READINESS OF SCHOOL LEADERS IN MALAYSIA TO FACE THE VUCA (VOLATILE, UNCERTAIN, COMPLEX, AMBIGUOUS) ERA: A RECENT COMPREHENSIVE STRUCTURED REVIEW

Graciella Mutil[1*], Abdul Halim Busari[2], Mohammad Nur Azhar Mazlan[3], Andrew Thomas Ujil[4]

[1] Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak, Malaysia
Email: 23010129@siswa.unimas.my

[2] Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak, Malaysia
Email: bhalim@unimas.my

[3] Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak, Malaysia
Email: mmnazhar@unimas.my

[4] Department of Postgraduate Study, Institut Pendidikan Guru Kampus Batu Lintang, Malaysia
Email: andrew@ipgm.edu.my

[*] Corresponding Author

Article Info:

Abstract:

The current era, characterized by volatility, uncertainty, complexity, and ambiguity (VUCA), presents significant challenges for school leaders globally, including in Malaysia. This systematic literature review aims to assess the readiness of Malaysian school leaders to navigate these challenges effectively. The study addresses the pressing issue of whether current leadership practices and training are sufficient to equip leaders with the necessary skills and competencies. To achieve this, we conducted an extensive search of scholarly articles from reputable databases such as Scopus and Web of Science, focusing on studies published between 2020 and 2024. The flow of study based on PRISMA framework. The database found (n=18) final primary data was analysed. The finding was divided into three themes which is (1) Leadership in Turbulent and Uncertain Times, (2) Inclusivity and Equity in School Leadership and (3) Technological Integration and Innovation in Education. The findings underscore the urgency for policy reforms and the implementation of comprehensive training frameworks to bolster leadership capabilities in the education sector. In conclusion, while there are pockets of excellence, the overall readiness of Malaysian school leaders to face the VUCA era is insufficient, necessitating immediate and sustained efforts to enhance their preparedness through strategic initiatives and continuous professional development.

Introduction

In the current global educational landscape, the Volatile, Uncertain, Complex, and Ambiguous (VUCA) era presents unprecedented challenges and opportunities. School leaders are at the forefront of navigating these dynamic conditions, especially in Malaysia, where educational reform and technological advancements are rapidly transforming the sector. The readiness of school leaders to effectively manage and thrive in such an environment is crucial for the sustained development and success of educational institutions. The concept of VUCA, initially coined by the U.S. military to describe the unpredictable nature of modern warfare, has been widely adopted across various sectors, including education (Gorsline, 2016; RAU, 2020). In the context of Malaysian education, VUCA reflects the rapid changes brought about by globalization, technological innovation, policy shifts, and socio-economic transformations (Noraini, Faizal, & Enamul, 2022). The volatility of educational demands, uncertainty of future skills requirements, complexity of integrating diverse technologies, and ambiguity in policy directions are some of the key challenges that school leaders must contend with.

Volatility in the educational landscape is driven by the swift pace of technological advancements and shifting educational paradigms (Baskara, 2024). However, this rapid evolution also creates a volatile environment where school leaders must continuously adapt to new tools and methodologies, often without adequate preparation or support (Juliana, Suwarto, Pramono, & Prasetya, 2024). Uncertainty is another significant factor impacting school leadership in Malaysia. School leaders must be prepared to make informed decisions amidst uncertain conditions, requiring a strong foundation in strategic thinking and agile leadership (Fullan, 2020; Fullan & Leithwood, 2012). Complexity arises from the multifaceted nature of modern education systems (Uzunboylu & Azhar, 2023). The integration of new technologies and pedagogical approaches adds layers of complexity to the management of educational institutions (Khomova, 2021; Sain, Baskara, & Vorfi Lama, 2024). Ambiguity in educational leadership is often linked to the unclear and shifting nature of educational policies and expectations (Kajs & McCollum, 2009). In Malaysia, frequent policy changes and reforms, aimed at improving the quality of education and aligning it with global standards, can create an environment of ambiguity for school leaders. This ambiguity requires leaders to be adaptable, resilient, and capable of interpreting and implementing policies effectively, even when guidelines are not explicitly clear.

Literature Review

The VUCA environment poses significant challenges for educational leadership, particularly in dynamic contexts like Malaysia. School leaders must be equipped to navigate these challenges effectively, fostering resilience and innovation within their institutions. Research on German school leaders during the COVID-19 pandemic highlights the importance of ambidexterity—balancing the refinement of existing knowledge (exploitation) and the pursuit of new knowledge (exploration) (Pietsch, Tulowitzki, & Cramer, 2023). Their findings reveal that principal's adept at shifting between these modes were more successful in driving innovative teaching practices. This adaptability is crucial for Malaysian school leaders,

suggesting that professional development should focus on enhancing both strategic refinement and innovative exploration to maintain educational quality amidst volatility. Ghodoosi (2021) exploration of smart contracts within blockchain technology offers insights into the potential of technological integration in educational administration. Despite challenges in enforceability and scope, smart contracts' reliance-based framework for dispute resolution could inspire new approaches to managing educational resources and data securely. Malaysian school leaders could leverage similar technologies to streamline administrative processes and ensure transparency, thus better positioning their schools in a VUCA environment.

Espitia et al. (2021) highlight the effectiveness of virtual learning environments in enhancing student competencies in veterinary education. Malaysian school leaders can incorporate similar virtual and augmented reality tools to promote competency-based education, helping students adapt to real-world challenges. Coventry, Hampton, Muddiman, & Bullock (2022) emphasize the evolving definitions of a "good" doctor, indicating a shift towards holistic, patient-centered care. This aligns with the educational shift towards student-centered learning. Malaysian school leaders can use these insights to redefine leadership competencies, focusing on both technical skills and emotional intelligence. Herrmann et al. (2021) examine COVID-19's impact on interpersonal aspects in schools, finding that empathy and social-emotional learning are critical for a supportive educational environment. Empathy training for school staff can enhance resilience and adaptability, essential for navigating the VUCA era. The VUCA environment requires dynamic and innovative leadership in education. Malaysian school leaders must understand various challenges and strategies to navigate this environment effectively. Stevenson, Wainwright, & Williams (2023) highlight that parental engagement in early childhood education significantly enhances children's fundamental movement skills (FMS). Integrating parents into school activities supports children's educational outcomes, crucial for managing VUCA complexities. Jiang (2022) discusses targeted policies for reducing carbon emissions in global supply chains using a complex network approach. This framework can be adapted for educational policymaking to identify key leverage points and drive systemic change. Understanding these network dynamics can help Malaysian school leaders develop effective policies and structural adaptations to enhance school readiness in volatile contexts.

