The Role and Challenges of School Leaders in Enhancing the Application of Digital Technology

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ABSTRACT

The transformation of digital technology serves as an instructional aid and can expand and enrich curriculum content to face 21st-century education. In the context of this study, leaders play a primary role in driving educational digitalization. Digital leadership is an emerging leadership concept in the digital education era because changing factors demand that technology leaders be more proactive in integrating and cultivating ICT use. Therefore, this study aims to explore the role of school leaders in enhancing teachers' application of digital technology in schools. This study also explores the challenges faced by school leaders in enhancing teachers' application of digital technology in schools. This qualitative study design used a purposive sampling method, focusing on leaders with technological leadership characteristics. The study was conducted in Kota Tinggi District, Johor, Malaysia with four participants. The findings indicate that all participants play a role in the application of digital technology. However, school leaders also face challenges such as a lack of infrastructure and resources, teachers' digital literacy gaps, and financial issues in implementation.

Keywords—Role and Challenges, School Leaders, Digital Technology.

INTRODUCTION

Education is a dynamic system that is constantly evolving to meet the needs and aspirations of the nation. In today's increasingly challenging modern era, the national education system also needs to undergo changes and shifts toward a better, more effective, and innovative approach. According to Safiek (2019), the changes that occur are, among other things, to produce quality human capital that is in line with current global changes to ensure the country develops in step with all aspects of global progress. The Malaysia Education Blueprint (PPPM) 2013-2025 also identified 11 shifts that need to be made to achieve the desired changes and educational goals. Therefore, educational institutions, as centers for producing human capital, must always be aware and ready to make changes so that the generation built through curriculum implementation becomes a reality and a functional asset to the country.

Each shift must have an impact on at least one of five system outcomes: access, quality, equity, unity, and efficiency. Quality is the main focus across all shifts because it is a crucial dimension that needs immediate attention. Based on this, the digitalization of education is seen as a step to empower the educational world today. Digital transformation in education is important in improving the quality of teaching and learning. To keep up with the times, any changes and plans need to be flexible. Change management is a methodological approach to handling changes to the goals, processes, or technology within an organization. According to Mohd Fahmi (2023), the objective of change management is to formulate strategies to implement changes, manage changes, and help people adapt to those changes. This is because the world is becoming more challenging and complex. Any changes and plans must be flexible (Ahamad Bahtiar et al., 2020). This means the role of every educational leader needs to change according to current needs, which is known as the digitalization era. This change must be carried out by leaders who will spearhead change in a school. This is because every educational leader must play a role in making changes according to current needs.

"The greatest danger in times of turbulence is not the turbulence. It is to act with yesterday's logic." (Drucker, 2017)

This statement clearly shows that leaders need to prepare themselves in all aspects when facing a changing world so they can adapt to any situation (Drucker, 2017). According to Fullan (1998), the role of educational leaders in making changes can be carried out or sustained through five actions: solving complex environmental problems, practicing effective communication, having flexibility, applying the latest technology, and combining old and new concepts. These leadership actions are supplemented by a sixth one based on the suggestions of Hall and Hord (2014), who explain that in implementing a change, educational leaders must become change facilitators through the dimensions of concern for others, organizational efficiency, and change strategies. In this digital technology era, education leaders are also responsible for carrying out transformations toward higher-quality education.

The transformation of digital technology not only serves as a teaching aid but also can expand knowledge and enrich curriculum content to face 21st-century education. In ensuring digital technology is applied comprehensively and effectively, the role of school leaders is demanded as the driver of any change. These individuals are seen as important in the application of digital technology by teachers, including Malay Language teachers. School leaders should be involved in determining the direction of digital technology implementation through policies, strategic planning, and the support provided to teachers and students. According to Mohd Aniq et al. (2024), high-impact instructional leaders always cultivate the dimensions of instructional leadership: the dimension of defining the school's mission, the dimension of managing learning programs, and the dimension of creating a school learning climate. Therefore, the role and responsibilities of school leaders in increasing the application of digital technology should be studied and understood. Their role is important so that efforts to empower digital education can be realized comprehensively.

The Concept of Digital Technology Leadership

Technology leadership is defined as a process of commitment to providing technology infrastructure and ensuring there is a suitable environment that allows for the full use of these facilities to facilitate classroom teaching and subsequently improve learning achievement among students (Bigirwa et al., 2022). Digital leadership is a concept of leadership that has emerged in the era of digital education (Omar, 2020). Change demands that technology leaders be more proactive in integrating and adopting the use of ICT and be ready to deepen their knowledge and skills in new technologies that are constantly evolving (Hanita & Khalip, 2024). Digital technology leadership refers to a leader's ability to strategically leverage an organization's digital assets to achieve business goals and drive transformative change. Digital leadership involves integrating technology with business strategies to optimize operations, create value, and enhance customer experience (GDS Group, 2022). Digital technology leadership refers to the practice of school leaders directing digital transformation and implementing innovative strategies to leverage digital technology to improve the quality of teaching and learning (AEEC Universitas Airlangga, 2023).

The Concept of Digital Education

Digital education encompasses the elements of life and career skills, learning and innovation skills, and information, communication, and media technology skills (Nurul Syuhada & Helmi, 2023). Digital education is defined as the innovative use of digital tools and technologies during teaching and learning, the administrative management of educational organizations, and the provision of human capital capable of competing in line with global developments (Putri, 2018). Digital education refers to the use of digital technology in an educational context to enhance the teaching and learning process. This involves the use of digital devices, software, and online resources to support and enrich the learning experience. Digital education not only involves access to information but also the development of critical digital skills in the modern technology era. The Digital Education Policy aims to produce a digitally literate generation by increasing knowledge, skills, and values among students, educators, and educational leaders (Ministry of Education Malaysia, 2023).

The Concept of Roles and Challenges for School Leaders

School leaders, including principals and headmasters, play a crucial role in ensuring the smooth management and achievement of educational goals. School leaders are responsible for planning, implementing, and

monitoring school activities, as well as ensuring a conducive learning environment for students and teachers. Their roles encompass aspects of instructional leadership, resource management, teacher professional development, and the involvement of the community and parents in the educational process (Rahayu et al., 2020).

School leaders often face various challenges in carrying out their duties. Leaders must manage ongoing changes in education policy, technology, and student needs, requiring them to be adaptive and flexible (Kamarulshahrizat & Khalip, 2024). Financial and human resource constraints can affect the implementation of school programs and activities (Azman, 2024), so school leaders need to be smart in managing resources. In the context of teacher professional development, school leaders must ensure teachers receive continuous training and support to enhance their competencies (Rahayu et al., 2020). School leaders are also responsible for community engagement, building good relationships with parents and the community to support the educational process (Kamarulshahrizat & Khalip, 2024). Furthermore, school leaders need to ensure the well-being of students and staff by addressing issues related to the mental health and welfare of both students and staff (Azman, 2024).

Problem Statement

The application of digital technology in education has become a primary necessity to support 21st-century teaching and learning. The Ministry of Education Malaysia (KPM) has introduced various policies and initiatives, such as the Malaysia Education Blueprint (PPPM) 2013–2025 and the Educational Digitalization Strategic Plan 2021–2025, to promote the widespread use of technology in schools. According to the Ministry of Education Malaysia (2021), these efforts are also made to emphasize the comprehensive integration of technology in schooling. However, studies show that the implementation of digital technology in schools has not yet reached an optimal level, or in other words, is inconsistent, especially in terms of comprehensive integration into teaching, teacher skills, and school leadership support (Alias & Yusof, 2020; Mustaffa et al., 2022).

