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Principals' Perceptions of Technology-Based Management Transformation: A Qualitative Study in the Context of Educational Digitalization

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ABSTRACT

In the face of educational digitalization, the transformation of management based on technology became a major challenge for school principals and teachers, with differences in perceptions, barriers, and implementation strategies. This study aimed to explore the perceptions of principals and teachers regarding the implementation of technology in school management, as well as to identify the barriers they faced and the strategies implemented during the transformation process. The study employed a qualitative approach using in-depth interviews, observations, and documentation with 10 school principals and 10 teachers from vocational schools (SMK) in Palangkaraya City. The results showed that principals had a positive perception of the technological transformation, despite facing barriers related to policies and resource limitations. On the other hand, teachers were more focused on barriers such as technological skills and the lack of training. To overcome these challenges, strategies such as technology-based training and guidance were implemented. The implications of this study highlighted the importance of policies that support ongoing technology training for both teachers and principals, as well as the development of more effective technology-based managerial systems in addressing the challenges of educational digitalization.

Keywords: barriers, digitalization, managerial transformation, school principals

INTRODUCTION

The development of digital technology in the last two decades has revolutionized various sectors of life, including the education sector, not only in the learning process but also in its management and institutional governance practices. The digitalization of school management encompasses various aspects, ranging from personnel administration, student data management, and internal communication, to information system-based decision-making [1], [2] This transformation demands adaptive and visionary leadership, especially from principals who play a strategic role in determining the direction, speed, and depth of change [3]. As the main actors in the managerial process, school principals are not only required to master technology, but also build an organizational culture that supports digital innovation in a sustainable [4] However, the successful implementation of technology-based management transformation is highly dependent on the perception, readiness, and interpretation of school principals to these changes. Therefore, it is important to understand how principals interpret and respond to the dynamics of digital transformation that are happening in their school environment.

Despite a strong push from national and global policies to integrate technology into school management[5], the reality is that not all principals are responding to this transformation uniformly. Some principals are showing high enthusiasm for adopting digital technology to improve management efficiency and transparency, while others still show resistance or limitations in its utilization. This difference is not only influenced by the level of access to technological resources, but also by the personal perception, conceptual understanding, and digital leadership competencies of each school principal. Furthermore, there is a tendency that managerial practices in schools are still administrative-conventional and have not fully experienced a paradigm shift towards data- and technology-based governance [6] This situation raises crucial questions about how principals understand, respond to, and direct the transformation of school management in the ever-evolving digital landscape. However, until now, there have not been many studies that have explored in depth the dynamics of school principals' perceptions of the transformation process, especially in the context of primary and secondary education in developing countries such as Indonesia. Based on the background, this study aims to explore the perception of school principals towards the

transformation of technology-based school management in the context of educational digitalization. This research focuses on an in-depth understanding of how school principals interpret their changing roles and responsibilities amid the demands of the digital era. In addition, this study aims to identify the factors that support or hinder the transformation process from the perspective of the principal as the leader of the educational institution. This study also describes the leadership strategies used by school principals in managing managerial changes powered by digital technology. The results of this research are expected to make practical and conceptual contributions to the development of educational leadership models that are responsive to the challenges and opportunities of digitalization.

Previous studies on the integration of technology in education have generally focused on aspects of online learning, digital media development, or the adoption of Learning Management System (LMS)-based learning platforms[7] [8] [9] Meanwhile, attention to the managerial dimension of schools, particularly how technology is changing governance and leadership practices at the education unit level, is still relatively limited [10][11][12][13][14][15][16][17][18]. Most studies that discuss digital education management also tend to use quantitative approaches that, while useful for measuring general trends, have not been able to delve deeply into the perceptions, personal experiences, and social contexts surrounding the transformation process. [19][20][21][22][23][24][25][26][27][28][29], Furthermore, the local context in developing countries such as Indonesia with the cultural complexity of school organizations, the limitations of digital infrastructure, and the diversity of leadership capacities has not been widely reflected in the global literature. Thus, there is a real need to fill this gap through qualitative studies that focus on how principals understand, respond to, and navigate technology-based managerial transformation in the context of education that is undergoing gradual digitalization.