Bianchi & Richiedei (2023) emphasize the importance of multi-level governance for cohesive sustainable development strategies. Fragmented governance hinders effective implementation, highlighting the need for Malaysian school leaders to develop integrated approaches aligning with national and regional policies. Strengthening cross-sectoral dialogue can enhance resilience and adaptability to manage VUCA complexities. Mansor et al. (2022) detail challenges in small Malaysian schools, such as financial constraints and inadequate infrastructure, showing that creative and passionate leadership is crucial. School leaders in these settings have used innovative strategies like developing ICT skills and being instructional role models. Adaptability, resourcefulness, and continuous professional development are vital for effective leadership, especially in rural and resource-constrained environments. Ard et al. (2022) highlight the potential of augmented reality (AR) and web-based technologies in enhancing scientific communication. These tools can modernize educational practices, improving schools' responses to the VUCA environment. Demeshkant, Schultheis, & Hiebl (2022) compare Polish and German school principals' experiences during COVID-19, showing that effective crisis management and sustainable school functioning depend on strong leadership. Malaysian school leaders can learn from these examples by focusing on leadership skills, ICT integration, and support systems. Krasniqi (2021) finds that principals who use a

mix of leadership styles are more successful in fostering a collaborative culture. Óskarsdóttir, Donnelly, Turner-Cmuchal, & Florian (2020) emphasize inclusive leadership practices, advocating for policies supporting diverse learner needs. Mantai & Marrone (2023) highlight the importance of achievements, mobility, and teaching experience for academic career progression. Continuous professional development is crucial for Malaysian school leaders. Gharipour & Trout (2020) stress the importance of a multidisciplinary approach in curriculum development to enhance knowledge and engagement. Integrating health and social-behavioral disciplines in active learning can help educational leaders address the complexities of a VUCA world.

McClelland, Shaw, O'Grady, & Fattoum (2023) propose a multi-dimensional framework for transformative change post-disaster, highlighting interconnected areas like community, economy, infrastructure, environment, health, and governance. Malaysian school leaders can adopt this framework to enhance crisis preparedness and resilience, ensuring a comprehensive and sustainable recovery. Berman et al. (2023) emphasize trauma-informed care in education, which is crucial for addressing the emotional and psychological well-being of students and staff. Implementing trauma-informed practices can create a supportive environment, helping leaders manage the uncertainties of a VUCA era. Youm & Corral (2019) discuss the benefits of simulation-based learning for developing practical skills in complex environments. Malaysian school leaders can use similar experiential learning modules to improve decision-making, leadership, and teamwork skills. Tiwari & Shukla (2022) provide a framework for post-disaster reconstruction aligned with sustainable development goals, focusing on restoring well-being. Adopting a capabilities-based approach can help Malaysian school leaders develop comprehensive post-disaster management plans, creating resilient and adaptable educational institutions.

In conclusion, the readiness of school leaders in Malaysia to face the VUCA era requires an integrated and innovative approach that incorporates multidisciplinary learning, comprehensive recovery strategies, trauma-informed practices, experiential learning modules, and a focus on well-being and sustainability. By drawing on diverse research insights, school leaders can enhance their capacity to navigate the complexities and uncertainties of the modern educational landscape, ensuring that their institutions are resilient, adaptable, and prepared for the challenges ahead.

Table 1: Summary Of Past Finding

Study	Key Findings	Implications for Malaysian School Leaders
Espitia et al. (2021)	Virtual learning environments enhance student competencies in veterinary education through tools like Second Life for simulating emergency scenarios.	Incorporating virtual and augmented reality tools can facilitate competency-based education, preparing students for complex, real-world challenges.
Coventry, Hampton, Muddiman, & Bullock (2022)	Evolving definitions of a "good" doctor emphasize holistic, patient-centered care.	Redefine educational leadership competencies to include both technical skills and emotional intelligence, aligning with student-centered learning.

Herrmann, Nielsen, & Aguilar-Raab	Empathy and social-emotional learning are critical for maintaining supportive educational environments during crises.	Empathy training for school staff can enhance resilience and adaptability, crucial for navigating VUCA challenges.
Stevenson, Wainwright, & Williams (2023)	Parental engagement in early childhood education enhances children's fundamental movement skills (FMS).	Integrating parents into school activities can support educational outcomes, important for coping with VUCA complexities.
Jiang (2022)	Targeted policies in reducing carbon emissions using a complex network approach.	Understanding network dynamics can inform effective policy and structural adaptations in education.
Bianchi & Richiedei (2023)	Multi-level governance is essential for cohesive strategies across different government levels.	Develop integrated approaches aligning with national and regional educational policies to enhance resilience.
Mansor et al. (2022)	Small schools face financial constraints and inadequate infrastructure, overcome by creative and passionate leadership.	Adaptability, resourcefulness, and continuous professional development are vital for effective leadership in resource-constrained settings.
Ard et al. (2022)	Augmented reality (AR) and web-based technologies enhance scientific communication.	Integrating digital tools can modernize teaching and improve responsiveness to VUCA challenges.
Demeshkant et al. (2022)	Effective crisis management in schools relies on strong leadership competencies and ICT integration.	Focus on strong leadership skills and robust support systems for educational continuity during crises.
Krasniqi (2021)	Teacher collaborative learning is essential for professional development, influenced by mixed leadership styles.	Encourage collaboration among teachers to enhance problem-solving and innovation in VUCA environments.
Óskarsdóttir et al. (2020)	Inclusive leadership practices support diverse learner needs.	Adopt inclusive leadership to ensure equitable educational opportunities, promoting social cohesion and resilience.
Mantai & Marrone (2023)	Attributes required for academic career progression include achievements, mobility, and teaching experience.	Provide clear pathways for leadership development and recognize achievements to motivate innovative practices.
Gharipour & Trout (2020)	Multidisciplinary platforms in curriculum development enhance knowledge and engagement.	Integrate multidisciplinary approaches to adapt to the interconnected nature of modern education.
McClelland et al. (2023)	Multi-dimensional framework for transformative change post-disaster.	Adopt comprehensive strategies encompassing diverse areas to enhance preparedness and resilience.
Berman et al. (2023)	Trauma-informed care is crucial in addressing the emotional and psychological well-being of students and staff.	Implement trauma-informed practices to create a supportive and resilient educational environment.

| Youm & Corral (2019) | Simulation-based learning enhances experiential learning and practical skills. | Incorporate experiential learning modules to improve decision-making and teamwork skills. |
| Tiwari & Shukla (2022) | Capabilities approach in post-disaster reconstruction aligns with sustainable development goals. | Develop comprehensive post-disaster management plans focusing on stakeholder well-being and resilience. |

Material And Methods

During the study, the PRISMA method was applied. systematically looking through the academic databases Web of Science (WoS) and Scopus. The four steps of the review process are identification, screening, eligibility, and inclusion, as shown in Figure 1. Below is a brief description of these.

Identification

Several crucial procedures from the systematic review approach were used in this study to choose a sizable body of relevant literature. Following the selection of keywords, dictionaries, thesauruses, and prior research were used to look up similar terms. Creating search strings for the Eric, Web of Science, and Scopus databases yielded all relevant phrases (see Table 2). 2632 publications pertinent to the research issue were successfully obtained from these two databases during the first phase of the systematic review.