One of the key factors influencing the success of digital technology application in schools is effective leadership. School leaders are not only responsible for providing physical facilities and technological infrastructure but also for shaping a culture of innovation, providing professional training to teachers, and continuously monitoring the implementation of technology use (Ng, 2019). The term "school leaders" here refers to principals who are the driving force behind the school. They act as the main catalyst for educational renewal, including in the integration of digital technology. According to a study by Davis and Fullan (2009), principals must have change management skills, including the ability to influence, lead, and develop strategies to maximize the use of technology in teaching and learning. However, a gap still exists between the policies outlined and the actual implementation at the school level. Several studies indicate that a lack of visionary leadership and structured strategies leads to technology being used in a limited and inconsistent manner (Rahim & Yunus, 2021). The challenges become more apparent with constraints such as a lack of specific training for teachers and the provision of technology infrastructure among schools. Additionally, not all school leaders possess sufficient digital competence to lead technological change in the school ecosystem. This creates challenges in strategic planning, building teacher capacity, and evaluating the effectiveness of technology use (Ismail & Hassan, 2020).

Based on these issues, it is clear that there is a need to study the actual roles of school leaders in the effort to apply digital technology among Malay Language teachers and the challenges they face. Therefore, this study is conducted to examine in depth the real role of school leaders in enhancing the application of digital technology or educational digitalization, as well as the challenges school leaders face in increasing the application of digital technology, especially among Malay Language teachers. This study is important for understanding the role of effective leaders in driving impactful digital change and identifying the challenges that need to be overcome in the implementation of digital strategies in schools.

Research Objectives

1. To explore the roles of school leaders in increasing teachers' application of digital technology.
2. To explore the challenges faced by school leaders in increasing teachers' application of digital technology.

Research Questions

1. Do school leaders have a role in increasing the application of digital technology?
2. What are the challenges faced by school leaders in increasing the application of digital technology?

ISTE'S MODEL OF TECHNOLOGY LEADERSHIP (2009)

The National Educational Technology Standards-Administrator (NETS-A) model is the cornerstone of principals' technology leadership, as introduced by the International Society for Technology in Education (ISTE, 2009). The NETS-A model (2009) outlines the requirements for a technology leader in an educational environment. Each component is structured based on the needs of a leader in guiding an educational organization that relies on the use of ICT. In the realm of education, the influence of ICT has begun to permeate and become a part of daily work routines. To ensure the effectiveness of ICT in schools, the NETS-A standards are used to guide the role of principals as technology leaders (ISTE, 2009).

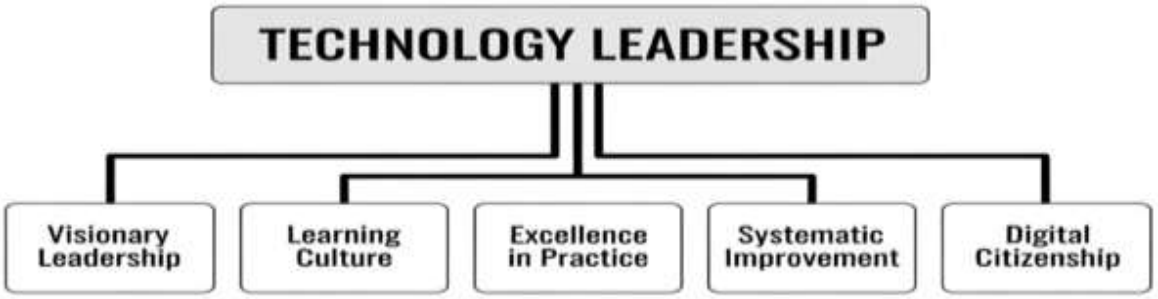

Fig. 1 The Technology Leadership Model by (ISTE, 2009)

To enhance the application of digital technology among Malay Language teachers, school leaders must possess clear and strategic visionary leadership. According to the Technology Leadership model, a visionary leader can mobilize the entire school community toward systematically and strategically empowering the use of technology. This shared vision is crucial to ensure that teachers do not use technology in an ad hoc manner but truly integrate it into their teaching and learning process. Furthermore, building a learning culture among teachers is also a vital element of this model. Leaders play a role in creating an environment that supports continuous professional learning through various initiatives such as professional learning communities (PLC), in-house training, and focused coaching. This culture can encourage Malay Language teachers to explore and apply digital technology consistently and creatively.

The Technology Leadership model also emphasizes the need for excellence in practice among leaders and teachers. School leaders should be exemplary role models in using technology and subsequently guide teachers to improve the quality of their teaching and learning (T&L) through digital tools. When leaders apply technology in administration and to support teaching and learning (T&L), teachers will be more confident and motivated to do the same. In addition, systematic improvement is a key component that allows leaders to identify weaknesses and continuously refine technology implementation. Monitoring, evaluation, and joint reflection with teachers are strategic approaches that help leaders understand the real challenges on the ground and formulate appropriate intervention plans. Digital citizenship in this model refers to the leader's responsibility to educate the school community about cybersecurity, the ethics of technology use, and compliance with digital laws.

In the context of Malay Language teachers, this aspect is important to ensure that the use of digital materials in teaching and learning (T&L) platforms is done ethically and professionally. The Technology Leadership model provides a comprehensive framework for understanding the roles and challenges of school leaders in the context of educational digital transformation. Through its five main elements - visionary leadership, learning culture, excellence in practice, systematic improvement, and digital citizenship - this model allows the study to identify the key dimensions of effective leadership in supporting the application of technology by Malay Language

teachers.

The use of this model also helps researchers structure interviews and data analysis in a more focused and thematic way. It not only enables the study to assess the effectiveness of the leader's role but also to identify the actual challenges faced in implementing the functions of technology leadership at the school level. Furthermore, this model provides an opportunity to understand the relationship between leadership and teacher readiness, as well as how leaders can be catalysts for sustainable digital pedagogical transformation. Overall, this Technology Leadership model is highly suitable for use in this study because it integrates aspects of vision, culture, practice, monitoring, and digital ethics, aligning with current needs in empowering the use of technology in Malay Language teaching and learning (T&L) at the school level.

SIGNIFICANCE OF THE STUDY

In the era of the Industrial Revolution 4.0 and 21st-century Education, digital technology has become an important component in teaching and learning (T&L), especially in the Malay Language subject. However, the success of applying this technology largely depends on proactive and strategic educational leadership. This study focuses on the roles and challenges of school leaders in increasing the application of digital technology by Malay Language teachers. Therefore, the findings of this study are expected to bring various benefits to various stakeholders, including the Ministry of Education Malaysia (KPM), State Education Department (JPN) / District Education Office (PPD), schools, teachers, and students.

For the Ministry of Education Malaysia (KPM)

This study provides empirical data that can help KPM evaluate and improve policies and initiatives related to educational technology leadership. The findings can serve as a basis for the development of a national digital leadership training module, especially targeting school leaders who manage language and non-STEM subject teachers, who are often marginalized in digitalization approaches (Zawawi & Hassan, 2022). For example, suppose the findings show that the main constraint is a lack of formal training for school leaders in leading technology integration in Malay Language T&L. In that case, KPM can develop a phased professional program that not only focuses on technology but also emphasizes the relationship between technology and language pedagogy.

For the State Education Department (JPN) / District Education Office (PPD)

The findings of this study can be used as an operational and implementation guide for JPN and PPD in formulating and executing technology leadership support programs at the school level. For instance, if this study finds that school leaders are less exposed to best practices or mentoring in educational technology, JPN and PPD can design digital professional learning communities (PLC) between schools, specifically for the Malay Language subject. A study by Roslan & Khadijah (2021) shows that the role of PPD is vital in building a network of knowledge between schools that allows for the direct and effective exchange of technology practices. The findings will also signal to JPN the need to align the allocation of equipment, technical support, and leadership models for schools that are still at a low level of digitalization.

For the School

This study provides a more comprehensive and in-depth overview for principals and the school administration team regarding the strengths and weaknesses of their strategies in guiding teachers to implement digital technology in T&L. Principals can use these findings to formulate a specific School Action Plan (PTS) for digital transformation, especially in core subjects like Malay Language, which plays a crucial role in student literacy achievement. For example, suppose the study finds that Malay Language teachers use technology less due to technical support constraints. In that case, the school can appoint an expert technology teacher as an internal mentor or formally request external resources through PPD initiatives. This approach aligns with a study by Hassan and Azlin (2020) that suggests implementing collaborative strategies as a best practice in driving technology use.

