MANAGERE
INDONESIAN JOURNAL OF EDUCATIONAL MANAGEMENT
PERMA PENDIS INDONESIA
ISSN : 2721-1053
E-ISSN : 2721-1045
Vol. 6 No. 2 (2024), p. 233-244
Available online at http://jurnal.permapendis.org/index.php/managere/index

Supervision in the Digital Age: Leveraging Technology to Enhance Teacher Development

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Article History:
Received: January, 2024
Accepted: June 2024
Published: August 2024

Keywords:
Digital supervision, Educational Technology, Teacher competence, Professional development

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Abstract : *This study focuses on the role of technology in enhancing the effectiveness of supervision by madrasah supervisors in Kraksaan District to improve teacher competence. Using a qualitative approach and case study method, data were collected through desk reviews, structured interviews, and observations involving madrasah supervisors, teachers, and principals. The study reveals that digital platforms can improve the efficiency of supervision by facilitating real-time feedback, enhancing collaboration, and accelerating the professional development of teachers. Despite these benefits, the implementation of technology in supervision faces significant challenges, including limited infrastructure, low digital literacy among supervisors, and inadequate policy support. The findings suggest that addressing these barriers through structured digital literacy training, improved access to technology infrastructure, and supportive policies could amplify the benefits of technology-based supervision. This study also highlights the potential of technology to transform traditional supervision methods, offering a more flexible and effective approach to professional development in madrasahs. The implications of this research emphasize the need for sustainable strategies to integrate technology into educational supervision practices, ensuring its long-term impact on teacher competence and educational quality. These results provide valuable insights for policymakers, educators, and researchers aiming to develop and implement technology-based supervision models in diverse educational contexts.*

INTRODUCTION

In the digital era, technology has great potential to support teachers' professional development through more effective and efficient supervision (ElSayary, 2024; Hennessy et al., 2022). Theoretically, technology can be used to improve communication, provide access to learning resources, and make it easier to evaluate teacher performance (Asad et al., 2021; Hennessy et al., 2022). However, the facts on the ground show that there is a gap between the potential of the technology and its implementation. In many madrasas, especially in Kraksaan District, supervision is still carried out conventionally, which often limits the scope of coaching. This is due to various factors, such as limited technological resources, low digital literacy of supervisors, and lack of policy support to support digital transformation in supervision. This gap is a crucial issue because it hinders efforts to improve teacher competence optimally, even though the demands of professionalism in the digital era are getting higher.

Various studies have been conducted related to the use of technology in education supervision. For example, a study by (Karo & Petsangsri, 2021; Zaheer & Munir, 2020) It shows that the use of digital platforms can increase the effectiveness of supervision and facilitate collaboration between supervisors and teachers. Other research by (Yuting et al., 2022) revealed that the integration of technology in supervision has succeeded in increasing teachers' motivation in participating in competency development programs. However, these studies focus more on the context of public schools in urban areas and less on the condition of madrassas in rural areas. Thus, this study occupies a strategic position to bridge the gap by highlighting how madrasah supervisors in Kraksaan District can utilize technology to improve teacher competence, considering the specific social and cultural context.

This paper aims to examine the effectiveness of technology utilization in supervision by madrasah supervisors in Kraksaan District. The main problem to be answered is how can madrasah supervisors in Kraksaan District improve teacher competence through the use of technology? This research also aims to identify the challenges faced in the implementation of technology in supervision and offer strategic recommendations to overcome these obstacles. Thus, the results of this research are expected to make a practical and theoretical contribution to the development of technology-based education supervision, especially in the madrasah environment.

Based on the initial study, the hypothesis proposed in this study is that the use of technology in supervision by madrasah supervisors in Kraksaan District can significantly improve teacher competence, as long as it is supported by adequate digital literacy training, adequate infrastructure, and supportive policies. This hypothesis will be tested through empirical research, focusing on how supervisors use technology to provide feedback, monitor teacher performance, and facilitate teacher professional development. With this approach, this research is expected to be able to provide relevant and applicable solutions to face the challenges of supervision in the digital era.