Table 2: The Search String

Databases	Search String
Scopus	TITLE-ABS-KEY (("VUCA" OR "Volatile" OR "Uncertain" OR "Complex" OR "Ambiguous") AND ("School Leadership" OR "Educational Leadership" OR "Principal" OR "School Leader") AND ("Readiness" OR "Preparedness" OR "Competence" OR "Capability")) AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2024)) *Date of Access: June 2024*
Web of Science	("VUCA" OR "Volatile" OR "Uncertain" OR "Complex" OR "Ambiguous") AND ("School Leadership" OR "Educational Leadership" OR "Principal" OR "School Leader") AND ("Readiness" OR "Preparedness" OR "Competence" OR "Capability") (Topic) and 2024 or 2023 or 2022 or 2021 or 2020 (Publication Years) and Article (Document Types) and English (Languages) and Education Educational Research or Social Sciences Other Topics (Research Areas) *Date of Access: June 2024*

Screening

During the screening phase, potentially relevant research items are evaluated to determine their alignment with predefined research questions. The criteria for this phase include selecting research items related to the readiness of school leaders in Malaysia for the VUCA era. At this

stage, duplicate papers are removed from the search results. Initially, 2,573 publications were excluded, followed by an examination of 59 papers based on specific exclusion and inclusion criteria for this study (see Table 3). The main criterion was literature (research papers), as it serves as the primary source of practical recommendations. This included reviews, meta-syntheses, meta-analyses, books, book series, chapters, and conference proceedings not included in the latest study. The review was limited to English-language publications from 2020 to 2024. Seven publications were rejected due to duplication.

Table 3: Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2020 – 2024	< 2020
Literature type	Journal (Article)	Conference, Book, Review
Publication Stage	Final	In Press
Subject	Social science	Besides Social science

Eligibility

52 papers were compiled during the third phase, which is known as the eligibility evaluation. To verify that the papers matched the inclusion criteria and were pertinent to the research goals of the ongoing study, a thorough review of the titles and body of each article was carried out during this phase. As a result, 32 data sets, papers, and articles were eliminated because they did not meet the eligibility requirements. These included being outside of the study's field, having a title that did not significantly connect to the goal of the research, having an abstract that had no bearing on the goal of the study, and lacking full text access supported by empirical data. This means that there are now 18 articles left for the next review.

Data Abstraction and Analysis

An integrative analysis was employed in this study to examine and synthesize various research designs, particularly quantitative methods. The primary goal was to identify relevant topics and subtopics. The initial step in developing themes involved data collection. As shown in Figure 2, the authors meticulously analyzed a compilation of 19 publications for assertions or material pertinent to the study's topics. Subsequently, they evaluated significant studies related to the readiness of school leaders in Malaysia for the VUCA era, investigating the methodologies and research results of these studies. The authors collaborated to develop themes based on the evidence within the study's context. Throughout the data analysis process, a log was maintained to record analyses, viewpoints, puzzles, and other thoughts relevant to data interpretation. Finally, the authors compared the results to identify any inconsistencies in the theme development process. Any disagreements between concepts were discussed among the authors to reach a consensus. The authors also compared the findings to resolve any discrepancies in the theme creation process. Note that if any inconsistencies on the themes arose, the authors address them with one another. Finally, the developed themes were tweaked to ensure their consistency. To ensure the validity of the problems, the examinations were performed by two experts, one specializing in teacher education and the other in educational management. The expert review phase helped ensure each sub-theme's clarity, importance, and adequacy by establishing domain validity. Adjustments based on the discretion of the author based on feedback and comments by experts have been made. The questions are as follows below:

1. How do school leaders in Malaysia adapt their leadership strategies to effectively navigate and manage the challenges posed by the VUCA environment?
2. What role do inclusivity and social justice play in the readiness of school leaders in Malaysia to address the needs of diverse and marginalized student populations in a VUCA era?
3. How prepared are school leaders in Malaysia to integrate and support technological innovations and digital transformation in education to enhance teaching and learning outcomes in the VUCA era?
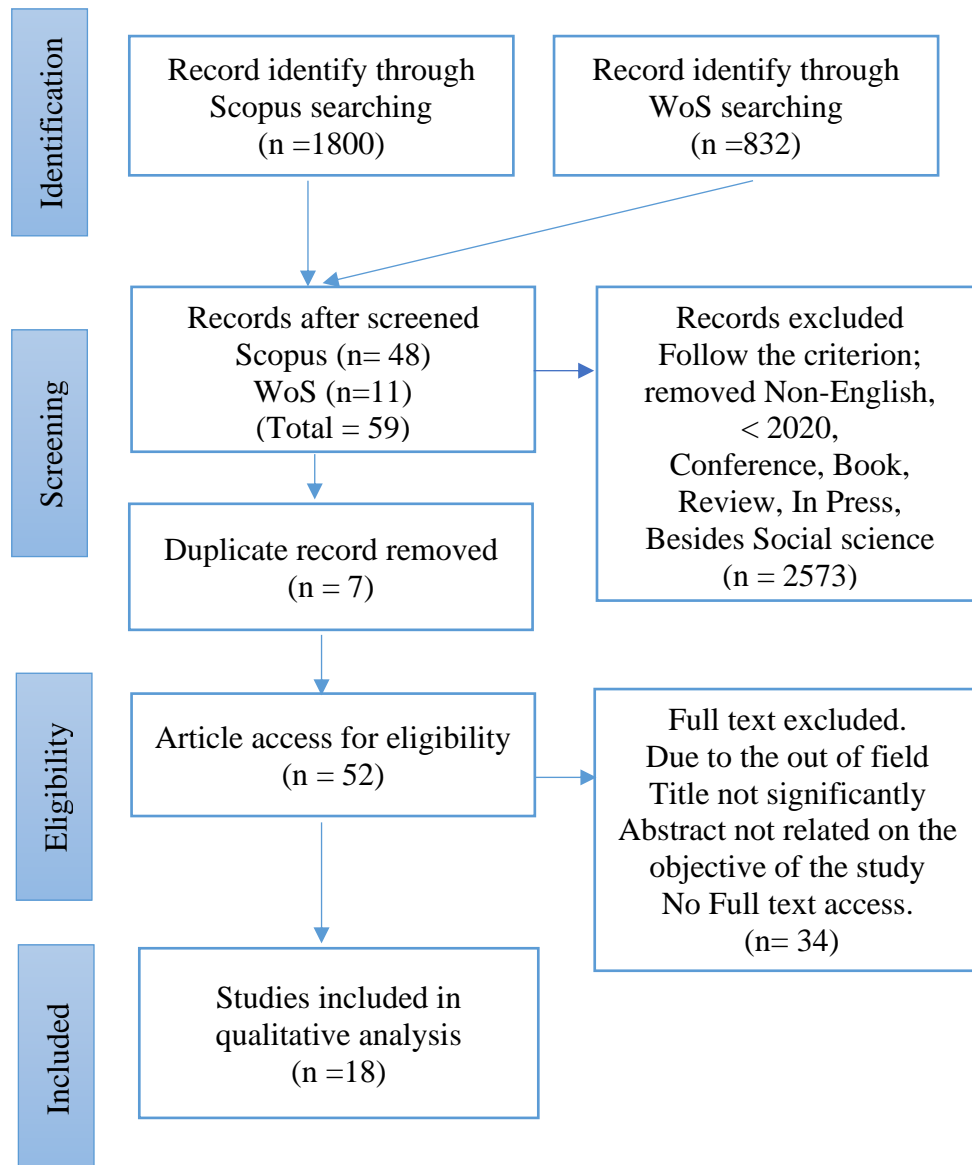

