School Administrators as Catalysts for the Digitalisation of Malay Language Education in Primary Schools

Nur Syafiqah Abdul Wahid*, Zamri Mahamod

Faculty of Education, University Kebangsaan Malaysia

***Corresponding author**

DOI: https://dx.doi.org/10.47772/IJRISS.2025.908000159

Received: 28 July 2025; Accepted: 02 August 2025; Published: 02 September 2025

ABSTRACT

This study aims to identify the capacity of school administrators as catalysts of the digitalisation of Malay language education in schools. It also seeks to explain the issues faced by school administrators in leading the digitalisation of Malay language education at the school level. This research employed a qualitative approach using a case study design, with interviews, observations, and document analysis as its research instruments. The study sample consisted of six school administrators, namely three headmasters and three senior assistants. The study was conducted in three national primary schools located in the Federal Territory of Kuala Lumpur. Purposive sampling was used for sample selection. Narrative and descriptive analysis methods were applied to interpret the research findings. The findings revealed that school administrators demonstrated capabilities in managing the digitalisation of Malay language education, teacher professional development, infrastructure and technology support, evaluation practices, and communication related to digitalization in Malay language education. The study also identified several issues hindering the digitalisation effort, including unstable Internet access, insufficient technological equipment, limited financial resources, teacher attitudes, increased workload, technical skill gaps, and time constraints. This study carries implications for stakeholders to remain attentive to the realities and challenges faced by school administrators and Malay language teachers in implementing the digitalisation of Malay language education in schools.

Keywords- Digitalisation of Malay Language Education, school administrator capacity, issues

INTRODUCTION

Digitalisation is not a new phenomenon in the field of education. Nearly all levels of learning—such as kindergarten, schools, and higher education institutions—have welcomed the idea of educational digitalisation (Aminamul Saidah & Bity Salwana, 2023). This concept was introduced in Malaysia to produce educators and students who are creative, innovative, motivated, and competent in line with the needs and demands of the Fourth Industrial Revolution (IR 4.0). The digital revolution in education has indirectly transformed and renewed the teaching and learning landscape holistically.

In Malaysia, the educational digitalisation initiative has been refined through the Malaysia Education Blueprint (MEB) 2013–2025, which emphasises the integration of information and communication technology (ICT) into the education system as a necessity rather than a choice (Ministry of Education Malaysia, 2013). In line with this development, the role of school administrators has also evolved—from merely managing daily operations to becoming change agents who should be capable of strategically driving the digitalisation of education.

In the context of primary schools, the teaching of the Malay language also requires dynamic and relevant approaches to suit the digital generation, which is already exposed to various internet systems and information technologies (Suzana & Zamri, 2023). In this regard, Mat Rahimi, Mohd Faiz, and Mohd Yusri (2019) emphasised that digitalisation in Malay language education not only requires teachers' pedagogical skills but also depends on the leadership capacity of administrators to effectively plan, support, and evaluate the implementation of technology. Strong technological leadership among administrators can thus act as a catalyst for the effective integration of digital technologies in classrooms, including in Malay language instruction.

However, several studies have highlighted the challenges faced by school administrators, including limited technological knowledge, resistance to change, and inadequate infrastructure support. These issues ultimately hinder the comprehensive implementation of educational digitalisation in schools (Richardson & McLeod, 2011). Therefore, it is crucial to assess the capacity of school administrators in fulfilling their role as key drivers of digitalisation, particularly in the context of Malay language subjects at the primary school level. Accordingly, this study aims to explore administrators' capacity as catalysts of digitalisation in Malay language education in primary schools and to identify the challenges they face in the implementation process. The findings of this study are expected to provide clearer insights into the support, training needs, and appropriate technological leadership strategies required to advance Malay language education in line with national digitalisation aspirations.

LITERATURE REVIEW

Studies related to administrators' capacity as technology leaders in driving educational digitalisation have been extensively conducted by researchers both locally and internationally. Among them is a study by Zuraidah, Shahrir, and Mohd Shahrill (2019), which examined the role of school administrators in enhancing teachers' literacy skills in the state of Pahang. This study employed a quantitative approach using a survey method and involved a sample of 530 teachers. Data were collected through questionnaires. The findings revealed both direct and indirect effects between school administrators' support and teachers' ICT literacy on their overall ICT competence. The study also demonstrated that the role of school principals in supporting teachers' ICT literacy is crucial in the integration of ICT into classrooms. Accordingly, the study recommended that school administrators undergo formal training in technological leadership to contribute more effectively to the digitalisation of education and to assist teachers in integrating technology into teaching and learning more efficiently.

Another relevant study was conducted by Wong Ai Yieng and Khadijah (2017), who investigated the capacity of headteachers as technology leaders and the challenges they face in fulfilling this role. This qualitative study collected data through interviews with six headteachers from primary schools in the state of Johor. The findings showed that all interviewed headteachers played active roles as technology leaders in their respective schools. They were found to possess their capacities in integrating technology into school education, including articulating and sharing the school's technology vision with all stakeholders to ensure alignment with the school's goals. Additionally, headteachers in Johor were reported to provide strong support and encouragement for ICT professional development among teachers effort closely tied to the success of educational digitalisation. The findings also indicated that these headteachers maintained good relationships with teachers, thereby fostering collaboration in the use of technology. However, the study also revealed challenges such as limited infrastructure, including an insufficient number of computers and LCD projectors, as well as weak internet access. Moreover, none of the headteachers were prepared to discuss the use of research findings related to technology as guidance for implementation in schools, suggesting that the application of technology research in school administration remains limited among headteachers in Johor.

An international study by Rifa, Salman, and Rudli (2023) explored the principal's responsibility in cultivating a culture of digital literacy within schools. The qualitative study employed interviews, observations, and document analysis as its research instruments. Informants included principals, teachers, and parents. The findings indicated that principals' digital literacy was at a relatively good level, as reflected in their ability to utilise digital ICT tools in their daily administrative tasks. The study further highlighted the principal's role as a technology leader, acting as an educator, manager, administrator, supervisor, leader, innovator, and motivator. Principals were found to possess the capacity to drive technology use in schools by conducting monitoring and spot checks on teachers. Additionally, they integrated the school's vision and mission into digital literacy training and programmes, offered support and encouragement for teachers to maximise the use of available technology, implemented innovation by analysing school conditions, and provided words of appreciation that motivated teachers to continue leveraging digital technology for effective student learning.

Another international study was conducted by Mizal, Julianita, and Tathahira (2023), which investigated administrators' capacity to enhance the use of digital technology in schools through various strategies, and also explored the challenges faced in doing so. Conducted in a secondary school in the Aceh district of Indonesia,

the study employed a qualitative approach with data collected via interviews and observations. Three participants were involved: a principal, a regular teacher, and an instructional staff member. The findings indicated that the principal could create a working environment that motivated teachers to use technology, offered encouragement and recognition, and provided learning resources for teachers to expand their technological knowledge. However, the study also found that one of the challenges faced by administrators was the difficulty in motivating some teachers, especially older ones approaching retirement, to adopt rapidly evolving technological advancements.