RESEARCH METHOD

This research is focused on madrasas in Kraksaan District as the main unit of analysis. The research site includes madrassas that are diverse in size, level of accreditation, and resources owned. The object of the research includes madrasah supervisors, teachers, and supervision programs that are implemented by utilizing technology. This research also includes analysis of supervision activities, teacher professional development programs, and events related to the implementation of technology in supervision. Thus, the results of the study are expected to represent the condition of technology-based supervision in madrasas in Kraksaan District.

This study uses a qualitative approach with a case study method. This design was chosen to deeply understand how madrasah supervisors in Kraksaan District utilize technology in supervision. Case studies allow researchers to explore phenomena holistically in a specific context. In addition, the grounded research approach is used to identify patterns and themes that emerge from the data. This approach helps researchers dig into rich and in-depth information, which is relevant to the research objectives. The sources of information in this study include respondents, informants, and texts.

The main respondent is the madrasah supervisor who is responsible for supervision in Kraksaan District. Additional informants include teachers, madrasah heads, and administrative staff related to supervision. Data is also obtained from texts, such as policy documents, supervision manuscripts, as well as relevant online news. These sources of information are selected to ensure the diversity of perspectives and completeness of the data required in the analysis. Data was collected through several techniques, namely desk reviews, observations, and interviews. Desk review is carried out by reviewing documents related to supervision and education policies.

Observations were made at the madrasah location to understand the implementation of technology in direct supervision. Interviews were conducted with supervisors, teachers, and madrasah heads using structured interview guidelines. In addition, questionnaires are also used to collect supporting quantitative data. The data collection process is designed to ensure the validity and reliability of the information obtained. Data analysis is carried out through several stages, namely data reduction, data display, and data verification.

Data reduction is done to filter relevant information from raw data. Data display is carried out by arranging information in the form of tables, graphs, or narratives to make it easier to interpret. Data verification is carried out to ensure the validity of the findings. The analysis methods used include content analysis, discourse analysis, and interpretation analysis. Content analysis is used to identify key themes in the data, discourse analysis is used to understand social and cultural contexts, while interpretive analysis is used to draw meaningful conclusions from the data.

FINDINGS AND DISCUSSION

Organizing Technology-Based Training and Workshops

Organizing Technology-Based Training and Workshops is a learning process that uses technology as the main medium to improve the competence of participants. This activity involves the use of hardware, software, and the internet to deliver material, interactions, and hands-on practice. The goal is to increase technological literacy, accelerate the adoption of innovation, and support work effectiveness, especially in education, to help teachers and education staff make optimal use of technology. The following is a data table of teachers' opinions about technology-based training.

Table 1. Teachers' Opinions on Technology-Based Training

Assessment Aspects	Agree (%)	Disagree (%)	Neutral (%)
Training to improve teachers' digital competencies	70%	15%	15%
Technology as an additional burden	40%	45%	15%
Adequate technological facilities	50%	35%	15%

The diagram shows a comparison of teachers' opinions regarding technology-based training in the categories of agree, disagree, and neutral. The findings of this data are corroborated by the results of the following interviews. "Technology training does help, but we feel the workload increases with digital-based tasks." (Mz_2024). "I support technology training, but our facilities are still limited, such as the internet network which is often problematic." (Sn_2024). "This training is very useful, but it requires support from the madrasah in providing adequate tools and media." (Ah_2024)

The results of the data show that the majority of teachers (70%) agree that technology-based training improves their digital competence. However, around 40% of teachers feel that technology is an additional burden, and another 35% revealed that technology facilities in madrasas are still not supportive. Interview citations reinforce this data, indicating that while technology-based training provides benefits, there are significant constraints in terms of infrastructure and facility support. From the data presented, the main patterns that reflect teachers' opinions regarding technology-based training appear. First, the majority of teachers appreciate the benefits of this training in improving their digital competencies. Second, there are concerns about the additional workload felt by some teachers. Third, the availability of technology facilities is the main challenge, with only half of teachers feeling that facilities in madrassas are adequate.