Figure 2: Flow Diagram Of The Proposed Searching Study
Source: Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009

Result and Finding
The following three themes are used to elaborate on the findings : Leadership in Turbulent and Uncertain Times (8 articles) ; Inclusivity and Equity in School Leadership (5 articles) ; and Technological Integration and Innovation in Education (5 articles)

Leadership in Turbulent and Uncertain Times

In periods of significant upheaval, such as the COVID-19 pandemic, the role of school leaders becomes pivotal in navigating the complexities and ensuring the sustainability and innovation of educational practices. Pietsch, Tulowitzki, & Cramer (2023) highlight the necessity for principals to balance exploitation and exploration activities to adapt to rapidly changing environments. Their study, based on data from German principals, shows that during the pandemic, leaders who managed to swiftly shift between leveraging existing knowledge and seeking new information facilitated more radical innovations in teaching and instruction. This dynamic ability appears essential for maintaining the longevity and effectiveness of schools in unpredictable conditions. Similarly, Hayes & Derrington (2023) investigate the leadership practices of U.S. school principals during the initial months of the COVID-19 crisis, identifying high emotional intelligence, collaboration, and contextual awareness as crucial traits. Their findings, derived from a national qualitative study, suggest that effective crisis leadership involves not only personal attributes but also the ability to engage stakeholders and adapt practices to meet unique school community needs. This aligns with the National Preparedness Leadership Initiative (NPLI) framework, which underscores the importance of meta-leadership in times of crisis. The international dimension of leadership in uncertain times is further explored by Demeshkant et al. (2022), who compare the experiences of Polish and German school principals in sustaining educational practices during remote learning. Despite the lack of significant institutional support, principals in both countries demonstrated resilience and adaptability, ensuring the continuity of education through innovative use of ICT and e-learning strategies. This study underscores the importance of leadership competences in mitigating the adverse effects of crises on education. Addressing the challenges specific to smaller schools, Mansor et al. (2022) examine the strategies employed by head teachers in rural Malaysian primary schools. These leaders often face financial constraints, dilapidated infrastructure, and a lack of resources, yet they overcome these hurdles through creative problem-solving and by serving as role models for instructional leadership. Their findings suggest that passion and resourcefulness are critical for school leaders managing limited resources, emphasizing the need for supportive policies to enhance educational quality in such contexts. Professional identity development is another crucial aspect of leadership during transformational times. Resnick (2023) utilizes an analytic framework to study how principals' professional identities evolve amidst shifting local expectations. Through a case study of elementary principals, the research illustrates how leaders gradually internalize new practices and redefine their roles, moving from compliance to a deeper commitment to new educational paradigms. This highlights the importance of continuous professional development and contextual learning in fostering effective leadership. The interpersonal aspects of school leadership during crises are examined by Herrmann, Nielsen, & Aguilar-Raab (2021), who discuss the impact of the COVID-19 pandemic on social-emotional education and relational competence. Their longitudinal project reveals that despite the challenges posed by physical distancing and virtual learning, some positive effects emerged, such as increased cohesion among faculty and improved learning environments in smaller classes. This suggests that fostering empathy and strong interpersonal relationships can significantly influence the resilience of school communities during crises. E Wyatt & Hobbs (2024) address the issue of out-of-field teaching among first-year graduates in Western Australia. Their study identifies the prevalence and impacts of out-of-field teaching, emphasizing the need for targeted support mechanisms such as subject-specific mentoring and workload adjustments. Understanding these challenges and providing adequate support can enhance the capability and retention of new teachers, ensuring a more stable and effective teaching workforce during turbulent times.

Inclusivity and Equity in School Leadership

The need for inclusive and equitable leadership in schools is imperative, especially in the face of growing diversity and the complex challenges that come with it. The development and enactment of social justice leadership (SJL) capabilities among pre-service teachers, as explored by E P Barnett & de Klerk (2023), is fundamental in this context. Their research emphasizes the importance of SJL in higher education institutions (HEIs) to foster a socially just environment, enabling pre-service teachers to actively apply social justice principles in teaching and learning. By promoting dialogue spaces and transformative activism, HEIs can empower future leaders to enhance social justice practices effectively. Moreover, the wellbeing of multiply marginalized and underrepresented (MMU) teachers is another crucial aspect that intersects with the broader discourse on inclusive leadership. Hong et al. (2023) highlight the challenges faced by MMU teachers in embracing their identities within school systems that often privilege dominant societal structures. Their study illustrates the complex interplay of relatedness, autonomy, and competence in the wellbeing of these teachers, underscoring the need for leadership practices and district policies that acknowledge and support their intersecting identities. Addressing these dimensions is vital for creating inclusive and supportive environments for all educators. Inclusive school leadership also plays a pivotal role in raising the achievement of all learners. Óskarsdóttir et al. (2020) present a model based on international and European policies that supports the development of competences for inclusive school leaders. Their work through the Supporting Inclusive School Leadership (SISL) project provides a framework that enables school leaders to meet the diverse needs of their school communities. This model promotes cross-national collaboration, reflecting on policy contexts necessary to support inclusive education systems and ensuring meaningful, high-quality educational opportunities for all learners. The education of refugee students presents specific challenges that require nuanced leadership approaches.

Ali Awsat Younus Khalid & Cansoy (2023) explore the difficulties faced by Turkish school principals in integrating refugee students into the education system. Their findings reveal issues related to language acquisition, psychological needs, and societal prejudices, highlighting the need for comprehensive support structures and multicultural education training for staff. Effective leadership in this context involves addressing these multifaceted problems and advocating for policies that enhance the educational experiences of refugee students. Early childhood education also demands a focused approach to inclusivity and equity. Franks, Barblett, & Kirk (2023) examine how early childhood teachers in Western Australia understand and foster self-efficacy in young children. Their research indicates that early childhood teachers prioritize developmental appropriateness in their strategies, recognizing the unique needs of younger learners. This understanding has significant implications for how teachers, school leaders, and policymakers design and implement curricula that support the development of self-efficacy in early childhood settings. Fostering inclusivity and equity in school leadership involves addressing the specific needs of diverse student and teacher populations. It requires a commitment to social justice principles, supportive policies, and an understanding of the unique challenges faced by marginalized groups. By promoting inclusive leadership practices, schools can create environments where all members of the educational community can thrive.

