indicate growing public concern about digital literacy, particularly in addressing misinformation and ethical issues in cyberspace, such sources are positioned in this study as contextual background rather than primary academic evidence. Therefore, this research primarily builds on scientific literature and policy documents to frame the importance of digital literacy for principals, especially in regions like Surakarta and Klaten, where geographical diversity may influence access to and utilization of digital resources in school management.

Based on an explanation from the Head of the Surakarta Education Service, he also explained that digital literacy in the education sector still needs to be improved. This reflects the implementation of learning during the last Covid pandemic. Even though the Surakarta City Government has initiated a Technical Guidance program for the Initiation of School Digitalization Towards Solo Smart Education, there are still obstacles faced by both by teachers and students in implementing internet-based learning. School principals have a key role in leading and driving increased digital literacy in their schools.

RESEARCH METHODOLOGY

Research Design and Location

This study employed a comparative quantitative research design to examine differences in the digital literacy levels of secondary school principals based on selected demographic and institutional variables. The research was conducted in Surakarta City and Klaten Regency, Central Java, during the odd semester of the 2022/2023 academic year. Data collection was carried out for one month through an online questionnaire distributed to school principals after obtaining permission from the relevant authorities.

Population and Sample

The population consisted of all principals of senior secondary schools (SMA, MA, and SMK) in Klaten Regency and Surakarta City, totaling 188 schools, with 91 schools in Klaten and 97 in Surakarta. The sample comprised 30 principals selected using area-proportional random sampling to represent urban, rural, and remote areas with varying levels of internet and ICT infrastructure.

Research Instrument

Data were collected using a structured questionnaire designed to measure principals' digital literacy. The instrument was developed based on key dimensions of

digital literacy and employed a Likert-scale format ranging from strongly disagree to strongly agree.

Validity and Reliability Testing

Instrument validity was tested using the product–moment correlation technique to examine the correlation between each item score and the total score. An item was considered valid if the obtained correlation coefficient (rcount) was greater than the critical value of rtable at a significance level of 0.05. Reliability testing was conducted using Cronbach's Alpha to determine the internal consistency of the instrument. The questionnaire was regarded as reliable if the Cronbach's Alpha coefficient was ≥ 0.70, indicating acceptable reliability for social science research.

Data Analysis Technique

Data analysis was performed using inferential statistical techniques. Prior to hypothesis testing, descriptive statistics were used to summarize the data. To examine differences in principals' digital literacy based on two-group variables such as gender, school organizer status (public vs. private), school location (urban vs. rural), ICT facilities (available vs. not available), and age groups, an independent samples t-test was employed. The level of significance was set at $\alpha = 0.05$. The t-test was selected because the study aimed to compare the mean scores of digital literacy between two independent groups. A significance value (p) less than 0.05 indicated a statistically significant difference between groups, while a value greater than 0.05 indicated no significant difference.

RESULT AND DISCUSSION

Digital Literacy by Age: Leadership Interpretation

Principals' digital literacy differed significantly across age groups, with younger principals demonstrating higher levels of competence in digital contexts. Rather than merely reflecting generational exposure to technology, this pattern aligns with research suggesting that digital competence develops through continuous engagement and self-directed learning (Hatlevik & Christophersen, 2013). Within educational management, this finding suggests that younger leaders may be more proactive in adopting digital tools for data-driven decision-making, instructional supervision, and communication with stakeholders. To bridge generational gaps, professional development should emphasize digital leadership skills that support strategic technology integration in school governance (Dexter & Richardson, 2020; see also OECD, 2021).

Gender and Digital Literacy: Equity and Inclusive Leadership

No significant differences in digital literacy were found between male and female principals. This is consistent with prior work showing that gender alone does not determine digital competence when access and opportunities are equitable (Hatlevik & Christophersen, 2013). Thus, discussing gender in terms of capability differences is unwarranted; instead, emphasis should be placed on equitable professional learning opportunities for all school leaders. From a managerial perspective, inclusive leadership

practices ensure that both female and male principals can contribute equally to digital transformation agendas.

School Type (Public vs. Private) and Digital Literacy

The absence of significant differences in digital literacy between public and private school principals suggests that institutional status does not inherently shape digital capabilities. Rather, the strategic application of digital tools within school operations reflects leaders' decisions and organizational culture. Placing emphasis on capacity building for all leaders, regardless of school type, can strengthen digital governance and innovation practices.

Urban–Rural Comparisons: Reducing the Digital Divide

Principals in urban and rural settings did not show significant differences in digital literacy. This finding challenges simplistic assumptions about the urban–rural digital divide, suggesting that access to mobile technologies and national learning platforms might mediate location disparities. However, leadership capacity remains crucial for effective ICT adoption in resource-limited contexts, requiring tailored support from educational authorities.

ICT Training, Facilities, and Leadership Development

Although the frequency of ICT training and the presence of facilities did not significantly influence principals' digital literacy levels, this result underscores the importance of training quality over quantity. Professional development should focus on strategic leadership competencies such as using digital systems for analysis, planning, and performance monitoring rather than isolated technical workshops. Research highlights that leadership-oriented digital professional development yields greater impact on school improvement and technology utilization (Howard et al., 2021).

Managerial and Policy Implications

Overall, this study reinforces that digital literacy is deeply intertwined with principals' role as digital leaders. Effective educational managers must integrate digital tools for operational efficiency, instructional leadership, and stakeholder engagement. Therefore, policy frameworks should prioritize sustained, context-sensitive leadership development that builds principals' capacity to lead digital transformation in schools.

CONCLUSION

This study examined differences in digital literacy among secondary school principals in Surakarta City and Klaten Regency based on demographic and institutional factors. The findings indicate that age is the only variable associated with significant differences, with younger principals demonstrating higher digital literacy, while gender, school status, location, ICT training frequency, and school facilities show no significant effects. These results suggest that generational familiarity and individual engagement with technology play a more decisive role than structural conditions.

The study highlights the need for age-responsive and continuous professional development programs that strengthen principals' capacity as digital leaders. Training should move beyond technical skills toward strategic uses of digital tools for instructional leadership, data-informed decision-making, and school management.

Policymakers are encouraged to integrate digital leadership competencies into principal preparation and certification systems.

This study is limited by its regional scope and reliance on self-reported quantitative data. Future research should adopt mixed or qualitative approaches to explore how digital literacy is enacted in everyday leadership practices across diverse contexts.

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