This research contributes to the discourse of educational leadership by presenting an in-depth qualitative perspective on how principals interpret and respond to technology-based management transformation. The main novelty of this study lies in its focus on the dimensions of perception and subjective experience of school principals, which until now have rarely been systematically examined in the context of managerial digitalization. By reaching the space where leadership practices meet the dynamics of technological change, this research presents a more complete understanding of the challenges and strategies of school leadership in the digital age. In addition to enriching the academic literature, the findings of this study also have practical implications in designing principal capacity development programs that are more adaptive and contextual to the demands of the times.

RESEARCH METHODS

This study uses a descriptive qualitative approach to explore the perception of school principals toward technology-based management transformation in the context of educational digitalization. This approach was chosen because it can reveal the subjective meaning and personal meaning of leadership experience in the digital era, as well as understand social dynamics that cannot be reduced to statistical numbers.

The subjects in this study are ten principals from State Vocational High Schools (SMKN) in Palangkaraya City, Central Kalimantan. Teachers are positioned as triangulation informants to enrich perspectives and strengthen the validity of data through cross-confirmation of the principal's narrative and views. Data was collected through three main techniques, namely Semi-structured in-depth interviews to explore the perceptions, experiences, and strategies of school principals in managing the digital transformation of school management. Observation in the school environment, to see the actual practice of using technology in managerial processes and leadership dynamics. Documentation, including documents related to school policies, work plans, evaluation reports, and the use of digital management systems. The data was analyzed using the interactive model of Miles and Huberman [30]which consisted of three main stages: Data reduction, namely the process of selecting, focusing, and simplifying relevant information; Data presentation, through the organization of information in the form of thematic narratives or categorization matrices; Conclusion drawing and verification, carried out continuously and iteratively to develop a valid and logical understanding of the phenomenon under study.

The validity of this study is maintained through the application of the principles of credibility, transferability, dependability, and confirmability. Credibility is obtained through *member checking*, which is the verification of the results of interpretation to the subject and informant. Transferability is supported by the presentation of rich contextual descriptions, dependability is maintained through consistency of data collection and analysis procedures, and confirmability is achieved through *audit trail* tracking of the entire research process. To increase the validity of the findings, this study uses triangulation of techniques and sources. The triangulation technique is carried out by combining interviews, observations, and documentation. Meanwhile, source triangulation was carried out by comparing information from school principals and teachers as supporting informants. This approach allows for robust cross-validation and results in more comprehensive data.

RESULTAND DISCUSSION

Based on the results of in-depth interviews with 10 heads of vocational schools and 10 teachers in Palangkaraya City, four main themes were obtained. These themes describe the meaning, implementation, obstacles, and transformation strategies of technology-

based school management from the perspective of the principal as a leader and the teacher as an implementer at the level of the educational unit.

1. **Perception of Technology-Based Management Transformation**

Based on the results of interviews, 9 out of 10 school principals view digital transformation as a strategic need in the modern era. They assessed that technology supports work efficiency, and information transparency, and accelerates the decision-making process. The results of the interview with the principal *include "With the digital school dashboard, I can see teacher reports, attendance, and daily agendas in one click."* (KS). However, 1 school principal considers digitalization only as a complement to administration, not a core element of management. Meanwhile, in the results of interviews with teachers, as many as 7 out of 10 teachers admitted that there have been changes in the work system due to digitalization, such as online presence and filling out e-reports. However, 3 teachers stated that technology is only partially used and has not touched on the substantial management aspect.*"We use an absenteeism application, but the teaching plan is still manual, so it is not uniform."* Based on the results of the interview above, it can be visualized in the following graph.