Technological Integration and Innovation in Education

The integration of technological resources into education is critical for modernizing teaching practices and enhancing learning outcomes. Dvoryatkina, Dyakina, & Safronova (2023) emphasize the potential of popular science films as a resource for integrating media education

technologies into mathematics teaching. Their study highlights the effectiveness of using media to make complex mathematical concepts more accessible and engaging for students. This approach not only enhances understanding but also fosters a more interactive and stimulating learning environment. Moreover, the use of augmented reality (AR) and web-based technologies in academic publications is another innovative application of technology in education. Ard et al. (2022) discuss the Schol-AR platform, which allows data to be directly integrated into publications. This technology facilitates a more dynamic and interactive way of presenting research findings, making it easier for readers to engage with and comprehend complex data. Such technological advancements can significantly improve the dissemination and understanding of scholarly work. The relationship between technological integration and teacher performance is also crucial, particularly in the context of fully online learning. Maipita, Dongoran, Syah, & Sagala (2023) explore the concepts of Technological Pedagogical Content Knowledge (TPACK), organizational support, and technostress in explaining teacher performance during online learning. Their findings indicate that while organizational support can enhance teacher performance, technostress remains a significant challenge.

Effective integration of technology in education requires addressing these stress factors to ensure that teachers can leverage technological tools effectively without being overwhelmed. In addition, the role of school principals in supporting technological integration cannot be overlooked. Krasniqi (2021) underscores the importance of principals in fostering teacher collaborative learning, which is essential for the successful implementation of new technologies. Principals who promote a culture of collaboration and continuous learning among teachers can significantly enhance the integration of innovative technologies in schools. This support is vital for building teacher confidence and competence in using new tools and methodologies. Furthermore, the quality of preschool education, as perceived by school principals, also plays a crucial role in the successful integration of technology. Kondrashova (2022) investigates the construct of the quality of preschool education in Moscow, highlighting the need for a comprehensive approach that includes technological innovations. Principals' perceptions and support are instrumental in shaping the quality of early childhood education, ensuring that young learners benefit from technological advancements from an early age. The integration of technology in education involves a multifaceted approach that includes the use of media, augmented reality, organizational support, and collaborative learning. It requires the active involvement of educators and school leaders to overcome challenges and leverage the full potential of technological innovations. By addressing these aspects, educational institutions can create more engaging, efficient, and effective learning environments. Highlights from 18 articles extracted and analyzed using the search technique mentioned earlier are presented in Table 4.

Table 4: The Research Article Finding Based On The Proposed Searching Criterion

Author Name and Year	Objectives	Conclusion and Future Research
Dvoryatkina, Dyakina, Safronova (2023)	Develop and implement media education technologies for future mathematics teachers.	Future teachers need media education technologies to adapt to digitalized education. Research should explore further technological forms of visual learning.

Author Name and Year	Objectives	Conclusion and Future Research
Barnett, de Klerk (2023)	Explore social justice leadership (SJL) capabilities for pre-service teachers from an education policy perspective.	HEIs should advance policy understanding and promote SJL. Future research could develop and test frameworks for SJL capabilities.
Hong et al. (2023)	Understand the wellbeing threats to multiply marginalized and underrepresented (MMU) teachers through intersecting identities.	Schools should consider both positive and negative dimensions of wellbeing. Future research should explore broader implications for school leadership and district policies.
Pietsch, Tulowitzki, Cramer (2023)	Investigate how school leaders adapted to the turbulent environment caused by the COVID-19 pandemic.	Transition between exploration and exploitation is vital for school longevity. Future research should investigate the balance of these activities in different contexts.
Resnick (2023)	Examine principal learning in contexts of educational transformation using an analytic framework.	The framework helps understand principal learning in transformation contexts. Future research should explore principal identity development further.
Herrmann, Nielsen, Aguilar-Raab (2021)	Evaluate the impact of COVID-19 on interpersonal aspects in elementary schools through empathy training.	Emphasizing relational competence and empathy is crucial. Future research should focus on long-term effects of empathy training and pandemic adaptations.
Mansor et al. (2022)	Explore leadership practices and challenges in small Malaysian primary schools.	Insights are useful for policymakers and school leaders. Further studies with more respondents are needed to understand complex challenges and strategies in small schools.
Kondrashova (2022)	Study the quality of preschool education from the perspective of school principals.	Findings highlight the need for clear quality standards. Future research should investigate broader contexts and diverse educational settings.
Ard T., Bienkowski M.S., Liew S.-L., Sepehrband F., Yan L., Toga A.W. (2022)	To integrate digital data into scientific publications using AR and web-based technologies.	Modernizing scientific communication through digital augmentation. Future research could explore broader applications of AR in various fields.
Ali Awsat Younus Khalid O., Cansoy R. (2023)	To investigate the obstacles faced by Turkish school principals in educating refugee students.	Principals struggle with complex problems due to system unpreparedness for refugee education. Future research should explore solutions to these systemic challenges.

Author Name and Year	Objectives	Conclusion and Future Research
Demeshkant N., Schultheis K., Hiebl P. (2022)	To explore the impact of COVID-19 on school sustainability and leadership in Poland and Germany.	Principals managed to adapt quickly despite institutional support limitations. Future research should focus on improving support structures for sustainable e-learning.
E Wyatt J., Hobbs L. (2024)	To understand the status and impact of out-of-field (OOF) teaching among first-year graduates in Western Australia.	Highlighted the need for reduced workload and formal mentoring for OOF teachers. Future research should involve large-scale, longitudinal studies.
Krasniqi R. (2021)	To investigate principals' roles in supporting teacher collaborative learning.	Recommends modernizing collaborative learning methods. Future research should further explore advanced collaborative learning models.
Hayes S.D., Derrington M.L. (2023)	To identify effective leadership practices of U.S. principals during the COVID-19 crisis.	Effective crisis leadership involves adaptability and stakeholder engagement. Future research could expand on crisis-specific leadership training.
Óskarsdóttir E., Donnelly V., Turner-Cmuchal M., Florian L. (2020)	To develop a model for inclusive school leadership.	Inclusive leadership is essential for high-quality education for all. Future research should refine the model and explore its practical applications.
Franks D., Barblett L., Kirk G. (2023)	To explore early childhood teachers' understanding of self-efficacy development.	Calls for rethinking self-efficacy development approaches in early education. Future research should further investigate early childhood self-efficacy sources.
Maipita I., Dongoran F.R., Syah D.H., Sagala G.H. (2023)	To analyze the impact of organizational support and TPACK on teacher performance and technostress.	Emphasizes the need for strategies to manage technostress. Future research should identify factors for effective technostress management.
Shah, V., Aoudeh, N., Cuglievan-Mindreau, G., Flessa, J. (2023)	To explore the experiences of Black and Brown district leaders in leading for racial justice in the Greater Toronto Area, and the complexities involved in their roles.	Anti-racist leadership requires shifts in perspectives, challenging representation politics, and changing metrics and accountability measures. Leadership is contextual, ambiguous, and goes beyond any individual, role, or generation. Future research should focus on these shifts and contextual complexities.