Another study by Muhammad Rashid, Bambang Budi, and Mustiningsih (2024) explored the capacity of administrators as technology leaders in schools, focusing on strategies, implementation, and obstacles. This qualitative study used interviews, observations, and document analysis as research instruments. Participants included a principal, a vice principal, and two regular teachers from two secondary schools in Malang, Indonesia. The findings showed that administrators demonstrated technological leadership by organising training on technology-based teaching media and ensuring the integration of technology in classroom teaching. The study also revealed that administrators made efforts to use digital technology and collaborated with various stakeholders to enhance the use of technology in education. Nonetheless, the findings also highlighted several barriers to educational digitalisation, such as differences in students' backgrounds, teachers' continued reliance on conventional methods, and unstable internet connectivity.

Based on these previous studies, it is evident that most research has focused on school administrators' roles in enhancing the general use of digital technology in schools, without specifically addressing the context of Malay language teaching and learning. Furthermore, past research has not explored in depth the actual capacity of administrators as key drivers of educational digitalisation in schools. Therefore, this study aims to fill that gap by focusing specifically on the capacity of school administrators as drivers of digitalisation in Malay language education and the issues that arise in the process.

Research Gap

Headteachers and school administrators hold significant influence over the implementation of technology in schools (Arumugam Raman, Raamani Thannimalai & Siti Noor, 2019). In this context, the school administrators' capacity as drivers of educational digitalisation is closely linked to their technological leadership. Recent drafts of educational reform implementation across various countries also indicate that technological leadership among school administrators in spearheading digital initiatives has become one of the key strategies for enhancing academic quality and student achievement. As the head of the institution, the headteacher must bear the primary responsibility of initiating and executing change within the school through the use of Information and Communication Technology (ICT).

However, the issue of weak technological leadership among school administrators in Malaysia is not new (Wong Ai Yieng & Khadijah, 2017). Many headteachers and school administrators are still found to be unprepared for their new role as technology leaders or drivers within schools. Some school administrators do not fully understand the concept of digital learning, lack the knowledge to make informed decisions on technical issues, have insufficient training in the use of computers and technology, and fail to actively focus on the integration of technology in the classroom.

In addition, the lack of support from school administrators also hinders teachers from optimally utilising technology (Nurul Salwani & Suhaida, 2023). The failure of school administrators to provide adequate training and professional development programmes has also become a barrier to efforts in digitalising education at the school level. Such situations should not occur, as headteachers and school administrators play a pivotal role in establishing a digital ecosystem in schools. School administrators must recognise that they should possess high levels of capacity and capability to ensure that the educational digitalisation policy, especially in the teaching and learning of the Malay language, can be implemented effectively.

Davis and Fullan (2009) also argue that school administrators must have the ability and skills in change management, including the capacity to influence, lead, and develop strategies to maximise the use of technology in teaching and learning. Therefore, this study aims to explore the extent of school administrators' capacity as

drivers of educational digitalisation in schools, particularly within the context of teaching and learning the Malay language, as well as the issues they face in carrying out this effort. Furthermore, studies focusing on technological leadership, especially in the context of Malay language education, are still limited (Arumugam Raman, Raamani Thannimalai & Siti Noor, 2019). Thus, this study seeks to fill that research gap.

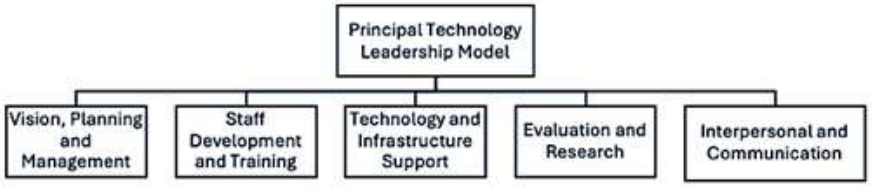
Objectives Of the Study

Specifically, the objectives of this study are as follows:

i. To explore the capacity of school administrators as drivers of digitalisation in Malay language education at the primary school level.

ii. To identify and explain the issues faced by school administrators in their role as drivers of digitalisation in Malay language education at the primary school level.

Figure 1: Theoretical framework



Theoretical Framework

This study employed a model known as the Principal Technology Leadership Model by Chang (2003) as the foundation of the research. This model was first introduced by Chang in 2002 through his doctoral dissertation in the United States, aiming to explore the dimensions of technology leadership among principals or headteachers. The focus of this study, which centers on school administrators' capacity as drivers of digitalisation in Malay language education at schools, is closely aligned with the concept of technology leadership among school leaders. Therefore, this model was selected as a guiding framework for the researcher in conducting this study.

The Principal Technology Leadership Model, as proposed by Chang (2003), comprises five key dimensions that school administrators must possess to serve as effective drivers or leaders of technology in schools, as illustrated in Figure 1 above. These five dimensions are Vision, Planning, and Management; Staff Development and Training; Technology and Infrastructure Support; Evaluation and Research; as well as Interpersonal and Communication. According to this model, all five dimensions are crucial as they represent the core responsibilities of principals or headteachers in leading the integration of technology and digital resources in both teaching and learning, as well as school administration.

The first dimension is Vision, Planning, and Management. As the leader of the school, the principal should possess a clear vision regarding the use of technology. This vision must be shared with the school community and stakeholders. Such sharing is essential to gain the commitment and consensus of the school community. With this shared understanding and commitment, the principal's vision and planning concerning technology integration can be more effectively achieved.

The second dimension is Staff Development and Training. As technology leaders, particularly in driving educational digitalisation in schools, principals or school administrators must be able to identify resources, plan, and adapt programmes according to the professional development needs of individuals and the school. In addition, school administrators should provide models, materials, and up-to-date technological support at every stage of technology plan implementation to ensure optimal staff development outcomes.

Next is the third dimension, which is Technology and Infrastructure Support. In this context, principals or school administrators must ensure that technological tools and technical support are adequately provided in the schools

under their leadership (Mohd Jamil, 2011). Equal access to technological resources should also be granted to all teachers, and proper facilities must be ensured to support effective technology usage.

The fourth dimension emphasises Evaluation and Research. Here, principals or school administrators should strive to assess each teacher's progress individually. They are also responsible for setting goals and implementing professional development plans related to technology. At the same time, principals and school administrators must evaluate students' academic achievements and encourage teachers to integrate technology in ways that enhance student performance (Nazri, 2011).

The fifth dimension focuses on Interpersonal and Communication skills as technology leaders and digitalisation drivers in schools, principals, or school administrators must be equipped with the ability to interact effectively with teachers, especially when they begin integrating technology into their teaching and learning processes. The role of principals or school administrators in leading digitalisation efforts inherently requires strong interpersonal communication skills and a strong understanding of technology. This aligns with Kim and Marshall (2009), who state that a principal can be an effective leader without being a technology expert. However, they cannot be an effective technology leader without strong interpersonal and communication skills.