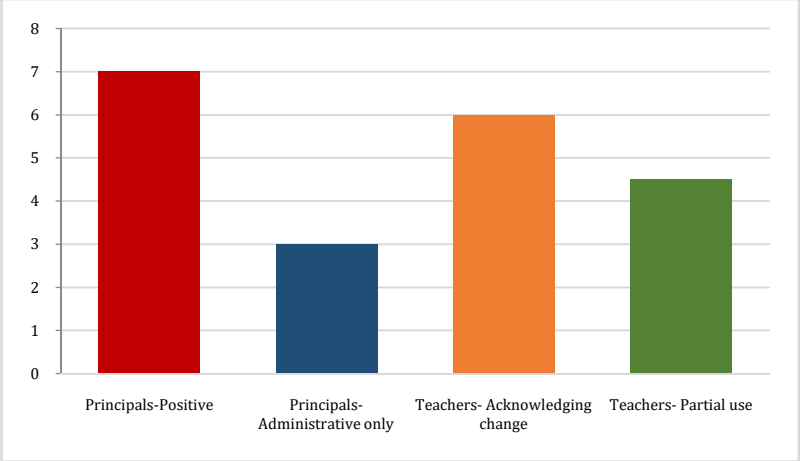

Figure 1. Perceptions of Management Transformation

The findings of this study show that school principals generally interpret the transformation of technology-based school management as an integral part of the institutional response to the demands of the digital age. This perception shows consistency with the framework *of Transformational Leadership Theory* [31] which emphasizes the importance of the role of leaders in inspiring change through strategic vision and coaching of followers [32], [33][34], [35], [36] In this case, the principal acts as an agent of change who not only introduces technology as an administrative tool, but also builds a system and work culture that supports the sustainability of digital transformation. The involvement of principals in forming technology teams, setting internal regulations, and providing informal training demonstrates the transposition of transformational leadership values into managerial practice at the school level.

On the other hand, the results of interviews with teachers reflect that the success of transformation is strongly influenced by the perception of the convenience and benefits of technology, as explained in *the Technology Acceptance Model (TAM)* Teachers who feel they have control and understanding of the use of technology show a positive and adaptive attitude, while teachers who feel burdened tend to be resistant to change [37], [38], [39]. This reinforces that perceived *usefulness* and *perceived ease of use* are important variables in encouraging or inhibiting the acceptance of technology in the school environment.

2. **Principal's Leadership in the Digital Transformation Process**

Based on the results of interviews with school principals, as many as 8 school principals stated that they were actively involved in leading digitalization, including compiling internal SOPs, socializing applications, and forming digitalization teams. Interview results *"I appointed a team of young teachers to help input online data, I monitored it directly from the dashboard."* (KS). Meanwhile, 2 school principals left the technical process to The Deputy Principal or ICT teacher, citing the limitations of personal digital literacy. As a result of interviews with teachers, as many as 6 teachers stated that their principals were supportive, provided training, and gave them time to adapt. However, 4 teachers said that the implementation was often top-down, without adequate room for discussion or socialization. As the results of an interview with theteacher, *"Sometimes digital policies are immediately set, even though we have not been given special training."* (G)

3. **Obstacles in Technology-Based Management Transformation.**

The results of the interviews found that the most common obstacles ncluded an unstable internet network stated by 7 people, 6 people stated the limitations of human resources who were not yet digitally proficient, and as many as 5 people stated

that the dual burden of manual and digital was great. Interview results *"We already have a system, but we still have to keep a hard copy because the Office sometimes asks for a printed one."* (KS). Based on the results of interviews with teachers, as many as 8 teachers said that the time for adaptation and training was very limited. Senior teachers have significant difficulty in using new technologies. As the result of the interview *"I'm in my 50s, if I am suddenly told to use the application, it is also stressful."* (G). Meanwhile, 2 teachers also said that not all the applications used ran optimally, some were still in the experimental stage. The results of the interviews can be seen in the following graph.