Discussion and Conclusion

During major upheavals like the COVID-19 pandemic, school leaders play a crucial role in managing complexities and fostering innovation in education. Research shows that principals who balance existing knowledge with new information navigate rapid changes effectively, facilitating innovations in teaching. Key traits for effective crisis leadership include high emotional intelligence, collaboration, and contextual awareness. Engaging stakeholders and adapting practices to meet the unique needs of school communities are essential (Charernnit et al., 2021; Rauseo et al., 2023). International studies highlight the importance of resilience and adaptability for principals in sustaining education during remote learning, even without significant institutional support (Espinosa, 2023). In rural Malaysian primary schools, head teachers face financial constraints and resource shortages but overcome these challenges through creative problem-solving and instructional leadership, emphasizing the importance of passion and resourcefulness (Mansor et al., 2022). Professional identity development is crucial for school leaders during transformational periods, as they internalize new practices and redefine their roles. Continuous professional development and contextual learning foster effective leadership. Despite challenges like physical distancing and virtual learning, positive effects such as increased faculty cohesion and improved learning environments can emerge. Fostering empathy and strong interpersonal relationships significantly enhances school community resilience. To address out-of-field teaching among first-year graduates, targeted support mechanisms like subject-specific mentoring and workload adjustments are necessary. Understanding these challenges and providing adequate support enhances new teachers' capability and retention, ensuring a more stable and effective teaching workforce during turbulent times. Inclusive and equitable leadership is crucial for addressing increasing diversity and associated challenges in schools. The development of social justice leadership (SJL) capabilities among pre-service teachers is fundamental in creating a socially just environment within higher education institutions (HEIs) (Emma Priscilla Barnett & de Klerk, 2023). HEIs play a pivotal role in equipping future educators with the skills to apply social justice principles effectively through dialogue and transformative activism. The wellbeing of multiply marginalized and underrepresented (MMU) teachers is also a significant concern. These educators often face challenges within school systems that favor dominant societal norms. The interplay of relatedness, autonomy, and competence is crucial for their wellbeing, necessitating leadership practices and district policies that support their intersecting identities. Inclusive school leadership is essential for enhancing the achievement of all learners. A model based on international and European policies, developed through the Supporting Inclusive School Leadership (SISL) project, provides a framework for school leaders to address the diverse needs of their communities. This model encourages cross-national collaboration and reflection on policy contexts to ensure high-quality educational opportunities for all. The education of refugee students presents specific challenges, including language barriers, psychological needs, and societal prejudices. Effective leadership in this context requires comprehensive support structures and multicultural education training for staff to improve the educational experiences of refugee students. Early childhood education also necessitates a focused approach to inclusivity and equity (Masnan, Mustafa, & Hosshan, 2017; Samawi, 2023; Vilches, Pighini, Stewart, Rossa-Roccor, & McDaniel, 2023). Understanding and fostering self-efficacy in young children is a priority for early childhood teachers, with implications for curriculum design and implementation. Recognizing the unique developmental needs of younger learners is essential for supporting their growth. Addressing the needs of diverse student and teacher populations involves a commitment to social justice, supportive policies, and an understanding

of the challenges faced by marginalized groups. Promoting inclusive leadership practices can create environments where all educational community members can thrive.

Integrating technological resources into education is essential for modernizing teaching practices and improving learning outcomes (Alenezi, Wardat, & Akour, 2023; Halili & Sulaiman, 2021). The use of popular science films in mathematics teaching has proven effective in making complex concepts more accessible and engaging, creating a more interactive and stimulating learning environment. Augmented reality (AR) and web-based technologies, such as the Schol-AR platform, enhance the presentation and comprehension of research findings, promoting a more dynamic interaction with academic content. Teacher performance in fully online learning contexts is influenced by Technological Pedagogical Content Knowledge (TPACK), organizational support, and technostress. While organizational support enhances performance, technostress poses significant challenges. Addressing these stress factors is crucial for effective technology integration, ensuring teachers can utilize technological tools without being overwhelmed. The role of school principals is pivotal in supporting technological integration (Laouni, 2021; McLeod & Richardson, 2013; Sterrett & Richardson, 2020). Principals who encourage collaborative learning among teachers play a significant role in the successful implementation of new technologies (Garland & Tadeja, 2013; Granger, Morbey, Lotherington, Owston, & Wideman, 2002; Johari, Wahat, & Zaremohzzabieh, 2021). This support builds teacher confidence and competence in using innovative tools and methodologies. In preschool education, principals' perceptions and support significantly impact the successful integration of technology. A comprehensive approach that includes technological innovations is essential for improving the quality of early childhood education. The active involvement of educators and school leaders is necessary to overcome challenges and maximize the potential of technological advancements. Overall, the integration of technology in education requires a multifaceted approach involving media, augmented reality, organizational support, and collaborative learning. By addressing these aspects, educational institutions can create more engaging, efficient, and effective learning environments.

This study significantly contributes to educational leadership by highlighting the necessity of adaptive, inclusive, and technologically proficient leadership, especially during crises like the COVID-19 pandemic. It addresses the unique challenges of rural Malaysian primary schools, showcasing the importance of creative problem-solving and instructional leadership in managing financial constraints. The research emphasizes the need for continuous professional development and contextual learning for school leaders, tackles out-of-field teaching among new teachers by proposing targeted support, and promotes the development of social justice leadership (SJL) among pre-service teachers through higher education. Additionally, it underscores the importance of integrating technology in education to modernize teaching and improve outcomes, while addressing technostress and the need for organizational support.

In conclusion, the VUCA era highlights the need for adaptive, inclusive, and technologically adept leadership in education. Effective school leaders exhibit emotional intelligence, contextual awareness, and collaboration, fostering resilience and innovation. They must balance traditional and emerging practices, especially in resource-constrained rural Malaysian primary schools, where creative problem-solving and instructional leadership are vital. Promoting social justice leadership and supporting marginalized educators enhance inclusivity and equity. Integrating technology like augmented reality and web-based platforms, alongside

targeted educator support, is crucial for modernizing teaching and improving learning outcomes. By nurturing empathy, continuous professional development, and technological integration, school leaders can create dynamic and supportive learning environments. Future research could explore the effectiveness of adaptive leadership in rural schools, technology's impact on teaching, the role of emotional intelligence in leadership, balancing traditional and emerging practices, the development of social justice leadership, and professional development programs for technological proficiency.