Guiding Teachers in Creating Interactive Learning Media

Guiding teachers in creating interactive learning media means providing support and training so that teachers can design media that allows students to interact directly with the material. This includes the introduction of tools, media design planning, content creation, and evaluation and improvement of media that have been created to improve the quality of learning. Indicators of guiding teachers in the creation of interactive learning media include:

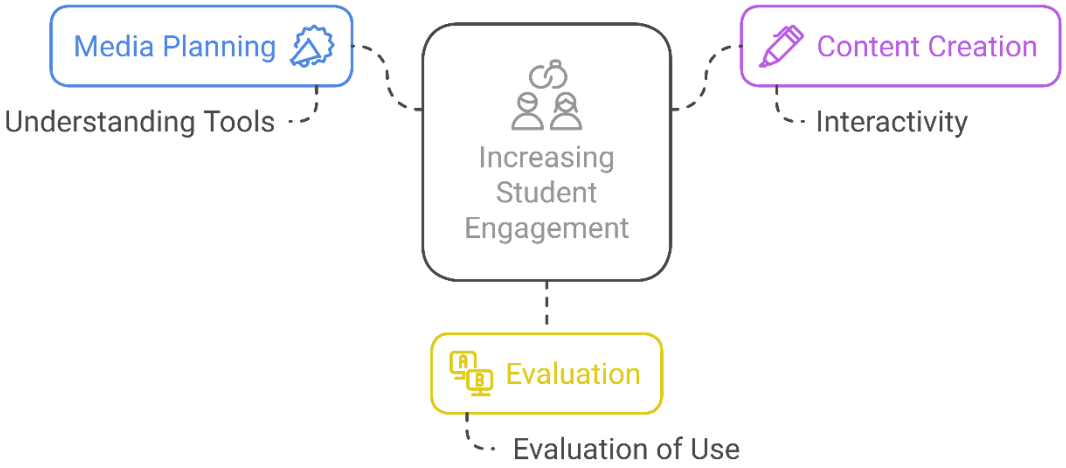

Figure 1. Guiding Teachers in the Creation of Interactive Learning Media

In interviews that have been conducted regarding Guiding teachers in the creation of interactive learning media, information related to this impact was obtained. "After participating in this training, I feel more confident in making interactive learning media. Some of the apps introduced were helpful, but I still needed more practice to get the most out of the features. Sometimes, I feel that not all students can access the media I create easily." (Mh_2024)
"I find it quite difficult to make learning media that can be accessed by all students. My biggest challenge is to create media that fits the learning objectives and remains attractive to students with diverse abilities. Even so, this training provided a lot of new insights that were very helpful." (Am_2024)

After participating in the training, teachers feel more confident in creating interactive learning media thanks to the introduction of useful applications. However, teachers admit that they still need more practice to optimize the existing features. In addition, there are concerns about the difficulty of some students in accessing the media created. Teachers also revealed difficulties in creating learning media that can be accessed by all students, especially in ensuring that the media is in accordance with learning objectives and remains attractive to students with diverse abilities. Even so, teachers feel that the training provides new insights that are very helpful in the process of making learning media.

From the results of the interview, it can be seen that although teachers feel more confident after participating in the training on making interactive learning media, they still face several challenges. Teachers admit that the apps introduced in the training are very helpful, but they feel that they need more practice to optimize the existing features. In addition, there are concerns that not all students can easily access the media created, which indicates a challenge in terms of the accessibility of such media. Another challenge is adapting the media to the learning objectives and ensuring that the media remains engaging and accessible to students of diverse abilities. However, the training provides new insights and additional knowledge for teachers to be better at creating effective and engaging learning media.

Technology-Based Monitoring and Evaluation

Technology-Based Monitoring and Evaluation is the use of technological tools and systems to monitor and assess the performance or results of a program. The technology allows for real-time monitoring, automated data collection, rapid analysis, and more efficient reporting and visualization. This increases efficiency, accuracy, and speed in relevant data-driven decision-making. This is in accordance with the results of interviews regarding Technology-Based Monitoring and Evaluation which shows that universities utilize technology to monitor educational performance and results to meet accreditation standards and maintain the quality of education in a sustainable manner. "We have started to implement a technology-based monitoring and evaluation system to monitor academic and administrative developments more efficiently. Using this system, we can see real-time data on lecturer and student performance, as well as identify areas that need improvement. In addition, technology makes it easier to collect and analyze the data needed for accreditation." (Fz_2024)"Technology-based monitoring and evaluation is very helpful for us in collecting data related to student performance. With the existing system, we can monitor their progress in real time and provide feedback more quickly. This system also makes it easier for us to report the results of the evaluation to meet the accreditation standards." Mh_2024)