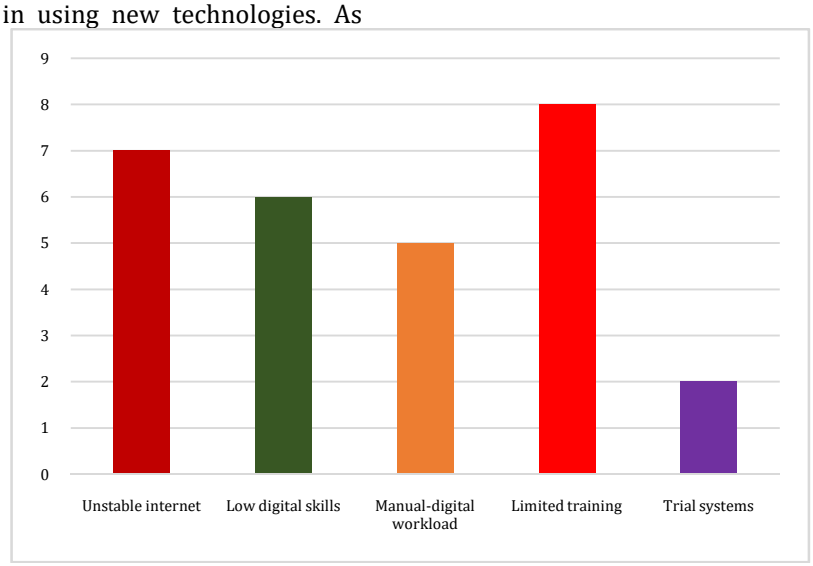

Figure 2. Barriers to Management Transformation

The success of technology-based management transformation depends not only on the availability of infrastructure but also on the psychological and cultural readiness of the educational actors involved.

4. Strategies for Managing Change and Fostering a Digitalization Culture.

Based on the results of interviews with 10 school principals, it is agreed that digital transformation requires a gradual strategy and a collaborative approach. The strategies carried out include: making internal regulations (6 people), forming a school IT team (7 people), and holding informal training (8 people). Interview results *"I prioritize young teachers to be peer coaches. It is more effective and they are more comfortable learning with fellow teachers."* (KS). Meanwhile, the results of interviews with teachers, the majority of teachers (7 out of 10) responded positively to collaborative strategies, especially when there was direct involvement and practical training. 3 teachers said that the strategy does not work well if it is only a formality. Interview results *"When I had a peer mentor, I quickly understood. But if it's just a one-way presentation, it's not enough."* (G) School principals who have a positive perception of technology tend to take initiatives such as internal training, collaboration with external parties, and the development of an independent school management system. They also encourage a data-driven work culture and time efficiency through the digitization of documents and administrative processes. The principal's strategy can be seen in the following graph.

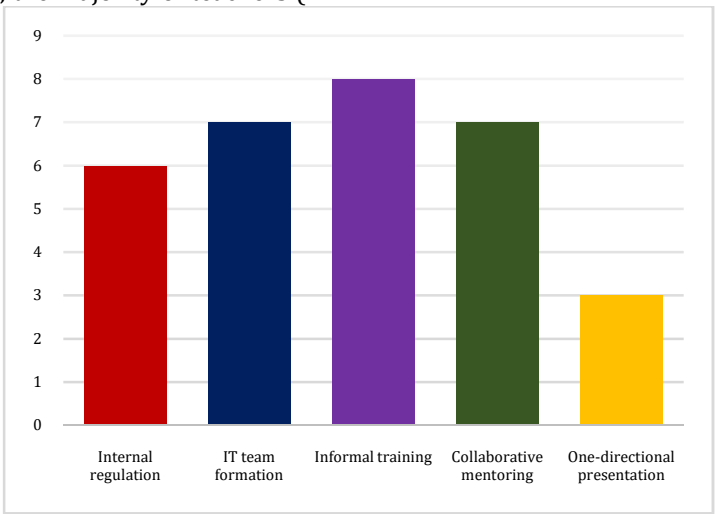

Figure 3. Strategies for Transformation

The results of this study make a significant contribution to the expansion of understanding of leadership theory in the context of digital education. Theoretically, this study enriches the literature on the adaptation *of Transformational Leadership* by adding a digital dimension as a new leadership space. Principals are not only positioned as structural leaders but also as *digital change leaders* who orchestrate the transition of organizational culture from a manual paradigm to a technology-based work system. These findings also underscore that digital leadership cannot be separated from the ability to build an adaptive, collaborative, and data-driven organizational learning ecosystem, which has not been explicitly accommodated in conventional leadership theory.