Acknowledgements

References

Alenezi, M., Wardat, S., & Akour, M. (2023). The Need of Integrating Digital Education in Higher Education: Challenges and Opportunities. *Sustainability (Switzerland)*. https://doi.org/10.3390/su15064782

Ali Awsat Younus Khalid, O., & Cansoy, R. (2023). Educating refugee students in Türkiye: an inquiry into obstacles faced by school principals. *International Journal of Leadership in Education*. https://doi.org/10.1080/13603124.2023.2290142

Ard, T., Bienkowski, M. S., Liew, S.-L., Sepehrband, F., Yan, L., & Toga, A. W. (2022). *Integrating Data Directly into Publications with Augmented Reality and Web-Based Technologies – Schol-AR*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85132067714&doi=10.1038%2Fs41597-022-01426-y&partnerID=40&md5=ff9e7dd

Barnett, E P, & de Klerk, E. D. (2023). Social Justice Leadership Capabilities for Pre-Service Teachers in Contemporary Times: An Education Policy Perspective. *International Journal of Learning, Teaching and Educational Research*, 22(8), 23–38. https://doi.org/10.26803/ijlter.22.8.2

Barnett, Emma Priscilla, & de Klerk, E. D. (2023). Social Justice Leadership Capabilities for Pre-Service Teachers in Contemporary Times: An Education Policy Perspective. *International Journal of Learning, Teaching and Educational Research*. https://doi.org/10.26803/ijlter.22.8.2

Baskara, FX. R. (2024). ChatGPT and Personalised Learning: Reshaping Pedagogical Approaches in the VUCA Age. *Jurnal Educative: Journal of Educational Studies*. https://doi.org/10.30983/educative.v8i2.7620

Berman, S., Brown, T., Mizelle, C., Diep, T., Gerber, M. R., Jelley, M., … Potter, J. (2023). *Roadmap for Trauma-Informed Medical Education: Introducing an Essential Competency Set*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85164455611&doi=10.1097%2FACM.0000000000005196&partnerID=40&md5=471847b55fc6d3fa2c0050a3fe0eb930

Bianchi, S., & Richiedei, A. (2023). *Territorial Governance for Sustainable Development: A Multi-Level Governance Analysis in the Italian Context*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85147912397&doi=10.3390%2Fsu15032526&partnerID=40&md5=9cb26b3237fd8d6207e26a27a09c60a4

Charernnit, K., Mathur, A., Kankaew, K., Alanya-Beltran, J., Singh, S., sudhakar, P. J., … Singh, N. D. (2021). Interplay of shared leadership practices of principals, teachers'

soft skills and learners' competitiveness in covid 19 era: Implications to economics of educational leadership. *Estudios de Economia Aplicada*. https://doi.org/10.25115/eea.v39i12.6463

Coventry, J., Hampton, J. M., Muddiman, E., & Bullock, A. (2022). *Medical student and trainee doctor views on the 'good' doctor: Deriving implications for training from a Q-methods study*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128075238&doi=10.1080%2F0142159X.2022.2055457&partnerID=40&md5=2a53aee84a892da02bf5b11405b70b4f

Demeshkant, N., Schultheis, K., & Hiebl, P. (2022). *School Sustainability and School Leadership during Crisis Remote Education: Polish and German Experience*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85131527897&doi=10.1080%2F07380569.2022.2071221&partnerID=40&md5=5

Dvoryatkina, S. N., Dyakina, A. A., & Safronova, T. M. (2023). Popular science film as a resource for integrating media education technologies into the mathematics teaching system. *Perspektivy Nauki i Obrazovania*, *66*(6), 192–203. https://doi.org/10.32744/pse.2023.6.11

E Wyatt, J., & Hobbs, L. (2024). Profiling the status of out-of-field teaching in Western Australia: graduate teacher and principal perspectives. *Asia-Pacific Journal of Teacher Education*, *52*(3), 366–388. https://doi.org/10.1080/1359866X.2024.2326878

Espinosa, E. O. C. (2023). Promoting Quality Hybrid Learning Through Leadership and Educational Management. In *Promoting Quality Hybrid Learning Through Leadership and Educational Management*. https://doi.org/10.4018/979-8-3693-0094-7

Espitia, N. F., Zoran, D. L., Clendenin, A., Crosby, S. M., Dominguez, B., Ellis, C. L., … Bissett, W. T. (2021). *Direct measurement of veterinary student learning outcomes for the NAVMEC professional competencies in a multi-uservirtual learning environment*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85102211431&doi=10.3138%2FJVME.0318-025R2&partnerID=40&md5=7bb3aeb5b0cbf38d672a596ed00122c1

Franks, D., Barblett, L., & Kirk, G. (2023). Teachers' Understanding of the Major Sources of Self-efficacy in Early Childhood. *Early Childhood Education Journal*. https://doi.org/10.1007/s10643-023-01566-9

Fullan, M. (2020). The nature of leadership is changing. *European Journal of Education*, *55*(2). https://doi.org/10.1111/ejed.12388

Fullan, M., & Leithwood, K. (2012). 21 st Century Leadership : Looking Forward. *In Conversation*, *IV*(1).

Garland, V. E., & Tadeja, C. (2013). Educational leadership and technology: Preparing school administrators for a digital age. In *Educational Leadership and Technology: Preparing School Administrators for a Digital Age*. https://doi.org/10.4324/9780203134702

Gharipour, M., & Trout, A. L. (2020). *Curriculum development in health and the built environment: creating a multidisciplinary platform to enhance knowledge and engagement*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85083390678&doi=10.1108%2FARCH-09-2019-0212&partnerID=40&md5=8b1c144451877949ca4e246813b6802c

Ghodoosi, F. (2021). Contracting in the age of smart contracts. *Wash. L. Rev*, *96*(51). Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85107160584&partnerID=40&md5=b6bf21cb86cca4b3078721ba8f6f5c9a

Gorsline, K. (2016). What does VUCA environment mean to HR? *Canadian HR Reporter*.

Granger, C. A., Morbey, M. L., Lotherington, H., Owston, R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*. https://doi.org/10.1046/j.0266-4909.2002.00259.doc.x

Halili, S. H., & Sulaiman, S. (2021). Students' perception to integrate education 4.0 in Science program. *Multidisciplinary Journal for Education, Social and Technological Sciences*. https://doi.org/10.4995/muse.2021.14768

Hayes, S. D., & Derrington, M. L. (2023). School leadership in uncertain times: identifying dimensions of effective principal leadership. *School Leadership and Management*, *43*(4), 330–347. https://doi.org/10.1080/13632434.2023.2171002

Herrmann, L., Nielsen, B. L., & Aguilar-Raab, C. (2021). *The Impact of COVID-19 on Interpersonal Aspects in Elementary School*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85108226979&doi=10.3389%2Ffeduc.2021.635180&partnerID=40&md5=43fac72e21db985192b3c650be83d05d

Hong, J., Cross Francis, D., Haskins, C., Chong, K., Habib, K., Ataide Pinheiro, W., … Dickinson, J. (2023). Wellbeing under threat: Multiply marginalized and underrepresented teachers' intersecting identities. *Teachers and Teaching: Theory and Practice*. https://doi.org/10.1080/13540602.2023.2263739

Jiang, M. (2022). *Locating the Principal Sectors for Carbon Emission Reduction on the Global Supply Chains by the Methods of Complex Network and Susceptible–Infective Model*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125803996&doi=10.3390%2Fsu14052821&partnerID=40&md5=49a12eda84fb4bb87bbde9e785d4e235

Johari, A. B., Wahat, N. W. A., & Zaremohzzabieh, Z. (2021). Innovative Work Behavior among Teachers in Malaysia: The Effects of Teamwork, Principal Support, and Humor. *Asian Journal of University Education*. https://doi.org/10.24191/AJUE.V17I2.13387

Juliana, Suwarto, Pramono, R., & Prasetya, A. (2024). Leadership Agility of Indonesian School Leaders During a Crisis: A Grounded Theory Approach. *Journal of Educational and Social Research*. https://doi.org/10.36941/jesr-2024-0008

Kajs, L. T., & McCollum, D. L. (2009). Examining Tolerance for Ambiguity in the Domain of Educational Leadership. *Academy of Educational Leadership Journal*.