For Teachers

This study gives a voice to Malay Language teachers in expressing the real challenges they face in their efforts to apply digital technology. This is crucial because a "one-size-fits-all" approach often ignores the specific needs of language subject teachers. The findings can open up opportunities for suitable training interventions, such as workshops based on language technology pedagogy and coaching sessions on using interactive applications for literacy and literature. A study by Teh and Ramli (2023) shows that teachers who receive phased and subject-appropriate training are more confident in using technology in T&L, thereby increasing student engagement in the classroom. Thus, the results of this study can reinforce teachers' need for relevant and continuous training.

For Students

Finally, the main importance of this study is for student learning, which is the ultimate goal of all educational efforts. When school leaders successfully guide Malay Language teachers to apply technology effectively, students will gain a more interactive, contextual, and personalized learning experience. This will directly impact language literacy achievement and student motivation to learn. For example, students involved in T&L who use technology such as AI writing assistants, gamified quizzes, and digital literacy through multimedia materials show higher achievement in comprehension and writing aspects (Yusof et al., 2022). Therefore, this study can contribute to more meaningful and relevant teaching strategies that meet the needs of 21st-century students.

Overall, this study makes a significant contribution to various parties in the educational ecosystem, from the policy level (KPM), implementation (JPN/PPD), institution (school), implementers (teachers), to the main beneficiaries (students). This study not only fills a gap in the literature on the application of digital technology in Malay Language teaching but also provides practical suggestions that can be translated into policies, programs, and actions on the ground. Thus, this study can contribute to efforts to empower a more holistic, inclusive, and needs-based digital education transformation.

LITERATURE REVIEW

The development of digital technology has changed the global educational landscape, including in Malaysia. The use of technology in teaching and learning (T&L) is no longer an option but a major necessity in line with the aspirations of the Malaysia Education Blueprint (PPPM) 2013–2025 and the Industrial Revolution 4.0. In this context, Malay Language teachers are also encouraged to integrate digital technology into their T&L to increase the effectiveness of delivery and attract students' interest. However, the success of this educational innovation depends on effective school leadership.

School leaders play a crucial role in driving change and innovation, particularly in providing support, training, facilities, and motivation to teachers. Transformational and distributed leadership are seen as approaches that can foster a culture of comprehensive technology use among teachers. However, school leaders also face various challenges, including resource constraints, a lack of digital skills among teachers, and a heavy administrative workload.

Past studies have identified several important aspects related to the roles and challenges of school leaders in the context of educational digital transformation. Therefore, this paper will systematically examine the findings of previous studies to understand how the role of school leadership can strengthen the application of digital technology among Malay Language teachers and identify the obstacles faced in implementing these initiatives.

A study by Zamri Mahamod (2019) examined the role of principals' instructional leadership in encouraging the use of technology in Malay Language teachers' lessons in daily secondary schools. The findings showed that principals who actively provided encouragement, resources, and built an innovative culture successfully increased the use of technology among teachers. This study also emphasized that effective instructional leadership can change skeptical teachers' attitudes toward technology to be more positive.

In a study by Noraini and Zaid (2021), the transformational leadership approach in secondary schools was

identified as a key driver of digital-based T&L innovation. Principals who have a technology vision, give autonomy, and support teachers' professional development were found to be able to increase teachers' involvement in technology use. Malay Language teachers in this study reported being more confident in trying digital platforms when school leadership was supportive and open. According to Leong et al. (2023), school leaders who leverage data-driven leadership successfully coordinate the use of technology strategically in T&L. This study involved 12 secondary schools in the Klang Valley and showed how data on teacher technology use was analyzed to provide targeted support. Malay Language teachers in this study received more relevant training when the principal took a data-based and individual teacher needs approach.

Mohamad and Yusof (2020), in their qualitative study, examined the strategies of rural school leaders in encouraging the use of digital technology by Malay Language teachers. Despite a lack of infrastructure, creative principals created teacher learning communities (PLC), supported the sharing of best practices, and connected teachers with outside experts. This study emphasized that constraints are not an obstacle if leaders are proactive and strategic.

A study by Dexter, S. (2018) in the United States examined the role of school leaders in building a culture of technology use through a distributed leadership approach. The study found that principals who empowered innovative teachers as micro-level technology leaders at the department level successfully increased the rate of technology application in the classroom. This study showed that when Language or Humanities teachers are given a mandate to experiment and share digital practices, the application of technology is more comprehensive and effective.

In a study by Schrum and Levin (2015), principals in high schools in America were identified as the main catalysts for the successful application of technology when they played the role of instructional technology leaders. This study emphasized that school leaders need to not only understand technology but also integrate it with a pedagogical vision. Principals who provided time, resources, and incentives to teachers succeeded in increasing the use of technology in Language and Literature teaching. According to Flanagan and Jacobsen (2021), in Canada, the effectiveness of educational technology leadership depends on the leader's ability to understand the classroom context and support innovation flexibly. An action research study found that leaders who are actively involved in planning technology implementation with teachers, including Language teachers, succeeded in creating a digital environment that is responsive to student needs.

In terms of challenges for school leaders in increasing the application of digital technology by Malay Language teachers, Sulaiman and Halim (2018) found that among the main challenges for school leaders in driving the use of digital technology were a lack of ICT competency among senior teachers and a lack of relevant training. In the context of Malay Language teachers, principals face difficulty in changing from a traditional to a digital approach due to cultural constraints and teachers' perceptions of technology. This study called for contextual and continuous training to be expanded to regular daily schools. A study by Ramasamy and Wong (2022) revealed that a lack of systemic support from PPD and JPN is a major obstacle for school leaders in implementing digital policies comprehensively. Principals complained that there was no specific action plan to help subject teachers like Malay Language integrate technology. This lack of clear direction caused leaders to lose focus and fail to provide clear guidance.

In an international study by UNESCO (2022), school leaders in the Asia Pacific region were reported to face major challenges in building the digital capacity of the school community due to a lack of access to expert mentors, scalable guidance, and a systematic training framework. In Malaysia's case, the report stated that most initiatives are still too general and do not target critical subjects like the Malay Language. A study by Jalil and Lim (2017) showed that school leaders are less exposed to practical models of technology change management. As a result, many principals do not have the decision-making skills related to choosing appropriate technology for specific subjects like Malay Language. This study suggested that technology leadership courses be included in NPQEL training.

A study by Anderson and Dexter (2020) emphasized that a lack of technology training for school leaders themselves is a major obstacle to implementing digital transformation. Through a survey of 1,200 school leaders

in the United States, the findings showed that only 37% of principals had formal technology leadership training. This made it difficult for them to guide teachers, including language subject teachers, in the effective use of digital technology. According to a study by Kafyulilo et al. (2016) in Tanzania, school leaders faced major constraints in building teachers' technology capacity due to a lack of policy support and inadequate infrastructure. Although leaders showed interest in technology integration, a lack of structured training models meant that the application of technology by teachers, including language teachers, remained low. This study suggested the need for a more active role from the ministry in directly supporting school leaders.

A study by Ertmer et al. (2019) showed that the biggest challenge for school leaders in using technology was teachers' skeptical attitudes toward the effectiveness of technology, especially in non-STEM subjects like Language. Even with available infrastructure, school leaders found it difficult to overcome internal barriers such as teachers' reluctance to try new approaches. This study recommended a leadership approach based on emotional support and role modeling.

Based on the analysis of local and international studies, it is clear that the roles and challenges of school leaders in increasing the application of digital technology by teachers, including Malay Language teachers, are complementary but influenced by different contexts. At the local level, the main emphasis is on instructional and transformational leadership, where supportive principals provide continuous training and create a conducive environment, which has been proven to be able to increase the use of technology in T&L (Zamri Mahamod, 2019; Noraini & Zaid, 2021). However, they also face challenges such as the absence of AI mentors, a lack of phased training, and limited exposure to best practices (Sulaiman & Halim, 2018; Ramasamy & Wong, 2022).