This study adopts Chang's (2003) Principal Technology Leadership Model as its theoretical framework and research foundation. The model outlines five key dimensions of technology leadership that principals or school administrators must master to effectively and optimally drive the use of digital technology in schools. These five dimensions, as previously discussed, play a significant role in shaping the capacity of school administrators in leading the digitalisation of Malay language education and in identifying the challenges faced in this effort. The selection of this model as the theoretical framework indirectly enables the researcher to explore holistically the aspects of technology leadership among school principals or school administrators, thereby facilitating a deeper understanding of their challenges and potential in realising the transformation of Malay language education towards a more digital learning environment.

METHODOLOGY

A. Research Design

This study employs a qualitative approach using a case study design. The rationale for adopting the qualitative approach lies in its suitability for addressing research questions that seek to explore what is happening in a particular context (Ghazali & Sufean, 2016). Merriam (1988), as cited in Syed Ismail et al. (2018), states that the case study design facilitates an in-depth investigation into a particular situation, specific event, or existing documented evidence. Therefore, the selection of a case study design aligns well with the focus and purpose of this research, which is to explore the extent of school administrators' capacity as drivers of digitalisation in Malay language education at schools. This study is also classified as an exploratory case study, aiming to investigate the issues faced by school administrators in driving educational digitalisation in schools, particularly within the context of Malay language education.

B. Research Sites

This study was conducted at three national primary schools located in Kuala Lumpur. These schools were selected as research sites based on the researcher's teaching placement at these schools. This, indirectly, facilitated the research process and enabled the researcher to collect the required data more efficiently.

C. Instruments Used

In this study, the researcher employed three research instruments for data collection, namely semi-structured interviews, observations, and document analysis. For semi-structured interview sessions, the researcher prepared an interview protocol and determined the number of questions to be asked to address the research questions (Syed Ismail et al., 2018). However, during the interview sessions, the researcher may also add follow-up questions to gain deeper insights into issues related to the focus of the study. The use of semi-structured interview questions indirectly enables the researcher to obtain accurate and in-depth data regarding the capacity of school

administrators as drivers of digitalisation in Malay language education, as well as the challenges they face in this process. This is because the researcher has the flexibility to pose additional questions beyond those listed in the interview protocol (Yuznaili, 2021). The use of interview instruments in this study is intended to address both research questions, which are the extent of school administrators' capacity as drivers of educational digitalisation, and the issues they face in driving digitalisation in schools, particularly in the context of Malay language education.

In addition to interviews, the researcher also employed the observation method as a research instrument to address the research questions. Observation is crucial for supporting the data obtained through interviews (Kamarul Azmi, 2012). In this context, the researcher observed the selected school administrators who participated in the study. Observations were conducted during briefings or meetings involving administrators and teachers. During the observation sessions, the researcher utilised an observation checklist that had been reviewed and validated by experts. The checklist will focus on any actions or verbal expressions by the school administrators that demonstrate their capacity as drivers of digitalisation in schools, particularly in the context of Malay language education. Observations were also conducted to identify any issues encountered in efforts to digitalise Malay language education. At the same time, the researcher took field notes on any significant events that occurred. This is in line with the view of Ghazali and Sufean (2016), who stated that writing observation notes is also essential in qualitative research as preparation before composing the final research report.

The researcher also employed document analysis as one of the research instruments. According to Creswell (2012), document analysis is a specialised technique in qualitative research. This form of content analysis is a scientific tool that involves specific procedures aimed at generating new insights, enhancing the researcher's understanding of particular phenomena, or explaining practical actions (Yuznaili, 2021). Document analysis also serves as a supporting instrument to the main method, which is the interview. In this study, the researcher analysed written reports such as meeting minutes, reports on the implementation of Professional Learning Communities (PLCs), and records of workshops or training sessions that reflect school administrators' capacity as drivers of digitalisation in Malay language education at schools. The document analysis was also conducted to support the findings related to the challenges faced by school administrators in their efforts to lead the digitalisation of Malay language education.

D. Data Analysis

According to Ghazali and Sufean (2016), data in studies employing a qualitative approach must be analysed continuously, beginning as soon as the data are collected through interviews, observations, and document analysis for the first time. Therefore, in the data analysis process of this study, the researcher planned and managed the data through three steps, as shown in Figure 2 below.

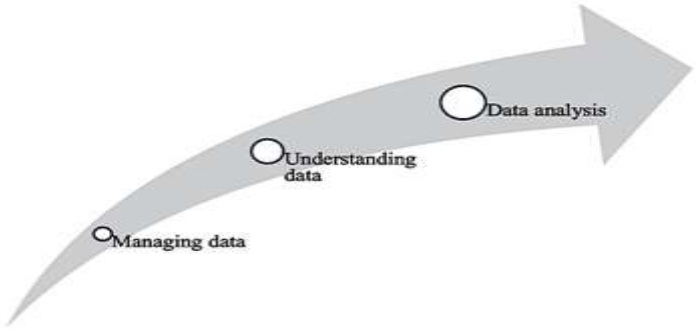


Figure 2: Steps of qualitative data analysis

Source: Ghazali and Sufean (2016)

Based on Figure 2 above, the researcher carried out the first step, which was managing the data obtained from interviews and observations. This data management step was conducted through several phases (Ghazali & Sufean, 2016). In the first phase, the researcher filtered the data by transcribing audio recordings of interviews into verbatim written text from the research participants. The transcription process was done manually by the

researcher. Once the interview data were transcribed, the researcher indexed the text on either the left or right margin. This indexing process involved labeling each data entry with a specific code based on the transcript, to ensure that the data were systematically organised. The codes developed referred to the date, location, participant name, and relevant topic (Syed Ismail et al., 2008). The aim was to enable the researcher to easily retrieve the original data and to facilitate cross-referencing during the report writing process.

In the second step, the researcher interpreted and understood the data gathered through interviews and observations (Ghazali & Sufean, 2016). The researcher interpreted the data from specific perspectives, particularly whether the data were sufficient to answer the research questions. Four steps were involved in this process. First, the researcher repeatedly read the transcriptions. Second, relevant sentences linked to the research questions were identified. Third, the researcher identified key content or facts related to answering the research questions. Finally, line numbering and categorisation were done according to the research questions. This process is aligned with the data reduction process in the Interactive Model of Data Analysis Components, which requires researchers to clean the data by repeatedly reading to interpret both the explicit and implicit meanings within the data (Syed Ismail et al., 2018). Based on this model, the researcher must also review the codes to determine whether they can be grouped into themes. Additionally, document analysis was conducted on workshop reports and subject committee meeting minutes to support the data collected from interviews and observations. The use of all three methods, like interviews, observations, and document analysis, was important to achieve data triangulation. Through data triangulation, the validity and quality of the data were enhanced. Furthermore, triangulation provided a clearer and more detailed picture of the studied phenomenon.