Universities have begun to implement a technology-based monitoring and evaluation system to increase efficiency in monitoring academic and administrative developments. With this system, real-time data related to lecturer and student performance can be easily accessed, making it easier to identify areas that need improvement, and supporting data collection and analysis for accreditation purposes. In addition, this system also helps collect data on student performance faster, allows for more efficient monitoring, and provides more timely feedback. The use of this technology also makes it easier to prepare the evaluation reports needed to meet accreditation standards.

The description of the results of this interview shows that universities have begun to implement technology-based monitoring and evaluation to increase efficiency in monitoring academic and administrative developments. With this system, universities can access real-time data regarding the performance of lecturers and students, allowing them to immediately identify areas that need improvement. Technology also makes it easier to collect and analyze the data needed to support the accreditation process. In addition, the system allows for direct monitoring of student progress and provides faster feedback, as well as making it easier to report on evaluation results to ensure compliance with accreditation standards. Thus, technology plays an important role in accelerating and simplifying the monitoring, evaluation, and accreditation process in higher education.

Use of Educational Social Media

The use of Educational Social Media is the use of social media platforms for learning purposes, such as sharing materials, discussing, and interacting between educators and students. This social media can present learning in interesting forms such as videos, infographics, and quizzes, as well as increase student engagement and collaboration in the learning process. This finding is corroborated by the results of interviews from several informants. "I started using educational social media to make learning easier and increase student engagement. Through platforms like Instagram and YouTube, I can share learning videos and interesting materials. Students also actively ask questions and discuss in the comment column, which makes them more involved in the material being taught." (Fr_2024). "I use educational social media, such as Facebook and WhatsApp, to provide additional materials and practice questions to students. Social media makes it easier to communicate two-way, so students can easily ask questions or discuss material they don't understand." (Fm_2024)

The first informants started using educational social media such as Instagram and YouTube to make learning easier and increase student engagement. Through the platform, he can share videos and interesting materials, while students become more active in asking questions and discussing in the comment column, which improves their understanding of the material being taught. On the other hand, the second informant uses educational social media such as Facebook and WhatsApp to provide additional materials and practice questions to students. With social media, two-way communication has become easier, allowing students to ask questions or discuss directly about material they don't yet understand.

The results of the interviews conducted show how educational social media can improve the learning process and communication between educators and students. The first informants utilize platforms such as Instagram and YouTube to share interesting videos and materials that make it easier for students to understand the subject matter. With the comment column, students become more active in asking questions and discussing, which makes them more involved in learning. Meanwhile, the second informant uses social media such as Facebook and WhatsApp to provide additional materials and practice questions to students. Social media facilitates two-way communication that makes it easier for students to ask questions or discuss material they do not yet understand, speeding up the learning process and strengthening academic support. These two interviews show that educational social media is not only effective for delivering material, but also for strengthening engagement in learning.

Discussion

Organizing technology-based training and workshops allows for increased learning effectiveness by leveraging various digital devices and platforms such as video conferencing, learning apps, and social media (Haleem et al., 2022; Zamiri & Esmaeili, 2024). The use of technology in training provides greater flexibility and accessibility, allowing participants to take part in training from multiple locations without having to be physically present, saving time and money (Javaid et al., 2022; Senbekov et al., 2020).

In addition, technology also provides interactive and collaborative facilities, such as chat, video call, and discussion forums, which enrich the learning process and accelerate the understanding of the material (Garlinska et al., 2023; Su & Zou, 2022). Participants can easily access a variety of additional resources through digital platforms, as well as leverage advanced evaluation tools to measure their understanding more efficiently (ElSayary, 2024; Haleem et al., 2022). However, challenges such as unstable internet connections, difficulties in the use of technology by less familiar participants, and lack of face-to-face interaction need to be considered. With the right implementation, technology-based training can significantly improve the quality of learning and skill development (Ahmmed et al., 2022; Dahri et al., 2023).