Meanwhile, international studies show a more systematic and data-driven dimension of technology leadership. School leaders who function as technology integrators or instructional technology leaders are seen as more effective when supported by formal training, solid policies, and collaborative approaches in building teacher capacity (Dexter, 2018; Flanagan & Jacobsen, 2021). However, they are also not free from challenges such as teachers' skeptical attitudes toward technology (Ertmer et al., 2019) and a lack of policy support in developing countries (Kafyulilo et al., 2016). Therefore, this comparative summary shows that the success of school leaders in driving the application of digital technology does not only depend on infrastructure or policies but also on leadership competence, school culture, and professional support that is appropriate to the context of the subject and locality

RESEARCH METHODOLOGY

Research methodology refers to the methods or processes used in conducting a study to achieve its objectives. Research methodology is implemented through planning, data collection techniques, and analysis, used to obtain valid and reliable results. Research methodology covers the ways and methods used to achieve the objectives and goals to be investigated (Haizah & Norazana, 2022).

Research Design

The design for this study is a qualitative study. Qualitative studies focus on data collection methods in the form of descriptions and in-depth analysis of phenomena. A qualitative approach can explore in depth and understand the feelings and situations of research participants more closely through semi-structured interviews. This is in line with Kamarul Azmi's (2012) opinion, which states that qualitative researchers can easily immerse themselves in all situations because they are in the actual situation. The researcher wants to explore the roles and challenges of school leaders in increasing the application of digital technology by Malay Language teachers in more depth.

Research Sampling

This study uses a purposive sampling method, focusing on several criteria centered on the research topic. This sampling technique is used to select individuals or samples based on specific criteria that are relevant to the research objectives. According to Creswell (2012), the purposive sampling method is used so that the selected

research participants have certain predetermined characteristics. The choice of sampling strategy depends on the purposeful and representative focus of the study (Patton, 1990). This study only focuses on leaders who have the characteristics of technology leadership, namely, leaders who are committed to providing technology infrastructure and ensuring there is an environment that allows for the full use of these facilities to facilitate classroom teaching (Nurul Syuhada & Helmi, 2023). The study sample consists of two principals from secondary schools (SMK) and two headmasters from primary schools (SK). All research participants are school leaders in the Kota Tinggi, Johor district.

Research Instrument

This study uses a flexible semi-structured interview method as its main instrument. The interview method is used to collect data from research participants in oral form. The interviews were conducted face-to-face. The interview questions were prepared before the interview protocol was implemented. Their arrangement is based on the study's themes, but the order and delivery can be adjusted according to the conversation (George, 2023). The researcher prepared a list of basic questions related to the study's themes, but allowed room for additional questions or adjustments during the interview session. The themes and form of the basic questions were determined beforehand, but they were always open to modification to remain relevant during the interview (Sulaiman et al., 2021). This interview method allows the interviewed individuals to be guided, feel free, and possibly bring up some new issues previously unknown to the researcher, and it is easy to understand the focus of the discussion (O'Keefe et al., 2015). This approach allows the researcher to explore participants' views and experiences in depth while ensuring the focus remains on the research objectives (Ruslin et al., 2022). The questions were divided into three parts as follows:

Part A: Demographics of the research participants, including gender, age, education level, and teaching experience.

Part B: Instrument on the roles of school leaders.

Part C: Instrument on the challenges faced by school leaders in increasing the application of digital technology by Malay Language teachers.

Validity and Reliability of the Instrument

The researcher sought assistance from a School Improvement Specialist Coaches + (SISC+) for Malay Language in the Kota Tinggi District to ensure that the research items had a clear sentence structure that was easy for respondents to understand. The research instrument on the roles of school leaders in increasing the application of digital technology by Malay Language teachers was adapted from studies by Anita et al. (2024) and Nurul Syuhada & Norman (2023). The instrument on the challenges of school leaders in increasing the application of digital technology by Malay Language teachers was adapted from a study by Rubathey et al. (2024). All instruments were modified to suit the purpose of the study.

Data Analysis

Data was analyzed based on the predetermined research objectives. The researcher used thematic analysis, a method for identifying, analyzing, and reporting patterns (themes) in qualitative data. This approach allows researchers to gain an in-depth understanding of participants' experiences, views, and perceptions. Thematic analysis is flexible and can be used in various research contexts, such as psychological, educational, and health studies (Braun & Clarke, 2023). In this study, the interview data were transcribed using the TurboScribe AI application. The interview data were analyzed and categorized into themes and subthemes identified through the transcription. The research findings were organized according to relevant themes and subthemes before the final report was written.

RESEARCH FINDING

Table 1 shows the demographics of the research participants, who are school leaders with teaching experience

ranging from 28 to 30 years. The researcher used a pseudonym for each participant as a condition to comply with research ethics. According to Iksan (2011), the use of a pseudonym aims to link the real name with the pseudonym that will be used for the research participant to facilitate the process of identifying the participant's real name. The research participants are referred to as Participant 1 (PK1), Participant 2 (PK2), Participant 3 (PK3), and Participant 4 (PK4). This study involves four technology leaders: two principals and two headmasters. All the school leaders in this study have between 28 and 30 years of teaching experience and are highly experienced in the field of education. The selection of principals and headmasters in this study provides a comprehensive overview of how leadership at the secondary and primary school levels influences the application of digital technology in Malay Language teaching.

TABLE I Demographics of research participants

Study Participant	PK 1	PK2	PK3	PK4
Gender	Female	Male	Male	Female
Age	53 years old	55 years old	55 years old	54 years old
Education Level	Bachelor's Degree	Doctor of Philosophy	Bachelor's Degree	Bachelor's Degree
Teaching Experience	28 years	30 years	30 years	29 years
Position	Principal	Principal	Headmaster	Headmaster
School Type	Secondary School	Secondary School	Primary School	Primary School

Based on the interviews conducted with the four research participants, named PK1, PK2, PK3, and PK4, the researcher identified two dominant themes in this study:

1. The role of school leaders in ensuring educational digitalization
2. The challenges faced by school leaders in educational digitalization

Educational digitalization is essential for improving the quality of today's education, including the application of artificial intelligence as a teaching aid and the enhancement of teacher pedagogy. It is also seen as a positive step to help teachers move from conservative teaching methods to education based on the latest technology, which can assist and facilitate teachers toward more effective education. The interview results have been arranged in a table for better clarity.

Question 1: The Role of School Leaders in Educational Digitalization

Leadership is a key pillar in the formation of any organization. The role of a leader is to ensure that every task is carried out by subordinates based on the organization's objectives. A leader's job is not just to issue instructions but to focus more on positively changing employee behaviour (Mohd Norakmar et al., 2019). School leaders have shown a positive role in supporting the development of digital education. Digital education is necessary to face the 21st-century era of education.

TABLE II The roles of school leaders in educational digitalization

Role of school leaders in educational digitalization	PK1	PK2	PK3	PK4	Frequency
Visionary leadership	/	/	/	/	4
Provision of infrastructure and resources	/	/	/	/	4
Development of teachers' professionalism	/	/	/	/	4
Fostering a culture of innovation and change	/	/	/	/	4

Based on Table II, it is clear that all research participants play a role in educational digitalization. This is proven by the fact that all four participants demonstrated visionary leadership. They admitted to being actively involved in providing infrastructure and resources to ensure the professional development of teachers. All four participants also acted as agents for promoting a culture of innovation and change toward technological digitalization in their schools. The following are the transcripts of the interviews that were conducted.

Visionary Leadership in Educational Digitalization

TABLE III Visionary Leadership In Educational Digitalization

Visionary Leadership in Education Digitalization	PK1	PK2	PK3	PK4	Frequency
Has a digital vision and mission	/	/	/	/	4
Involves all school stakeholders	/	/	/	/	4
Establishes a support team	/	X	/	X	2
Applies digitalization in administration	/	/	/	/	4

All participants in the study, namely PK1, PK2, PK3, and PK4, played a role in embracing digitalization and planning for positive change by supporting the Ministry of Education's (KPM) recommendations to integrate educational digitalization. All participants acknowledged that their school's mission and goals were aligned with KPM's efforts to integrate digital education.