Finally, the researcher analysed the data obtained from the interviews, observations, and document analysis. For interview data, the verbatim transcriptions went through the next phase, where they were sent to the relevant participants for content validation (Yuznaili, 2021). This process ensured the validity of the data. In this context, participants reviewed whether what they heard in the audio recordings matched the written transcription. Corrections were made collaboratively between the researcher and the participants if any errors were found in the transcriptions. Subsequently, the researcher selected each transcribed unit and assigned it to a specific theme or category using the predefined codes. According to Ghazali and Sufean (2016), the process of reading transcripts and identifying relevant themes must be repeated until all meaningful units that truly represent the intended themes or subthemes have been grouped. Units with no meaningful content were excluded. Observation data also underwent the same analytical phases as interview data. In this case, sentence phrases that conveyed the intended meaning or frequently recurring issues were matched with the research questions.

In conclusion, the data obtained from the interviews were analysed using thematic analysis to interpret the qualitative data and research information. Thematic analysis was also conducted to identify, analyse, and report patterns (themes) and sub-themes within the data, encompassing the process of managing and explaining the dataset in detail. Subsequently, the analysed data were presented descriptively and narratively. The data gathered from observations and document analysis served as supporting evidence to strengthen the findings from the interviews.

FINDINGS

A. Demographics of Research Participants

Table 1: Demographics of research participants (school administrators)

Participants Code	P1	P2	P3	P4	P5	P6
Gender	Female	Male	Female	Male	Female	Male
Age	53	52	46	53	45	49
Teaching Experiences	32 years	29 years	22 years	27 years	20 years	26 years
School Location	Urban	Urban	Urban	Urban	Urban	Urban
Academic Qualification	Bachelor's Degree	Diploma	Bachelor's Degree	Bachelor's Degree	Master's Degree	Bachelor's Degree

Based on Table 1 above, the study participants consisted of six school administrators serving in national primary schools located in urban areas. In terms of gender, there were three female school administrators and three male school administrators. Each participant was labeled as Participant 1 (P1), Participant 2 (P2), Participant 3 (P3), Participant 4 (P4), Participant 5 (P5), and Participant 6 (P6). These participants varied in age and teaching experience, as shown in Table 1. Four participants (P1, P3, P4, P6) held a Bachelor's degree. P2 held a Diploma, while P5 held a Master's degree.

B. Research Question 1

To what extent do school administrators possess the capacity to drive the digitalisation of Malay language education in primary schools?

The analysis of the research data revealed five identified themes, namely the management of Malay language education digitalisation, teacher professional development, infrastructure and technology support, evaluation practices, and communication related to the digitalisation of Malay language education.

Theme 1: Management of Malay Language Education Digitalisation

The findings for this theme are organised into five subthemes, which are digitalisation vision, resource management, financial management, workforce management, and scheduling.

Digitalisation Vision

All six school administrators articulated clear digitalisation visions focused on enhancing the Malay language teachers' use of digital tools in the Malay language teaching and learning (PdP). Their visions included improving Malay language teacher competencies in digital technology and increasing student engagement and language proficiency. These visions were also reflected in meeting discussions and institutional planning.

Resource Management

All six school administrators also demonstrated effective management of digital resources such as laptops, projectors, and desktop computers. These devices were strategically placed in designated rooms, such as computer labs, to ensure controlled access. Some schools also established digital libraries, while others implemented flexible scheduling and resource-sharing systems to support digital PdP of the Malay language.

Financial Management

School administrators reported diverse strategies for funding Malay language digitalisation efforts. Most schools relied on contributions from the parent-teacher association and public funds. Some obtained external sponsorships from government agencies or the private sector, while others included digitalisation in their annual budget planning to cover infrastructure, device purchases, and maintenance.

Workforce Management

All participants emphasized the importance of assigning tech-savvy teachers as mentors or digital coordinators to support Malay language teachers who are less digitally literate. Strategies included peer mentoring, internal workshops, and shared project responsibilities to ensure collaborative implementation of digital practices in Malay language education.

Scheduling Management

Four of the six school administrators highlighted the importance of managing access to digital facilities through structured timetables. Scheduling ensured the equitable use of digital equipment and learning spaces among the Malay language teachers, despite limited resources. Although not all explicitly mentioned this practice, data indicated that all participating schools implemented digital usage schedules.

Theme 2: Teacher Professional Development

The findings under this theme are categorised into two subthemes, which are the implementation of courses or workshops and practices of Professional Learning Communities (PLC).

Implementation of Courses or Workshops

All six school administrators reported actively organising various professional development programmes to enhance Malay language teachers' competencies in using digital technologies for Malay language teaching. These included internal workshops, LADAP (in-service training), and training sessions focused on tools such as smartboards, smart TVs, and educational apps like Wordwall and Quizizz. Additionally, practices such as learning walks were encouraged, where tech-savvy teachers demonstrated digital teaching methods to their peers. This finding is further substantiated by data derived from observations and document analysis.

Professional Learning Communities (PLC)

The study found that all participating schools implemented Professional Learning Communities (PLCs) as part of their digital education initiatives, specifically aimed at enhancing the teaching and learning of the Malay language. These PLCs were often led by experienced Malay language teachers or subject panel heads and focused on the integration of digital tools in Malay language instruction. Activities included hands-on sessions involving platforms such as Google Forms, Canva, and various digital teaching strategies tailored for Malay language pedagogy. Document analysis and classroom observations further confirmed that school administrators actively supported and encouraged the involvement of Malay language teachers in these digital-focused PLCs.

Theme 3: Infrastructure and Technological Support

This theme comprises three subthemes, which are the provision of special rooms, the provision of digital technology equipment, and the provision of Internet access.

Provision of Special Rooms

All six school administrators (P1–P6) confirmed the availability of designated spaces in their schools to support digital learning initiatives of Malay language education. These included computer labs, smart classrooms, seminar rooms, digital libraries, and rooms equipped with Frog VLE. The facilities were reported to house equipment such as laptops, LCD projectors, and smartboards. School administrators noted the importance of scheduling and managing the use of these rooms to optimise their impact on teaching and learning, including the teaching of the Malay language.

Provision of Digital Technology Equipment

Each school administrator reported efforts to provide various forms of digital equipment to support technology-integrated teaching, particularly for Malay language education. The equipment supplied included computers, laptops, projectors, smart TVs, speakers, and mobile digital devices. In some cases, schools collaborated with external agencies or parent-teacher associations to acquire or rent additional devices. These efforts were aimed at ensuring that Malay language teachers had adequate access to digital tools to enhance the quality and effectiveness of their teaching practices.

Provision of Internet Access

All school administrators acknowledged that Internet access was available throughout their schools and viewed it as essential for supporting digital-based teaching and learning of the Malay language. Several school administrators highlighted plans or ongoing efforts, in collaboration with the parent-teacher association, to further improve connectivity. Although some schools faced issues with network stability, proactive measures had been taken to ensure that the Internet infrastructure could effectively support the use of digital tools in Malay language education.