From a practical perspective, this study reveals the importance of building *institutional* readiness through strengthening the digital capacity of human resources. The implementation of strategies such as community-based training (*peer mentoring*), the formation of digital transformation teams, and the preparation of technology-based internal regulations have proven to be able to encourage the acceleration of change at the school level. Teachers are not only users of technologybut are also positioned as key actors in the implementation of responsive digital management systems.

The practical implications of this study confirm the need for education policy formulation that is not only oriented towards the provision of devices but also invests support in leadership coaching and comprehensive digital capacity development at the education unit level.

Although this research has provided valuable insights into the perception of school principals toward technology-based management transformation, it has several limitations that need to be examined. One of the main limitations is the limited geographical coverage of Palangkaraya City, Central Kalimantan. The findings obtained from schools in this region cannot necessarily be generalized to other regions with different levels of digital advancement, both in urban and rural areas. This research only focuses on principals and teachers, without involving other parties who play an important role in the implementation of digitalization in schools, such as parents, students, or the education office. A more holistic and comprehensive perspective on technology-based managerial transformation in schools can be gained if all stakeholders are involved.

Another limitation is the method of data collection that relies on interviews and observations, documentation that despite providing depth of information, remains vulnerable to subjective bias from both sides (principals and teachers). For example, principals may be more likely to express successes in the implementation of technology than the challenges they face, while teachers may feel less comfortable speaking openly about their dissatisfaction with the policies being implemented. Therefore, while these findings provide a useful overview, it is important to consider potential bias in the interpretation of the results.

While this study provides significant insights, there are some suggestions for further research to deepen understanding of technology-based management transformation in schools. First, expanding the scope of geography is a priority for future research. A comparative study between schools in urban and rural areas with different levels of digitalization will provide a more diverse perspective on the challenges and opportunities in the application of technology in different contexts. Second, quantitative research can be conducted to measure the relationship between variables such as the principal's leadership style, teachers' technological readiness, and the level of managerial effectiveness in schools. The use of survey instruments can help to unearth more representative and generalized findings.

Longitudinal research is highly recommended to trace the sustainability of technology-based management implementation in the long term. This kind of research can evaluate whether the changes implemented by the principal last longer and how they affect the school's organizational culture. Further research can also engage parents, students, and relevant agencies to provide a more holistic picture of the impact of digitalization in school management.

The transformation of technology-based management in schools has significant social implications, especially related to the equal access and distribution of technology**.** While digitalization offers the potential to improve managerial efficiency and transparency, it's important to remember that not all teachers or staff have equal access to digital tools or the skills needed. This research shows that senior teachers often find it difficult to keep up with technological changes, which creates inequalities in terms of active participation in the transformation process. Therefore, school principals need to ensure that the digitalization process does not create a digital divide among teachers who have different technological backgrounds.

Ethically, the application of technology in school management must pay attention to the protection of the personal data of students, teachers, and staff. Data security is a crucial issue that should not be ignored, considering the large amount of sensitive information processed through digital systems. The principal as a managerial leader has a great responsibility to ensure that the system implemented complies with applicable data security standards and involves the entire school community in education regarding the ethics of using technology. For example, it is important to educate about digital privacyanddata security as part of

school policies, to protect the personal information collected.

While digitalization offers great advantages in school management, an inclusive and safe approach must be implemented so that this change is not only beneficial to some parties but can be enjoyed fairly by all school members.

CONCLUSION

This research has revealed that the transformation of school management is technology-based, although it directs the use of technology to improve administrative efficiency, it also shapes a digital culture in schools. This role is aligned with the principles of *Transformational Leadership*, where principals serve as key drivers in the implementation of digital policies, and training is seen as an essential step in the face of the digital age, facing significant challenges in its implementation. Principals play a central role as agents of change that are not only sustainable for teachers. However, the gap between the understanding and acceptance of technology among teachers, especially senior teachers who have limitations in digital literacy, suggests that the success of technology-based managerial transformation depends not only on the provision of tools but also on the mental readiness and skills of human resources in schools. Infrastructure-related obstacles, unstable internet access, and synchronization between central and regional policies are still major obstacles that hinder the sustainability of these changes.

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