Khomova, O. (2021). Trends in the development of tertiary education in the context of modern challenges. *Applied Linguistics Research Journal*. https://doi.org/10.14744/alrj.2021.04372

Kondrashova, E. (2022). Construct of the Quality of Preschool Education in the Representation of School Principals (Evidence from Moscow). *Journal of Curriculum and Teaching*, *11*(3), 1–16. https://doi.org/10.5430/jct.v11n3p1

Krasniqi, R. (2021). *Principal's Role in Supporting Teacher Collaborative Learning*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125811966&doi=10.30828%2FREAL%2F2021.4.5&partnerID=40&md5=ca583167012a5552fdd2ddd1da9984ee

Laouni, N. E. (2021). Principals' technological competencies and technology integration in Moroccan public schools. *International Journal of Leadership in Education*. https://doi.org/10.1080/13603124.2021.2006793

Maipita, I., Dongoran, F. R., Syah, D. H., & Sagala, G. H. (2023). TPACK, ORGANIZATIONAL SUPPORT, AND TECHNOSTRESS IN EXPLAINING TEACHER PERFORMANCE DURING FULLY ONLINE LEARNING. *Journal of*

Information Technology Education: Research, 22, 41–70. https://doi.org/10.28945/5069

Mansor, A. N., Hamid, A. H. A., Medina, N. I., Vikaraman, S. S., Abdul Wahab, J. L., Mohd Nor, M. Y., & Alias, B. S. (2022). *Challenges and strategies in managing small schools: A case study in Perak, Malaysia*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85088997255&doi=10.&partnerID=40&md5=264beecaeba6c66f82bd434e6116c128

Mantai, L., & Marrone, M. (2023). *Academic career progression from early career researcher to professor: what can we learn from job ads*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85146989533&doi=10.1080%2F03075079.2023.2167974&partnerID=40&md5=64c02da032643a246fc1e1fe7880dcee

Masnan, A. H., Mustafa, M. C., & Hosshan, H. (2017). New Preschool Teachers and Implementation of Inclusive Classes Issues in Malaysia. *International Journal of Academic Research in Business and Social Sciences*. https://doi.org/10.6007/ijarbss/v7-i10/3419

McClelland, A. G., Shaw, D., O'Grady, N., & Fattoum, A. (2023). *Recovery for Development: A Multi-Dimensional, Practice-Oriented Framework for Transformative Change Post-Disaster*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85141156375&doi=10.1080%2F00220388.2022.2130055&partnerID=40&md5=62020d7002cbe58eb7022df3c125eab6

McLeod, S., & Richardson, J. W. (2013). Supporting effective technology integration and implementation. *Principal 2.0: Technology and Educational Leadership*.

Noraini, A. L., Faizal, A. G. M., & Enamul, H. K. (2022). Global Leadership Competency for Malaysia Public Sector Educational Leaders. *Jurnal Kurikulum & Pengajaran Asia Pasifik*.

Óskarsdóttir, E., Donnelly, V., Turner-Cmuchal, M., & Florian, L. (2020). *Inclusive school leaders – their role in raising the achievement of all learners*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-8509&doi=10.1108%2FJEA-10-2019-0190&partnerID=40&md5=dd8d1eced5dc37f2e66ec8c232ad57fe

Pietsch, M., Tulowitzki, P., & Cramer, C. (2023). *Innovating teaching and instruction in turbulent times: The dynamics of principals' exploration and exploitation activities*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85130734365&doi=10.1007%2Fs10833-022-09458-2&partnerID=40&md5=fb9058a5df249d7e6d2e27ae4994ede7

RAU. (2020). Volatility, uncertainty, complexity and ambiguity. In *RAU, 4402, Orientation, A 4.1*.

Rauseo, M., Harder, A., Glassey-Previdoli, D., Cattaneo, A., Schumann, S., & Imboden, S. (2023). Same, but Different? Digital Transformation in Swiss Vocational Schools from the Perspectives of School Management and Teachers. *Technology, Knowledge and Learning*. https://doi.org/10.1007/s10758-022-09631-9

Resnick, A. F. (2023). Professional Identity as an Analytic Lens for Principal Learning in Contexts of Transformation. *Educational Administration Quarterly*, *59*(5), 1038–1072. https://doi.org/10.1177/0013161X231204883

Sain, Z. H., Baskara, R., & Vorfi Lama, A. (2024). Rethinking Pedagogy in the Digital Age: Analyzing the Effectiveness of E-Learning Strategies in Higher Education. *Journal of Information Systems and Technology Research*. https://doi.org/10.55537/jistr.v3i1.772

Samawi, F. S. (2023). Empowering Early Learners: The Prospective Impact of Artificial Intelligence on Kindergarten Education. *INTERNATIONAL JOURNAL OF EDUCATIONAL SCIENCES*. https://doi.org/10.31901/24566322.2023/42.1-3.1299

Sterrett, W., & Richardson, J. (2020). Supporting professional development through digital principal leadership. *Journal of Organizational & Educational Leadership*.

Stevenson, A., Wainwright, N., & Williams, A. (2023). *Interventions targeting motor skills in pre-school-aged children with direct or indirect parent engagement: a systematic review and narrative synthesis*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85124259138&doi=10.1080%2F03004279.2022.2034174&partnerID=40&md5=25f6097d2f2e9441598b93fd6cc8192a

Tiwari, P., & Shukla, J. (2022). *Post-Disaster Reconstruction, Well-being and Sustainable Development Goals: A Conceptual Framework*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139645935&doi=10.1177%2F09754253221130405&partnerID=40&md5=e19cac9e25c1f91db689b8dbecde5027

Uzunboylu, H., & Azhar, N. (2023). Mobile learning as a new technology in education. *Global Journal of Information Technology: Emerging Technologies*. https://doi.org/10.18844/gjit.v13i1.8459

Vilches, S. L., Pighini, M. J., Stewart, M. J., Rossa-Roccor, V., & McDaniel, B. (2023). Preparing Early Childhood Educators/Interventionists: Scoping Review Insights Into the Characteristics of Rural Practice. *Rural Special Education Quarterly*. https://doi.org/10.1177/87568705221150514

Youm, J., & Corral, J. (2019). Technological Pedagogical Content Knowledge among Medical Educators: What Is Our Readiness to Teach with Technology? *Academic Medicine*, *94*, S69–S72. https://doi.org/10.1097/ACM.0000000000002912