PK1: *"My school is moving toward educational digitalization and has been selected as a digital school at the Kota Tinggi district level. The school has established five digital classes equipped with ICT facilities, such as an art studio, a photography studio, a Malay Language SBC room, and a sports science lab."*

PK2: *"The school has incorporated educational digitalization into its operations and planning policies, in line with the guidelines issued by KPM for 2025. The school has started moving toward digitalization, but it's not yet fully comprehensive."*

PK3: *"Our school's vision and goals are aligned with KPM in integrating educational digitalization to provide quality education for the development of educated citizens for the nation."*

PK4: *"Our school's vision and goals are to produce digitally fluent students. We use digital platforms to disseminate information and the latest developments happening at the school."*

Provision of Infrastructure and Resources

TABLE IV Provision Of Infrastructure And Resources

Infrastructure and Resource Provision	PK1	PK2	PK3	PK4	Frequency
Meets requirements	/	/	/	X	3
Ensures readiness	/	/	/	/	4
Needs improvement	/	X	X	/	2

All the study participants - PK1, PK2, PK3, and PK4 - acknowledged that their schools are committed to providing infrastructure and resources for educational digitalization.

PK1: *"...the school is already equipped with four buildings and will have eight more in the future. The school has a special room, smart TVs, and LCDs for teachers to use during T&L."*

PK2: *"...the infrastructure is not 100% supported yet due to cost constraints. ...The school has provided smart TVs, two smart boards, and wider internet access, but suggestions for improvements have been discussed with the PPD."*

PK3: *"...the school is equipped with laptops, LCD projectors, special rooms, and a computer lab."*

PK4: *"...the school is equipped with a computer lab, high-speed internet connection, and digital devices for T&L use."*

Teacher Professional Development

TABLE V Teacher Professional Development

Teacher Professional Development	PK1	PK2	PK3	PK4	Frequency
Strategic planning	/	/	/	/	4
Provision of access & resources	X	/	/	X	2
Training facilitator	/	/	/	X	3
Motivation builder	/	/	/	/	4

Professional development must be seen as a crucial element in the successful application of digital technology by teachers, especially for Malay Language teachers. Based on interviews with PK1, PK2, PK3, and PK4, professional development among teachers has been organized and implemented.

PK1*: "...two teachers have attended an AI course through in-service training (LDP) and have become trainers for other teachers. They are also responsible for updating the latest AI developments, including the use of e-RPH."*

PK2: *"...after the briefing, the school leadership requested all teachers to plan for the application of digital technology in T&L, invited an e-RPH knowledge company to enhance teachers' skills, and encouraged teachers to use the free ID D5 platform."*

PK3: *"...established a committee or ICT support team, provided access to AI tools and platforms, and acted as a motivator by giving moral support and recognition."*

PK4: *"...organized courses and workshops related to the use of digital technology and AI in Malay Language T&L, and encouraged teacher participation in courses and obtaining professional certificates in educational technology."*

Fostering a Culture of Innovation and Change

TABLE VI Teacher Professional Development

Promotion of an Innovation & Change Culture	PK1	PK2	PK3	PK4	Frequency
Exemplary leadership	/	/	/	/	4
Sharing culture (PLC)	/	X	/	/	3
Giving recognition	X	X	/	/	2
Continuous support	/	/	/	/	4

The findings from the interviews also show that all four research participants, PK1, PK2, PK3, and PK4, fostered a culture of innovation and change in their leadership style through technological digitalization.

PK1: *"...sent teachers to an AI course and then held briefings for the teachers, with monitoring conducted through learning walks by the school leadership."*

PK2: *"...mandated that teachers conduct T&L using technology, whether it be visuals, audio, or other forms."*

PK3: *"...provided regular training and a phased approach to digital use, and encouraged professional learning (PLC) while also leading by example."*

PK4*: "...held best practice sharing sessions and gave recognition to teachers who integrated technology into their T&L."*

Question 2: Challenges for School Leaders in Increasing the Application of Digital Technology by Malay Language Teachers

The application of digital technology, particularly artificial intelligence (AI), by Malay Language teachers is receiving increasing attention in the effort to empower 21st-century teaching and learning. However, the implementation of AI at the school level is not without its challenges, especially for school leaders who are the main pillars in planning and supporting the use of digital technology among teachers. School leaders are not only responsible for providing a conducive environment but also need to address various technical, organizational, and pedagogical barriers that hinder the effective implementation of AI. According to Hashim et al. (2021), educational leaders often face teachers' unreadiness to accept technological changes, which indirectly affects the success of AI implementation in schools. Therefore, identifying these challenges is crucial for school leaders to formulate more effective strategies to ensure that the application of digital technology can be implemented comprehensively and sustainably in Malay Language teaching.

TABLE VII Challenges of Infrastructure and Resource Constraints

Challenges: Infrastructure and Resource Constraints	PK1	PK2	PK3	PK4	Frequency
Poor Internet access	/	X	/	/	3
Cost of resources	X	/	/	X	2
Lack of digital devices	X	/	/	/	3

Challenges with Infrastructure and Resource Constraints

This finding addresses the second research question, which is about the challenges leaders face in increasing the application of digital technology among Malay Language teachers.

Weak Internet Connectivity

PK1, PK3, and PK4 stated that unstable Internet connectivity is a major obstacle to the application of digital technology among Malay Language teachers. This constraint disrupts the flow of digital teaching and learning and limits the optimal use of AI applications.

PK2: *"Sometimes teachers are enthusiastic about using AI, but when the Internet is unstable, that enthusiasm just disappears. They are forced to revert to old methods."*

PK3: *"During peak hours, the school's internet is very slow. Applications like ChatGPT are difficult to open and show to students."*

PK4: *"Teachers face issues with the school's Wi-Fi connection, which often gets disconnected when they are using digital technology."*

Cost of Resources

Based on the study's findings, PK2 and PK3 stated that they face challenges related to the cost of resources for digital technology applications, especially for teachers' use of AI in T&L. The cost of gaining access to premium AI applications and related equipment is seen as a burden. This is a constraint for schools, especially small or private schools, in providing sufficient resources for teachers to apply AI.

PK1: *"There are good AI applications, but they are paid. We can't afford to subscribe for all the teachers."*

PK4: *"Sometimes our teachers can only use the free versions, but the functions are limited. Teachers become less interested in continuing."*

Lack of Digital Devices

Based on the study's findings, PK2, PK3, and PK4 stated that they face challenges from a lack of digital devices for the application of digital technology (AI) by teachers in T&L. The lack of suitable digital devices, such as computers, tablets, or smartphones, also limits the use of AI technology. Some teachers are forced to share devices or use personal devices that do not support AI applications well.

PK1: *"Some teachers still use old laptops that are completely unsuitable for running AI applications."*

PK2: *"The school only has a few computers in the lab. When many teachers want to use them, it becomes a problem."*

PK4: *"Teachers are forced to use their phones, and not all of their phones can handle heavy applications."*

TABLE VIII Challenges of Teachers' Digital Literacy Gap

Challenges: Teacher Digital Literacy Gap	PK1	PK2	PK3	PK4	Frequency
Difficulty accepting change	/	/	/	X	3
Concerns about originality and integrity	/	X	/	X	2
Lack of skills	/	/	/	/	4

Challenges of Teachers' Digital Literacy Gap

Reluctance to Embrace Change

Based on the interview findings, PK1, PK2, and PK3 agree that teachers are reluctant to change their methods and apply AI technology in their T&L. This makes it difficult for leaders to foster a readiness among teachers to shift from traditional methods to new technological approaches.

PK1: *"Several teachers are not ready to change. They are more comfortable using old methods and are less confident in the potential of AI digital technology in teaching."*

PK2*: "Some teachers think this AI digital technology is just a current trend and doesn't need to be learned in depth."*

PK3: *"The attitude of being afraid to try something new still exists, especially among long-serving teachers."*

Concerns about Authenticity and Integrity

Based on the findings, PK1 and PK3 agree that they face challenges when teachers express concern about academic integrity issues when using AI digital technology. They worry about the negative impact on students' values and the authenticity of their work, as well as on the preparation of lesson plans or student assessments.