Theme 4: Evaluation Practices

This theme includes two subthemes, which are monitoring of Malay language teachers' PdP and monitoring of special room usage records.

Monitoring of Teaching and Learning (PdP)

All six school administrators (P1–P6) confirmed that regular observations and evaluations of Malay language teachers' PdP sessions were conducted. The purpose of these evaluations was to assess the extent to which digital technologies were integrated into classroom instruction. Monitoring was carried out through classroom visits, lesson observations, and lesson plan reviews. School administrators observed the use of digital tools such as laptops, projectors, digital applications like *Kahoot!,* and other devices. P5 highlighted that the evaluation also considered the effectiveness of the teaching, not just the use of technology. Overall, this practice of monitoring was systematically implemented by all school administrators involved in this study.

Monitoring of Special Room Usage Records

Two school administrators (P1 and P2) reported monitoring the record books for the use of special rooms such as computer labs and smart classrooms. The other four (P3–P6) did not indicate any involvement in this aspect. This finding suggests that while Malay language teachers' PdP monitoring is widely practiced, the monitoring of room usage records receives comparatively less attention. Nevertheless, observational data indicated that all six school administrators were aware of and involved in evaluating the integration of digital tools in Malay language teachers' classroom practices. Thus, the monitoring of room usage records remains an area for further improvement in the overall evaluation practices of school administrators.

Theme 5: Communication Related to the Digitalisation of Malay Language Education

The study found that communication regarding the digitalisation of the Malay language education occurred through two primary channels, such as online applications and official school meetings.

Communication via Online Applications

Four out of six school administrators (P1, P2, P5, P6) reported using digital platforms such as WhatsApp and Telegram to disseminate information related to the integration of technology in Malay language education. These applications facilitated prompt and efficient communication with all teachers, including Malay language teachers.

Communication via Meetings

All six school administrators confirmed that information related to educational digitalisation was regularly communicated during staff meetings and Malay Language Panel meetings. These meetings served as formal platforms for reminders, briefings, and discussions to ensure Malay language teachers were informed and aligned with digital initiatives. These findings underscore the importance of both digital and conventional communication methods in supporting the implementation of digital at the school level, particularly in the Malay language education.

C. Research Question 2

What are the issues faced by school administrators as drivers of the digitalisation of the Malay language education in primary schools?

The analysis of the research data based on the second research question identified a single overarching theme, which is the challenges faced by school administrators in implementing the digitalisation of the Malay language education.

Theme: Challenges Faced by Administrators in the Digitalisation of Malay Language Education

The study identified seven main challenges encountered by school administrators in implementing the digitalisation of the Malay language education.

Unstable Internet Connectivity

All six administrators (P1–P6) reported that unstable and weak Internet connections severely disrupted digital Malay language PdP processes, especially in classrooms located far from the main access points.

Insufficient Number of Computers

A lack of digital devices, particularly computers, was highlighted by all participants. Students were often required to share computers, which limited effective and equitable use of technology during Malay language lessons.

Teachers' Attitudes

Four school administrators (P1, P2, P3 & P5) noted that some Malay language teachers, especially senior ones, were resistant to adopting digital tools. This negative attitude affected the success of digital initiatives such as online lesson planning systems.

Increased Workload

The implementation of digital tools was seen as an additional burden. Malay language teachers had to manage existing teaching responsibilities while also preparing and managing digital equipment and materials.

Technical Skill Gaps

All school administrators acknowledged a wide disparity in Malay language teachers' digital competencies. While some of them were proficient, other teachers, particularly those who had served longer, were found to lack confidence and skills in using ICT effectively.

Time Constraints

Two school administrators (P1 & P2) mentioned that Malay language teachers faced time limitations due to heavy curricular responsibilities and assessment duties. These constraints made it difficult for them to attend digital training sessions or implement digital tools fully in their Malay language classrooms.

Limited Financial Resources

Two school administrators (P1 & P2) raised concerns about insufficient financial allocation. They stated that the inability to repair or replace malfunctioning devices hindered digital integration in the Malay language education.

DISCUSSIONS

A. Research Question 1

To what extent do school administrators possess the capacity to drive the digitalisation of Malay language education in primary schools?

Overall, this study found that all school administrators involved as research participants demonstrated a high capacity in managing the digitalisation of Malay language education in their respective schools. This encompasses aspects such as digital vision, resource management, financial management, workforce management, and scheduling. This finding indicates that school administrators' efforts in managing digitalisation reflect the first dimension of Chang's (2003) Principal Technology Leadership Model, which is Vision, Planning,

and Management. Their capabilities also indicate that they act not only as facilitators but also as key drivers in determining the direction of Malay language education digitalisation in their schools. These findings are consistent with previous research by Wong Ai Yieng and Khadijah (2017), which found that school administrators play a significant role in shaping the vision, planning, and management related to the use of digital technology in schools. In this context, the implementation of the Digital Education Policy in schools largely depends on the school administrators' ability to strategise, set short and long-term goals, and organise digital education implementation systematically and effectively. This is further supported by findings from Mohd Fahmi Asyraf and Mohd Izham (2023), who showed that school administrators' ability to manage and strategise digital transformation is crucial to the success of digital technology implementation in schools. Their management capacity is also closely linked to effective technology leadership, where digital transformation is not merely about the use of advanced devices, but also requires strategic approaches to foster a technology-driven learning culture and professional development, as well as equitable access to digital resources for all teachers and students.

In addition, the study also revealed that all participating school administrators were capable of becoming key drivers in developing the professional competence of Malay language teachers about digital education at the school level. School administrators were not only involved in planning but also took the initiative to provide various forms of internal training and courses aimed at enhancing Malay language teachers' knowledge and skills in using digital technologies in teaching and learning (PdP). Examples include the implementation of Professional Learning Communities (PLCs), internal workshops, and knowledge-sharing sessions among Malay language teachers within the Malay Language Panel. This finding also demonstrates that the school administrators performed roles aligned with the second dimension of Chang's (2003) Principal Technology Leadership Model, which is Staff Development and Training. However, these findings contradict a study by Saiful Adli et al. (2021), which reported that some school administrators failed to provide appropriate training and professional development programs for teachers, particularly in the area of education digitalisation. The differing results may be due to factors such as school administrators' readiness, school location, and the management of digital transformation in their respective institutions. Nevertheless, every school administrator should be aware of the importance of professional development programs in enhancing teaching quality in the classroom. Therefore, school administrators are encouraged to consistently play a role in empowering the implementation of such programs, particularly within the context of Malay language education digitalisation.