Guiding teachers in creating interactive learning media is an important process to improve the quality of teaching in the classroom (Wu, 2021). In the era of rapidly developing technology, interactive learning media can help teachers to convey material in a more interesting and easy-to-understand way for students (Haleem et al., 2022; Sofi-Karim et al., 2023). This guidance includes an introduction to various tools and applications that allow teachers to create materials that are not only informative, but also facilitate interaction between students and learning materials (Marougkas et al., 2023). In addition, the training also teaches teachers how to integrate interactive elements, such as quizzes, simulations, and learning videos, to encourage student engagement (Ahshan, 2021; Khan et al., 2022). However, the challenges faced by teachers in creating interactive learning media are limited time, technological skills, and difficulties in adapting the media to various needs and abilities of students (Ferri et al., 2020; Sofi-Karim et al., 2023). Therefore, effective guidance needs to include technical and pedagogical support to ensure that the resulting learning media can be used optimally in supporting the learning process (Kuba et al., 2021; Marougkas et al., 2023).

Technology-Based Monitoring and Evaluation is a monitoring and assessment process that utilizes digital tools and systems to collect, analyze, and report data more efficiently (Qureshi et al., 2023). The use of technology in monitoring and evaluation allows real-time monitoring, so that the data obtained is more accurate and up-to-date (Rao et al., 2022). This system facilitates automated data collection through various platforms, such as specialized applications or software, which reduces manual errors and speeds up the analysis process (Tyagi et al., 2020). In addition, technology also allows data visualization in the form of graphs or dashboards that are easier to understand, making it easier to make data-driven decisions (Naqvi et al., 2021). With the application of technology, evaluation becomes more transparent and accessible to interested parties more easily and quickly (Javaid et al., 2021). However, challenges in technology implementation, such as infrastructure issues and human resource readiness, need to be considered so that the monitoring and evaluation process can run optimally (Gupta et al., 2022). The use of educational social media is increasingly popular in the world of education because of its ability to facilitate more interactive and flexible learning (Cavus et al., 2021).

Platforms such as Instagram, YouTube, Facebook, and Twitter are used by educators to deliver material, share information, and interact with students (Aduba & Mayowa-Adebara, 2022). Educational social media allows the delivery of material in a variety of more engaging formats, such as videos, infographics, and articles, which can improve student comprehension (Jaleniauskiene & Kasperiuniene, 2023). In addition, social media also provides a space for students to discuss, ask questions, and share ideas with friends or teachers, which enriches the learning process (Greenhow & Galvin, 2020). The use of educational social media also allows for more affordable learning and can be accessed at any time, increasing the accessibility of education outside the classroom (Sofi-Karim et al., 2023). However, despite its many benefits, the use of social media also requires supervision to keep students focused and avoid irrelevant distractions (Dontre, 2021).

CONCLUSION

This study shows that the use of technology in digital supervision can significantly improve teachers' professional development. Technology allows supervision to be carried out more efficiently and flexibly, utilizing digital platforms to provide feedback, monitor progress, and provide additional learning resources. In addition, technology also allows for more open communication and collaboration between principals, supervisors, and teachers, which can ultimately improve the quality of teaching and learning. The main contribution of this paper is to renew the perspective on the role of technology in education supervision, which was previously more conventional.

This research also offers a new approach in supervision methods by utilizing digital tools to monitor and provide feedback to teachers. By exploring variables such as the digital platform used, the type of feedback given, and its influence on teachers' professional development, this paper provides new insights into education management in the digital era. However, the study was limited to specific cases in a few schools with varying technology applications and in limited locations, so the findings may not be fully generalizable. In addition, the methods used in this study are limited to a qualitative approach that may not comprehensively describe the overall phenomenon. Therefore, further research with a broader survey method is needed to get a more comprehensive picture, so that it can be used as a more effective policy basis in improving teacher professional development in various educational contexts.

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