PK2: *"Teachers worry that students will become too dependent on AI and will not produce original work on their own."*

PK3: *"The issue of content authenticity is a major concern, especially when teachers can confirm errors and shortcomings in the work produced by AI digital technology, whether in preparing lesson plans or assessments."*

Lack of Skills

Based on the findings, all participants agree that they face challenges due to teachers' lack of skills in using and applying digital technology. The lack of skills in using AI digital technology makes teachers less confident and

hesitant to try it. This requires continuous support and guidance from the administration.

PK1: *"Some teachers are not skilled in using technology, let alone more complex AI."*

PK2: *"Some teachers still don't understand the basic functions of AI applications. This is implemented at the school level."*

PK3: *"We found a digital skills gap among teachers. Without proper training, AI digital technology is difficult to leverage."*

PK4: *"Although there is interest, teachers' skills in the technical aspects are still low and require a lot of guidance."*

TABLE IX Challenges of Financial Problems and Funding

Challenges: Financial and Funding Issues	PK1	PK2	PK3	PK4	Frequency
Limited school allocation	/	/	/	/	4
Lack of internal or external contributions	X	/	/	/	3

Challenges with Financial Issues and Funding

Limited School Allocation

Based on the study's findings, all participants stated that their schools face financial challenges that hinder the comprehensive implementation of AI. The existing budget is more focused on basic needs, while specific allocations for the purchase of AI equipment or systems are still insufficient.

PK1: *"The school's allocation is very limited, only enough for basic needs. When there is a desire to use AI digital technology in T&L, we have to think twice because the cost is high."*

PK2: *"We once tried to apply for a grant from an NGO, but we were not successful yet. We hope for another chance because the school budget is really limited."*

PK3*: "AI requires good devices and infrastructure support. Unfortunately, the school budget cannot cover all*

of that. We rely on external sources."

PK4: *"We have to prioritize our use of the allocation. Sometimes technology like AI has to be set aside because funds are needed more for basic maintenance."*

Lack of Internal or External Contributions

Based on the study's findings, three of the participants—PK2, PK3, and PK4—stated the need to get internal contributions from the school community or external ones from companies, agencies, or individuals to cover the cost of purchasing AI technology.

PK2: *"Sometimes teachers and administrators themselves pool resources, buying tools together to help implement new technology like AI."*

PK3: *"Contributions from former students and the local community are very helpful, even if small. But for AI, the cost is quite high and requires a long-term strategy."*

PK4: *"We have an internal fundraising program. But it is not enough yet to buy AI equipment like smart learning systems."*

TABLE X Time Constraints and Teachers' Workload

Time Constraints and Workload	PK1	PK2	PK3	PK4	Frequency
Packed school activities, programs, and competitions	/	/	/	/	4
Prioritization of core duties	/	/	/	/	4

Time Constraints and Workload

Packed School Activities, Programs, and Competitions

All participants in the study, from PK1 to PK4, agreed that the school's schedule, which is packed with activities, programs, and competitions, prevents teachers from having enough time to attend training, research, or explore AI digital technology in T&L. The priority given to annual programs often hinders innovation.

PK1: *"The school schedule is very packed with various programs. So, it's difficult to find a special time to train teachers about AI or conduct experiments on using AI in T&L."*

PK2: *"We have to focus on implementing ministry activities and external competitions. AI is considered an add-on, not a priority."*

PK3: *"The teachers themselves complain they don't have time to learn new things because there are too many school programs to manage."*

PK4: *"Even though they are interested, teachers can't commit to learning about AI because most of their time is spent on extracurricular activities and programs."*

Prioritization of Core Duties

Based on the study's findings, all participants stated that teachers have to prioritize core duties such as teaching, preparing lesson plans (RPH), conducting classroom assessments, and related documentation. This causes the exploration of technology like AI to receive less attention.

PK1: *"AI needs time to be understood and tested. But teachers are more focused on their main tasks like RPH and reporting because those are their KPIs."*

PK2: *"Teachers prioritize existing tasks. When there's new technology, they feel it's an additional, non-mandatory burden."*

PK3: *"Core responsibilities like teaching, recording assessments, managing students—all of this means teachers have no time to try AI."*

PK4: *"I understand the importance of AI, but teachers need to fulfill their main responsibilities first. If everything is done simultaneously, it becomes too burdensome."*

TABLE XI Challenges of a Lack of Training and Exposure to AI Digital Technology

Challenges: Lack of AI Training and Digital Technology Exposure	PK1	PK2	PK3	PK4	Frequency
Lack of AI experts or mentors	/	/	X	/	3
Lack of specific and continuous AI training	/	/	/	/	4
Lack of exposure to good practices for using AI	/	X	/	/	3

Challenges: Lack of Training and Exposure to AI Digital Technology

Lack of AI Experts or Mentors

Three of the four participants—PK1, PK2, and PK4—stated that the absence of AI experts or mentors at school is a major challenge. Teachers have no one to turn to for technical guidance when they want to apply AI in their T&L.

PK1*: "We don't have anyone who is truly skilled in AI to help teachers. If we had an expert, teachers would be more confident to try."*

PK2: *"The lack of an AI mentor makes it difficult for us to start initiatives. We all have to learn on our own."*

PK4: *"If teachers have a technical problem or don't understand how to use AI, there's no one who can give them direct guidance."*

Lack of Specific and Continuous AI Training

Based on the study's findings, all participants agreed that the training provided is not specific enough to the use of AI in a classroom context. The training is also not continuous, making it difficult for teachers to master the technology.

PK1: *"AI-related training is usually general or a one-time thing. There is no phased or follow-up training that genuinely helps teachers."*

PK2: *"Teachers need consistent training. AI is not something that can be mastered in just one session."*

PK3: *"The existing training is more about basic ICT. As for AI in T&L, it's still too new and given less emphasis."*

PK4: *"We need training that is systematically organized and appropriate for the teachers' skill levels. Right now, many teachers feel left behind."*

Limited Exposure to Best Practices in AI Use

Based on the study's findings, three participants—PK1, PK3, and PK4—stated that teachers have limited exposure to examples of best practices they can use as a reference. This makes it difficult for teachers to

understand and recognize the true potential of AI in T&L.

PK1: *"If teachers could see examples of successful AI use in other schools, they might be more open and confident to try it."*

PK2: *"Teachers need inspiration from their colleagues. But for now, there's no platform to share best practices."*

PK4: *"We are not exposed to examples of effective AI-based teaching by the PPD or JPN. So teachers don't see the benefits."*

DISCUSSION

This section covers an in-depth discussion of the research findings, addressing the study's research questions. The researcher will focus on the roles of school leaders in educational digitalization and the challenges leaders face in applying AI among teachers.

The Role of School Leaders in Educational Digitalization

School leaders do not deny that educational digitalization is an important step in meeting today's educational needs. In the digital era, the landscape of a leader has changed in line with current technological developments. Leaders now need to be more aware and ready to accept sudden changes through the implementation of information and communication technology (ICT) in their organizations (Esplin, Stewart, & Thurston, 2018; Ozkan, Tokel, Celik, & Oznacar, 2017). This statement is also supported by Mohd Fahmi Asyraf & Mohd Izham (2023), who state that administrators, as individuals responsible for the organization, must be sensitive to the changes occurring in Malaysia's educational ecosystem. Administrators must work together with teachers to make this change agenda a success. In this context, the effectiveness of the role played by the headmaster determines the extent to which the desire for change towards PAK21 (21st-century education), which involves implementing digital education, can be realized.

The interview findings with PK1, PK2, PK3, and PK4 show visionary leadership in digital education. Every participant acknowledged that, as the main leaders of their schools, they understand and have made educational digitalization a mission and vision for the school, in line with KPM's mission and vision for digital education by 2025. School leaders with a clear vision and mission can steer the school's direction toward digital transformation. According to Safiek (2019), a school's direction is usually reflected in its vision and mission because the vision and mission guide a headmaster as a leader and their organization toward where the school is headed. This can illustrate the school's direction in the long term, while the school's goals reflect the school's short-term objectives. The study shows that school leaders who can plan long-term strategies can encourage teachers to be more open to using technology during the T&L process.