Furthermore, the study found that all school administrators involved demonstrated strong capabilities in providing infrastructure and digital technology facilities. Administrators were found to be consistently attentive to ensuring the availability of digital technology for both Malay language teachers and students. They made constant efforts to ensure that facilities such as Internet access, computers, laptops, and LCD projectors were available and usable. These findings further reinforce the view that school administrators exhibit the necessary competencies aligned with the third dimension of Chang's (2003) Principal Technology Leadership Model, namely Technology and Infrastructure Support. As mentioned by P1 through P6, they actively sought donations from the parent-teacher association and external parties such as the Selangor State Library Corporation and politicians to increase the number of technological devices in schools. This demonstrates the school administrators' capacity to provide the necessary digital infrastructure and facilities. These findings align with the study by Mizal, Julianita, and Tathahira (2023), which showed that school administrators play a vital role in supporting infrastructure and encouraging teachers to integrate technology into their PdP practices. The same study also emphasised that proactive school administrators can cultivate a positive digital culture in schools by ensuring adequate technology and creating a conducive working environment that encourages teachers to explore and experiment with digital tools in their teaching, including Malay language instruction. Therefore, school administrators' ability to provide digital infrastructure must continuously be strengthened through technology-friendly school policies that are aligned with the needs of both Malay language teachers and students.

The findings also showed that school administrators demonstrated their capacity as drivers of digitalisation in Malay language education through their implementation of Malay language teacher evaluations. This finding also indicates that the school administrators possess capacities aligned with the fourth dimension of Chang's (2003) Principal Technology Leadership Model, which is Evaluation and Research. These evaluations were carried out periodically on the Malay language PdP practices conducted by Malay language teachers. This is

consistent with the study by Wong Ai Yieng and Khadijah (2017), which indicated that school administrators are capable of conducting evaluations on teachers' use of technology. Such actions are important because, without systematic monitoring, efforts to embed digital education among Malay language teachers may be hindered and may fail to achieve their intended objectives. Monitoring also serves as a quality control mechanism for technology-based PdP. However, in terms of usage records of special rooms, only two administrators were found to carry out such evaluations. This indicates that monitoring of supporting infrastructure, such as special rooms, is still less emphasised compared to the monitoring of teaching practices. School administrators should thus be responsible for preparing comprehensive strategies for change, implementation, and monitoring to ensure that the digital transformation agenda can be successfully achieved (Mohd Fahmi Asyraf & Mohd Izham, 2023). Hence, school administrators must enhance their roles in conducting comprehensive evaluations regarding the use of digital technology among Malay language teachers in schools.

Finally, the study also revealed that school administrators possess the ability to communicate effectively with Malay language teachers, especially concerning matters related to the digitalisation of Malay language education. This finding demonstrates that school administrators possess competencies aligned with the fifth dimension of Chang's (2003) Principal Technology Leadership Model, namely Interpersonal and Communication Skills. This ability allows them to convey their vision, direction, and implementation needs for digital education to Malay language teachers. The findings are supported by Wong Ai Yieng and Khadijah (2017), who found that school principals exhibit strong communication and interpersonal skills. In this regard, school administrators utilised various channels such as teacher meetings, Malay Language Panel meetings, and communication apps like Telegram and WhatsApp to deliver digital education-related information. Effective communication among school administrators also serves as a motivational tool to encourage Malay language teachers to adopt digital technologies in their PdP. Furthermore, Mat Rahimi, Mohd Faiz, and Mohd Yusri (2019) stated that communication skills and the ability to build a digital learning environment, including the use of meetings and technology applications, are critical dimensions that school administrators must possess. Therefore, school administrators are advised to continuously strengthen their communication skills, particularly in supporting the digitalisation of Malay language education.

B. Research Question 2

What are the issues faced by school administrators as drivers of the digitalisation of Malay language education in primary schools?

The findings of this study reveal that all participating school administrators had to deal with issues such as unstable Internet connectivity and insufficient numbers of computers and technological equipment. These findings are consistent with the study by Wong Ai Yieng and Khadijah (2017), which found that weak Internet access in schools posed a barrier to the use of technology in teaching and learning. The same study also found that the lack of equipment, such as computers and LCD projectors, was among the challenges in integrating technology in schools. These two issues have indirectly prevented Malay language teachers from optimally using digital technology in their teaching. Although the Ministry of Education Malaysia (MOE) has implemented various initiatives and introduced the Digital Education Policy 2023–2030, the digitalisation of Malay language education remains incomplete and unsatisfactory due to the persistent problems of poor Internet access and insufficient computer equipment. Similarly, Khalissafri and Mohd Isa (2023) also stated that unstable Internet connectivity and limited access to digital facilities hinder the implementation of digital teaching and learning in schools. Therefore, these deficient technology resources and unreliable Internet connectivity require purposeful policies and strategic investment. There is an urgent need to enhance digital equity in national policies, such as with regular technology audits, alongside funding targeted towards high-speed Internet, modern equipment, and digital infrastructure in schools, prioritizing rural and underserved regions. Alongside technology audits for urgent funding allocation, there is a pressing need for building capacity, with sustained digital literacy training for school administrators and Malay language teachers, and the establishment of modern collaborative platforms for best practice co-design. Educators can also be trained on the use of adaptive technologies, which would allow for the effective delivery of instruction in poorly resourced settings. With a merged approach to professional development, technology can seamlessly be integrated into Malay language education.

Additionally, the study findings also indicate that school administrators face financial constraints in supporting

the digitalisation of Malay language education. This shortage of financial resources directly affects schools' ability to provide adequate digital technologies such as computers, LCD projectors, mobile devices, and other necessary digital tools for Malay language teaching. This finding is aligned with a study by Mustafa et al. (2024), which reported that the lack of funding made it difficult for schools to integrate digital technology. Moreover, schools were unable to immediately repair damaged equipment due to high repair costs, resulting in teachers and students having to share or rotate the use of available resources. Consequently, efforts to optimise the use of digital technology in Malay language PdP were affected. Therefore, sufficient financial allocations are necessary to ensure that the Digital Education Policy is implemented in a more systematic, holistic, and effective manner, particularly in Malay language education.

The study also highlights that school administrators face challenges due to Malay language teachers' lack of enthusiasm towards using digital technology in teaching Malay. This is in line with findings by Muhammad Rashid, Bambang Budi, and Mustiningsih (2024), who found that some teachers still prefer using traditional methods. Malay language teachers' preference for conventional approaches over digital technology reflects a negative attitude towards educational digitalisation. In this study, such attitudes were more evident among experienced Malay language teachers, who felt more comfortable using older methods they deemed easier, as digital tools require learning and adaptation to new devices and apps. Additionally, some Malay language teachers believe that digital tools are only suitable for subjects like Science and Mathematics. Such attitudes hinder school administrators' efforts to implement digitalisation in Malay language education and may create a digital competency gap among Malay language teachers in a school. Therefore, policy measures should promote positive mindsets by embedding digital pedagogy into professional development frameworks and making digital competence a part of Malay language teacher evaluation. Besides, incentive-based policies, such as recognition, promotions, or grants, can further encourage innovation in Malay language teaching practices. Policymakers should also provide training initiatives that include sustained, context-specific coaching and mentoring, particularly for Malay language teachers that less familiar with technology. Peer-led models and communities or practices can also help shift perceptions and build digital confidence. Aligning supportive policies with targeted training will help cultivate a digitally capable teaching workforce, advancing the integration of technology in Malay language education.