It is undeniable that technological infrastructure is a primary need for integrating educational digitalization. Complete and perfect infrastructure or resources should be provided by the school to help teachers increase their application of educational digitalization. A successful school leader will ensure that infrastructure, such as internet access, digital devices, and technical support facilities, is available and maintained (Alias & Yusof, 2020). Without infrastructure support, efforts to apply digital technology in education will be hindered. This is proven by the fact that the Ministry of Education Malaysia (2021) has provided infrastructure facilities that are a cornerstone of the Educational Digitalization Strategic Plan. According to Mohd Fahmi Asyraf & Mohd Izham (2023), a smart administrator can identify the strengths and weaknesses that exist in the organization and optimize the available digital resources to ensure that the implemented changes have an effective and lasting impact on their organization, in line with the development of the digital world. This clearly shows that school leadership needs to play a role in coordinating resources and acting as a link between stakeholders to obtain allocations and external support. The evidence is that all four participants acknowledged that their schools have provided infrastructure and resources to teachers to support educational digitalization, such as Smart TVs, LCDs, special rooms, and wide Internet access.

The interview findings also show that teacher professional development is a critical aspect that needs attention. School leaders must be active in providing continuous training based on the actual needs of teachers in the classroom to implement digital education. According to Mohd Fahmi Asyraf & Mohd Izham (2023), to enhance administrative professionalism, the Continuous Professional Development (CPD) courses that have been conducted need to be continued periodically. Effective school leaders provide training. This is in line with the findings of Lokman and M. Al-Muzammil (2008), who explained that leadership that prioritizes teacher autonomy and collaborative decision-making can influence teacher commitment and trust in school leaders. An effective leader provides continuous, relevant training based on the actual needs of teachers in the classroom (Ismail & Hassan, 2020). In addition, a study by Rahim and Yunus (2021) also shows that teachers are more likely to use technology if they are given hands-on training and practical guidance.

Finally, the findings show that school leaders who promote a culture of innovation and flexibility are more successful in normalizing the use of technology among the school community. Leaders who are open to new ideas, support digital pedagogical experimentation, and give recognition to teachers who show initiative have created a more creative and progressive work climate (Ng, 2019; Mustaffa et al., 2022). A school culture that supports change and renewal will accelerate the process of technology adoption and reduce rejection among teachers (Alias & Yusof, 2020). Therefore, leaders who canbuild a positive ecosystem and support digital pedagogical risks will be more successful in making digital education transformation a reality.

Overall, the rapid development of the digital world requires capable leaders who can keep up with digital technology developments in performing their duties so that the organization's goals can be achieved, especially in improving quality at school. School administrators play an important role in improving the quality of change in the digitalization era. Leadership plays a crucial role in any organizational development. Current global conditions, such as the increasing need for competency, the urgent need to implement learning and digital technology, require a new approach to organizational leadership (Tai & Kareem, 2019). However, at the same time, this group faces challenges in applying it. School leadership needs to involve all stakeholders in the school and create a support team to smooth the way and achieve the goals of digitalization. The provision of infrastructure and resources also needs to be emphasized so that the implementation can be done smoothly. Leaders are also required to play a role in ensuring professional development through strategic planning, providing access and resources, facilitating training, and building motivation.

Challenges for School Leaders in Increasing the Application of Digital Technology by Malay Language Teachers

This section covers an in-depth discussion of the research findings, addressing the second research question. The aspect that the researcher will focus on is the challenges school leaders face in increasing the application of digital technology by Malay Language teachers.

The study's findings show that weak Internet access is identified as a major challenge by school leaders in their efforts to increase the application of digital technology among Malay Language teachers. This digital infrastructure weakness is consistent with the findings of a study by Ramli et al. (2023), which shows that inconsistent Internet access in rural and small-town schools is a major obstacle to the implementation of digital transformation in education. Furthermore, according to a study by Tan and Mohd Nor (2022), teachers need a stable internet connection to run AI applications like ChatGPT or Canva for Education optimally, especially when it involves live demonstrations to students. This also aligns with a report by UNESCO (2021), which states that quality internet access is a basic prerequisite for successful digital education. Without this infrastructure support, teachers will face pressure and frustration, which will reduce the effectiveness of technology use in T&L.

The cost of resources is the second challenge identified in this study, especially involving access to paid AI applications and the need to purchase supporting equipment. Subscriptions to premium AI applications such as Grammarly, Quillbot, or the Plus version of ChatGPT are burdensome, especially for small or private schools that have financial constraints. According to a study by Zulkifli and Hassan (2021), financial constraints are a major factor preventing educational institutions from providing comprehensive access to the latest technology,

including AI. This is supported by Yahaya et al. (2024), who state that investment in AI requires a high initial cost, and without institutional or ministerial financial support, its application is limited. Meanwhile, Hassan and Lim (2022) explain that the gap between high-capacity and low-capacity schools is widening as only some can get full access to the latest technology. Therefore, school leaders need to find alternatives such as open-source resources, educational incentives, or collaboration with external organizations to reduce the cost burden and expand access.

The lack of digital devices is also identified as a major challenge in increasing the application of digital technology by Malay Language teachers. Teachers are still using old devices that are not suitable for running AI applications. In fact, in some cases, teachers have to share computers in the lab or use personal phones that do not support heavy AI applications well. A study by Abdullah et al. (2022) found that the lack of up-to-date and sufficient digital devices causes teachers to be unable to implement AI-based T&L effectively. This is reinforced by Shahril and Ng (2023), who reported that the use of technology requires stable and high-capacity device support to run various digital applications simultaneously. In this context, school leaders face a major challenge to ensure every teacher has access to suitable digital devices, especially in a school environment with a limited budget. Furthermore, digital transformation initiatives, as outlined in the KPM Digital Transformation Plan 2021–2025, also outline the importance of providing sufficient infrastructure and devices as a basic component in making digital education a success in Malaysia.

In addition, a major challenge faced by school leaders in their efforts to increase the application of digital technology among Malay Language teachers is the difficulty teachers have in accepting the change from traditional approaches to using technology like artificial intelligence (AI). This situation shows that there is a gap in the mindset of teachers, especially those who have been serving for a long time. According to Leong and Saleh (2022), the challenge of changing the work culture is a major obstacle to educational digital transformation because many teachers are more comfortable staying in their comfort zone. Furthermore, according to a study by Mohd Yusof et al. (2023), teachers' conservative attitudes toward teaching methods are an obstacle to the effective implementation of new technology in T&L. Therefore, school leadership needs to play a more active role in fostering the mental and emotional readiness of teachers to accept change as a professional necessity, not just an option. "Teachers' readiness to change plays a crucial role in the success of digital transformation. School leaders need to consistently provide motivation and confidence to encourage teachers to get out of their comfort zones" (Leong & Saleh, 2022).

Next, the challenge is teachers' concern about issues of authenticity and academic integrity when using AI technology. This concern is indeed justified because the use of AI without ethical guidelines can create integrity problems among students and teachers. A study by Hamid and Wahab (2024) shows that 68% of teachers are concerned that AI will erode core values like honesty and self-effort among students. Meanwhile, Ramasamy et al. (2023) also emphasized that AI technology needs to be accompanied by clear ethical usage guidelines to ensure that the quality of education is not compromised. Therefore, school leaders need to provide ethical guidelines for AI use and train teachers to use AI responsibly and ethically. "The use of AI in education must be guided by clear ethical principles to ensure academic integrity is maintained. Without guidance, AI can be misused and affect the development of students' character" (Hamid & Wahab, 2024).

The findings show that all administrators agree that the lack of digital skills among teachers is a major obstacle to the implementation of AI technology. They stated that some teachers are not skilled in using basic technology, let alone complex AI. This skills gap makes teachers less confident and hesitant to try, thus requiring continuous guidance from the administration. A study by Zainal et al. (2021) shows that teachers' digital skill levels are still low, especially among older teachers and those with less exposure to ICT training. In this context, school leaders need to provide continuous professional training, including a Professional Learning Community (PLC) focused on empowering teachers' digital skills. In addition, Azman et al. (2023) suggest a structured coaching and mentoring approach as an effective strategy to help teachers master AI technology gradually. "The development of technology skills among teachers requires structured training, continuous guidance, and solid technical support from the school administration" (Azman et al., 2023).

The findings show that financial constraints are a major challenge faced by school leaders in their efforts to

increase the application of digital technology among Malay Language teachers. All participants stated that the school's allocation is very limited and is only enough for basic needs, such as the maintenance of existing infrastructure and daily operational needs. Therefore, any investment in artificial intelligence (AI) systems for teaching and learning requires careful consideration and cannot be implemented comprehensively without additional resources. This situation is in line with a study by Ismail et al. (2021), which found that financial limitations are a major obstacle to digital transformation in schools, especially in the implementation of technology that requires a large initial investment. They emphasize that without a clear allocation policy for new technologies like AI, schools will continue to rely on traditional methods in T&L. "Schools in the less-resourced category need structured financial support from the government and private sector to ensure new technologies can be used comprehensively in the classroom" (Ismail, Abu Bakar, & Halim, 2021).

The lack of internal and external contributions is also a major challenge for school leaders in their efforts to apply digital technology like AI in Malay Language teachers' teaching. Three participants stated that efforts to get contributions from the school community, alumni, local community, or non-governmental organizations are still not enough to cover the cost of purchasing high-tech equipment. This finding is supported by a study by Low and Wong (2022), who emphasize that the success of implementing digital technology in education requires continuous collaboration between the school and external parties such as NGOs, alumni, and the private sector. They stated that schools that successfully maintain continuous digital innovation are schools that have strong collaboration networks with external parties who are committed to providing material contributions and expertise. Therefore, school leaders need to strengthen their collaboration networks with various parties to ensure continued support for the development of digital technology, including in the T&L of Malay Language teachers.

The busy school schedule, which is too packed with various activities, annual programs, and competitions, limits the space and time for teachers to explore digital technologies like AI in T&L. This schedule means that the implementation of digital innovation is not only marginalized but also not given priority in the school's management plan. This phenomenon is also documented by the Ministry of Education Malaysia (2021), which explains that time management is a critical component in the implementation of digital transformation in schools, and excessive involvement in external programs often hinders pedagogical renewal efforts. A study by Jamaluddin and Nordin (2022) also found that schools with too-packed annual schedules find it difficult to create strategic space for the implementation of technology training, especially for advanced technologies like AI. In this case, school leaders need to have the ability to re-evaluate program priorities so that a balance between teacher professional development and the implementation of annual programs can be achieved (Rahim & Yusof, 2023). "Schools that are filled with various annual activities are at risk of neglecting the digitalization agenda if no re-evaluation of priorities is done by educational leaders" (Tan & Hashim, 2024).

Another significant challenge identified is teachers' high focus on core duties such as teaching, preparing lesson plans (RPH), conducting classroom assessments, and documentation, which makes it difficult for the use of AI technology to be given attention or become a teaching routine. A study by Zainudin et al. (2023) also states that the implementation of AI in the classroom requires a deep understanding of the concepts, time for experimentation, and continuous professional support. However, when teachers are too burdened by routine tasks that are the main assessment of their performance, the tendency to see technology as an additional burden increases (Lee, 2022). This shows that school leaders must be smart in formulating strategies that integrate core duties with technological innovation so that they are not seen as two separate entities. "Technology initiatives like AI need to be integrated with teachers' daily tasks so that they don't add to the workload, but rather speed up the assessment and T&L management process" (Mustafa & Chong, 2025). School leaders are also urged to review the distribution of duties and ensure that sufficient human resources and time are provided so that teachers are not only tied to reporting requirements, but also able to contribute to high-impact digital innovation.

The absence of experts or mentors in the field of Artificial Intelligence (AI) at school is identified as a major challenge in encouraging the application of this technology by teachers, especially in Malay Language T&L. The lack of a reference point makes teachers' efforts individualistic and disconnected from an effective professional community network. As emphasized by Mohd Salleh et al. (2022), the availability of technology mentors within the school community can accelerate the process of technology adaptation and form a culture of technology-based learning among teachers. Furthermore, according to a study by Tan and Abdul Rahman (2023),

direct professional guidance is a catalyst for increasing the level of teacher competency in implementing high-impact digital pedagogy.

The findings show that all participants stated that the training received was insufficient in terms of specificity to the classroom context and was not conducted in phases or continuously. This situationillustrates that without systematic exposure and follow-up training, teachers will continue to feel left behind in the flow of educational technology progress. As stated by Aziz and Lim (2021), digital training programs that are short-term and 'one-off' do not have a long-term impact on teachers' teaching practices. A study by Norhayati et al. (2024) also states that phased training such as the Professional Learning Community (PLC) or continuous Coaching and Mentoring model can improve the efficiency of AI pedagogy in Malay Language T&L. This proves that training planning needs to be comprehensive and appropriate to the level of teachers' technological literacy so that knowledge transfer is more effective.

In addition, the participants also stated that teachers have limited exposure to best practices in AI applications that can be used as a guide or inspiration in T&L. This shows a weakness in the knowledge dissemination system and the sharing of good practices by educational authorities. According to Abdullah and Mahmud (2020), sharing best practices between schools through a school networks model can be a catalyst for digital pedagogical transformation. Furthermore, a report by UNESCO (2022) recommends that the education system provide a catalog of good practices in AI education to be used as a global reference to drive teaching innovation. Therefore, school leadership needs to be proactive in creating a professional discourse space for teachers to access, adapt, and implement practices that have been proven effective in the local context. Overall, these challenges show that the implementation of AI use in preparing e-RPH still requires systematic support in terms of expertise, professional training, and the sharing of high-impact practices to ensure that teachers can integrate this technology more confidently, effectively, and efficiently.

CONCLUSIONS

This study shows that the effectiveness of using digital technology among Malay Language teachers largely depends on school leadership that can create a supportive environment, foster digital skills, and cultivate innovation in education. School leaders must always be sensitive and carry out their responsibilities well to ensure that no one is left behind in generating digitally literate human capital (Nurul Syuhada & Helmi, 2023). School leaders are responsible for setting the vision and direction of educational digitalization, providing digital resources and infrastructure, and ensuring the professional development of teachers through continuous training and support. School leaders also need to foster a culture of innovation and change among teachers to ensure digital technology is used effectively, especially in Malay Language teaching. School leaders face various challenges in their efforts to integrate digital technology. The lack of sufficient resources and infrastructure is a major constraint to educational digitalization, a challenge in providing quality training to teachers, and cultural barriers or negative attitudes of teachers in applying new technology, such as the use of AI applications in teaching. School leaders face ongoing educational issues, such as the difficulty in aligning the use of digital technology with the curriculum and time constraints, and the workload of teachers.

Future research can be given to further explore the roles and challenges of school leaders in increasing the application of digital technology in Malay Language teaching. A quantitative study can be conducted by touching on the differences in the demographics of gender and education level of school leaders in increasing the application of digital technology at school. The study of the use of digital technology in Malay Language teaching in various types of schools, such as full boarding schools, religious schools, private schools, Trust schools, or TS25 schools. The use of research respondents using the student population based on school differences. A comparison based on school differences is also an interesting research area to explore. In addition, the researcher can study the use of digital technology in Malay Language teaching in schools with different backgrounds, such as urban and rural schools, national schools, and national-type schools. This study will explore more deeply the demographic and environmental factors that influence the application of digital technology in Malay Language teaching. In addition, the implementation of a qualitative study by exploring the experiences and perceptions of Malay Language teachers toward educational digitalization. This study can identify the factors that influence the acceptance and use of digital technology, such as the level of technological

knowledge, support from school leaders, and the readiness and motivation of teachers to adapt to digital education.

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