The study further reveals that school administrators face issues with Malay language teachers perceiving increased workload when using digital technologies, especially in teaching the Malay language. This aligns with Poobalan and Mahmud (2022), who found that advances in educational technology contributed to increased workloads for teachers both in and outside of school. In this context, the rapid development of educational technology has triggered a new phenomenon where Malay language teachers feel overwhelmed. They need to find time to plan and prepare digital teaching materials, attend training and workshops, and adapt to using new technologies on top of existing clerical duties. As a result, Malay language teachers may experience psychological stress and reduced motivation (Fatin Imanina & Anuar, 2024). If left unaddressed, this issue will affect the effectiveness of implementing digitalisation in Malay language education. Therefore, school administrators must remain aware of teacher well-being and ensure that digitalisation efforts are supported by appropriate workload management systems, such as reducing clerical tasks.

Another issue identified is the lack of time among Malay language teachers. This time constraint prevents them from fully maximising the use of digital tools in their teaching. The findings are consistent with Rubhaty, Norliza, and Nurulhuda (2023), who reported that lack of time is a barrier to technology use, particularly among senior teachers. Malay language teachers need considerable time to learn, create, and assess the suitability of digital materials before using them in class. Potential technical problems that arise while using digital tools can also "steal" teaching time (Fatin Imanina & Anuar, 2024). For this reason, many Malay language teachers opt for non-digital materials. In addition, packed teaching schedules further hinder the integration of technology in their teaching practices. The use of tools like LCD projectors requires additional setup and packing time, prompting Malay language teachers to favour textbooks that demand less preparation. Time constraints also limit opportunities for Malay language teachers to attend digital technology training, resulting in reduced technology use in classrooms. Therefore, school administrators must identify practical solutions to address time limitations among teachers to ensure effective implementation of digital education.

The study also found that school administrators face the issue of technical skills gaps among Malay language teachers. This aligns with findings by Muhammad Rashid, Bambang Budi, and Mustiningsih (2024), who reported that teachers often prefer traditional methods due to a lack of digital skills. The technical skills gap is particularly noticeable between younger and more senior Malay language teachers. Low technical proficiency also correlates with lower creativity, as teachers lacking the ability to creatively integrate digital technology into lessons are often seen as less effective (Ilias et al., 2013). This negatively impacts digitalisation efforts in Malay language education at the primary level. Furthermore, this situation limits the potential of digital tools to enhance the quality and effectiveness of Malay language teaching, such as attracting student interest, diversifying instructional methods, and offering meaningful learning experiences aligned with current educational trends. Therefore, school administrators are encouraged to provide focused training, implement mentor-mentee programs between tech-savvy and less experienced Malay language teachers, and offer ongoing support to help Malay language teachers to use digital tools more efficiently, creatively, and effectively.

The issues reported by school administrators regarding the digitalisation of Malay language education (Research Question 2) highlight the importance of Chang's (2003) Principal Technology Leadership Model. Each identified issue corresponds to a specific leadership area, showing where more support, resources, or training might be needed. For example, the problem of unstable Internet access and a lack of computers points to limitations in Technology and Infrastructure Support. Even though school administrators try to provide equipment and access, they encounter systemic or budget issues that prevent full implementation. The lack of financial resources is also closely connected to the Vision, Planning, and Management area. Setting a clear vision and putting it into action requires resource mobilization, which, according to the findings, is a major hurdle. Meanwhile, Malay language teacher attitudes, such as resistance or lack of motivation, along with gaps in technical skills among them, highlight the need for more focused efforts in the Staff Development and Training area. These findings indicate that professional development should be more tailored, ongoing, and inclusive. Besides, the challenge of increased workload and limited time shows practical limitations that affect multiple areas at once, particularly Vision, Planning and Management, and Communication. Time limits reduce chances for training, discussions, and effective monitoring. These findings suggest that while Chang's model is still relevant and useful, its successful application heavily relies on the specific circumstances, including funding, infrastructure, and policy support.

CONCLUSIONS

In conclusion, this study has demonstrated that school administrators possess significant capabilities in shouldering the responsibility as key drivers of the digitalisation of Malay language education in schools. The study has successfully identified the extent of school administrators' capacity in driving educational digitalisation at the school level. In this context, administrators have proven to be effective in managing various aspects such as vision-setting, resource management, infrastructure support, teacher professional development, communication, and the implementation of evaluation on the use of digital technology among teachers. However, evaluation in terms of monitoring record books for the use of special rooms still requires improvement.

This study has also successfully identified several issues faced by school administrators in their efforts to enhance the use of digital technology among Malay language teachers during teaching and learning. These include poor Internet connectivity, lack of digital technological equipment, financial constraints, unmotivated teacher attitudes, increased workload, and technical skill gaps among Malay language teachers. The findings of this study have important implications for stakeholders, highlighting the need to be aware of the actual challenges and realities faced by school administrators and Malay language teachers in implementing the Digital Education Policy in schools. Overall, this study has provided a broad and clear picture of the actual capacity of school administrators as the driving force behind educational digitalisation, particularly in the context of the Malay language subject.

Limitations Of the Study and Future Research Opportunities

This study has several limitations that should be addressed in future research. This study employed a purely qualitative approach. Future studies may consider adopting a mixed-methods design that integrates both

qualitative and quantitative approaches. Such a combination has the potential to yield more comprehensive insights and a deeper understanding of school administrators' capacity as drivers of digitalisation in Malay language education at the primary school level, as well as the challenges they encounter.

In addition, the current study was confined to national primary schools (Sekolah Kebangsaan). Therefore, future research is recommended to expand the scope by including other educational settings such as Chinese national-type schools (Sekolah Jenis Kebangsaan Cina), Tamil national-type schools (Sekolah Jenis Kebangsaan Tamil), and private schools. This broader coverage would allow for a more holistic understanding of the school administrators' role in promoting digital transformation in Malay language teaching across different school contexts.

ACKNOWLEDGEMENT

The author would like to express sincere appreciation to the Faculty of Education at Universiti Kebangsaan Malaysia for their ongoing academic support during this research. Special thanks go to Prof. Dr. Zamri Mahamod for his invaluable supervision, thoughtful guidance, and helpful feedback, which played a key role in completing this study. The author is also grateful to the educators who took part in the study and shared their experiences. Their contributions provided valuable insights and enriched the overall discussion.

REFERENCES

1. Aminamul Saidah Mad Nordin & Bity Salwana Alias. (2023). Digitalisation of Education. International Journal of Academic Research In Progressive Education And Development 12(2): 2474-2482.
2. Arumugam, R., Raamani, T. & Siti Noor Ismail. (2019). Principals' technology leadership and its effect on teachers' technology integration in 21st-century classrooms. International Journal of Instruction 12(4): 423-442.
3. Bailey, C.A. (2018). A guide for qualitative field research. SAGE Publications, Inc.
4. Baniah Mustam. (2015). Penerapan informal dan formal pendidikan alam sekitar di suatu kawasan tercemar. Tesis Ijazah Doktor Falsafah, University Malaya.
5. Chang, I. (2003). Assessing the dimensions of principals' effective technology leadership: An application of structural equation modeling. Educational Policy Forum 6(1): 111-141.
6. Creswell, J.W. (2012). Educational research: planning, conducting and evaluating quantitative and qualitative research. (4th ed). Boston: Pearson Education.
7. Davis, N., & Fullan, M. (2009). The school leader's role in creating effective technology integration. Educational Researcher 38(4): 246-259.
8. Fatin Imanina Abd. Rahman & Anuar Ahmad. (2024). Cabaran guru menggunakan bahan electronic dalam proses pengajaran dan pembelajaran Sejarah. Malaysian Journal of Social Sciences and Humanities 9(2): 1-11.
9. Ghazali Darusalam & Sufean Hussin. (2016). Methodology penyelidikan dalam pendidikan: Amalan dan analysis kajian. Edisi kedua. Kuala Lumpur: Penerbit University Malaya.
10. Ilias, M. F., Ismail, M. F. & Jasmi, K. A. (2013). Faktor dorongan dan halangan penggunaan bahan bantu mengajar oleh guru Pendidikan Islam di Sekolah Bestari. 3rd International Conference on Islamic Education, Selangor, Malaysia. http://eprints.utm.my/37714/
11. Kamarul Azmi Jasmi. (2012). Kesahan dan Kebolehpercayaan dalam Kajian Kualitatif. Kursus Penyelidikan Kualitatif Siri 1 2012. 29 Mac 2012. Institute Pendidikan Guru Kampus Temenggong Ibrahim.
12. Kementerian Pendidikan Malaysia. (2013). Pelan Induk Pembangunan Pendidikan Malaysia 2013-2025. Putrajaya: Kementerian Pendidikan Malaysia.
13. Khalissafri Mohd Haslin & Mohd Isa Hamzah. (2023). Pendigitalan pendidikan: kesediaan dan cabaran terhadap murid dalam pembelajaran. QALAM International Journal of Islamic and Humanities Research 3(1): 41-57.
14. Kim, H.Y. & Marshall, W. (2009). The effect of a technology leadership workshop on principals' five dimensions of technology leadership. In G. Siemens & C. Fulford (Eds.), Proceedings of

EdMedia: World Conference on Educational Media and Technology. 2415-2420.
15. Mat Rahimi Yusof, Mohd Faiz Mohd Yaakob & Mohd Yusri Ibrahim. (2019). Digital leadership among school leaders in Malaysia. International Journal of Innovative Technology and Exploring Engineering 8(9): 1481-1485.
16. Mizal, B., Julianita & Tathahira. (2023). The role of school principal as motivator in utilization of digital technology at SMAN 5 Takengon. International Journal of Education, Language and Religion 5(1): 61-73.
17. Mohd Fahmi Asyraf Mohd nor Azmi & Mohd Izham Mohd Hamzah. (2023). Cabaran pentadbir dalam mengurus perubahan digital di sekolah. Malaysian Journal of Social Sciences and Humanities 8(4): 1-9.
18. Mohd Jamil Saleh. (2011). Principal's technology leadership at a smart school in Kota Tinggi, Johor. Unpublished Master Project Paper. Kuala Lumpur: University Malaya.
19. Muhammad Rasyid Ridhod, Bambang Budi Wiyono & Mustiningsih. (2024). Digital leadership of school principals to improve the quality of learning in the industrial revolution era 4.0. Journal Pemikiran Alternatif Kependidikan 29(1): 17-34.
20. Mustafa, F., Hoa Thi Mai Nguyen & Xuesong Gao. (2024). The challenges and solutions of technology integration in rural schools: A systematic literature review. International Journal of Educational Research 126: 1-14.
21. Nazri Bakar. (2011). Principal technology leadership for implementation of information and communication technology (ict) in school. Unpublished Master Project Paper. Kuala Lumpur: University Malaya.
22. Nurul Salwani Abdullah & Suhaida Abdul Kadir. (2023). Relationship between principals' digital leadership and teachers' digital competency in Klang district secondary schools. Asian Journal of Vocational Education and Humanities 4(20 :1–14.
23. Poobalan, M. C., & Mahmud, M. S. (2022). Tahap pengetahuan dan persepsi guru terhadap pengaplikasian tmk dalam pengajaran Matematik sekolah rendah. Malaysian Journal of Social Sciences and Humanities 7(11): 1–10. https://doi.org/10.47405/mjssh.v7i11.1885
24. Puvenesvary Muthiah, Sivabala Naidu, Mastura Badzis, Noor Fadhilah Mat Nayan, Radziah Abdul Rahim & Noor Hashemi Abdul Aziz. (2020). Qualitative research data collection and data analysis techniques. 2nd Edition. Sintok: Penerbit University Utara Malaysia.
25. Richardson, J.W. & McLeod, S. (2011). Technology leadership in native american schools. Journal of Research in Rural Education 26(7): 1-14.
26. Rifa Nailufar, Salman Imaddudin & Rudli Zamal Muttaqin. (2023). The principal's role in implementing digital literacy in school. Proceeding of International Conference on Education, Society and Humanity 1(1): 524-532.
27. Rubathey Muniyandi, Norliza Abdul Majid & Nurulhuda Md Hassan. (2023). Pelaksanaan ICT dan cabaran dari aspek kesediaan dalam kalangan guru senior di bilik darjah. Journal Ilmi Ilmi Journal 13: 15-28.
28. Saiful Adli Ab Rahim, Muhammad Faizal A Ghani, Harris Shah Abd Hamid, Norhanida Samsudin & Zawawi Ismail. (2021). Cabaran pelaksanaan program pembangunan profesionalisme pemimpin guru sekolah berperestasi tinggi. Journal Kepimpinan Pendidikan 8(2): 25-40.
29. Suzana Kamarudin & Zamri Mahamod. (2023). Amalan pedagogi guru bahasa Melayu dalam mengaplikasi bahan digital**.** Journal Penyelidikan Jelai 16: 1-10.
30. Syed Ismail Syed Mustapa, Ismail Radu an & Bushro Ali. (2018). Asas penyelidikan dalam pendidikan. Petaling Jaya: Sasbadi Sdn. Bhd.
31. Wong Ai Yieng & Khadijah Daud. (2017). Headmaster technology leadership in Malaysia elementary schools. Journal of Education and Learning 11(2): 154-164. DOI: 10.11591/edulearn.v11i2.5573
32. Yuznaili Saleh. (2021). Panduan komprehensif penyelidikan: navigasi penyelidikan anda. Kuala Lumpur: Nusamas.
33. Zuraidah Baharuldina, Shahrir Jamaluddina & Mohd Shahril Nizam Shaharoma. (2019). The role of school administrative support and primary school teachers' ict literacy to integrate ict into the classrooms in Pahang, Malaysia. International Online Journal of Educational Leadership 3(1): 26-42.