INSANIA : Jurnal Pemikiran Alternatif Kependidikan
Vol. 29 No. 1, 2024, 17-34
e-ISSN: 2598-3091; p-ISSN: 1410-0053
DOI: 10.24090/insania.v29i1.9566

Digital leadership of school principals to improve the quality of learning in the industrial revolution era 4.0

Muhammad Rasyid Ridho[1]✉, Bambang Budi Wiyono[1], Mustiningsih[1]

[1]Department of Educational Administration, Universitas Negeri Malang
Jl. Semarang 5, Malang 65145, Indonesia
✉muhammadrasyidridho505@gmail.com

Received 13 September 2023; Accepted 13 May 2024; Published 30 June 2024

Abstract: The current globalization has also given rise to new leadership styles, including digital leadership. Digital leadership style is one alternative approach school principals use to improve the quality of learning by utilizing technological sophistication. This study aims to determine the strategy, implementation, and obstacles in the digital leadership of school principals to improve the quality of learning in the era of the Industrial Revolution 4.0 at SMA Muhammadiyah 1 Malang and MA Al Irtqio' Malang City. This study uses a qualitative approach with a multi-site study design conducted at SMA Muhammadiyah 1 Malang and MA Al Irtiqo' Malang City. Data collection techniques include observation, interviews, and documentation. The results showed that in his strategy, the principal sought to conduct technology-based learning media training for educators, seeking the ability of educators to utilize technology. The implementation is done by striving to learn using digital media, completing technology-related facilities, collaborating with various parties, and integrating technology into school administration. The obstacles are children's different backgrounds, conventional teaching, and internet network connectivity.

Keywords: digital leadership; industrial revolution 4.0; learning quality; school principals.

A. Introduction

In an organization, leadership is the main factor in carrying out all important elements in the wheels of organization in society. Without the presence of a leader, an organization will lose control to lead it. According to Yustika, et al. (2020), leadership has a crucial role in the success of an organization. The success or failure of an organization is heavily influenced by its resources. However, the leadership factor also plays a very important role in achieving the success of the organization.

It cannot be denied that the principal is the determinant of policy; the view of the principal is as a determinant of direction in policy formulation. The principal's strategy

Published by Faculty of Tarbiya and Teacher Training, State Islamic University of Prof. K.H. Saifuddin Zuhri Purwokerto

is an important thing to do to build superior and quality schools (J et al., 2023), especially in the digital era of the Industrial Revolution 4.0 as it is today. The task of the school principal is increasingly complex because school work includes not only the formation of a skilled and creative workforce but also involves changing students' thinking patterns to face the ever-changing Industry 4.0 era (Timan et al., 2022).

Entering the era of the Industrial Revolution 4.0, leadership in educational organizations is required to adapt quickly to this fast-paced change. In this fast-paced Industrial Revolution 4.0, leadership requires the right and fast strategy to achieve the goals expected by the organization (Aryawan, 2019). The strategy in question is a plan with various actions to achieve certain goals that must be prepared, and the principal, as a policy maker, can provide technical direction to all of its members (J et al., 2023).

The Industrial Revolution 4.0 is a time when technology and information move very fast, and we need to have quality human resources in education, including the leadership of school principals (Ardiansyah, 2020). Since the emergence of the Industrial Revolution 4.0 and the rapid development of technology, organizations have gradually shifted towards adopting contemporary technology in aspects of work, especially managerial ones (Husban et al., 2021).

Advanced artificial intelligence, supercomputers, genetic engineering, nanotechnology, automatic cars, and a number of other innovative technologies can mark the Industrial Revolution 4.0. Changes in the Economy, Industry, Government, and politics are occurring at an ever-increasing pace, which will significantly impact all aspects of life. In today's world, there is a greater sense of connectedness than ever (Satya, 2018).

The Industrial Revolution 4.0, which has information technology as its main foundation, has integrated itself into human life. With unlimited computing power and data, things now seem limitless, opened by the great connectivity of humans and machines, driven by the extraordinary advancement of the internet and digital technology. This era disrupts various aspects of human life, including science and technology. The challenges faced by the Industrial Revolution 4.0 must be responded to promptly by all stakeholders in the education sector so that Indonesia can increase its competitiveness at the global level (Taufikurrahman, 2021).

As the highest stakeholder in educational organizations, the principal is responsible for all activities related to the successful implementation of education in the context of educational goals (Yani et al., 2021). So it can be said that the principal

is the main determinant of the excellence of the school organization. As leaders, school principals mustave qualified and capable competencies in all fields, because school principals have a huge role in the sustainability of the quality of education (Suharyati & Laihad, 2020). Especially in the Industrial Revolution 4.0, school principals must be able to read all the conditions and situations that will continue to develop so that the educational institutions they lead can continue to compete and continue to exist to produce quality graduate profiles.

Digital leadership is an effort to direct, influence, and make decisions with technology as its basis and guide and influence lasting change through access to technology, initiating change so that it lasts, and building relationships to predict changes that are important for the success of schools in the future (Muslim, 2021). So, in short, digital leadership combines hardware, software, resources, and leaders (Tanti & Sethupathy, 2022).

According to Sheninger (Karakose et al., 2021) explained that digital leadership in education is the ability of individuals to direct, influence others, and initiate sustainable change based on knowledge of digital technology. In addition, digital leadership also includes the ability to build strong relationships and anticipate changes that are important for the future success of schools. Digital leadership is one of the most relevant collaborative approaches, fast in making decisions and oriented to work groups focused on innovation (Oberer & Erkollar, 2018).

There are 7 pillars of digital leadership as explained by Sheninger, which are as follows: communication, public relations, branding, student engagement/learning, professional growth/development, area realignment, and income and opportunity environment (Sheninger, 2019). Furthermore, Sheninger lists five elements of digital leadership:isionary leadership, learning culture in the digital age, excellence in professional practice, systemic improvement, and digital citizenship (Karakose et al., 2021).

The principal's leadership certainly influences the progress and quality of the educational institutions they lead because the principal has the highest authority in making all policies. Therefore, school principals must have a strategy, as explained by Juharyanto, et al (2018), namely, schools must be able to change according to cultural developments and technological advances better changes; this strategy is carried out by continuously seeking and digging for information from various parties as how to design, maintain and develop schools of achievement that are effective and efficient.

Broad insights and knowledge are needed to develop and change schools in a better direction.

In his role, the school principal has a very strategic position; this is as explained by Sobri (2018) that the role and responsibility of the school principal is very large, including overseeing the changes that occur so that the school he leads can keep abreast of technological developments and can compete with other schools. Besides that, school principals are also responsible for preparing educators to improve the quality of learning in line with the Industrial Revolution that occurred in the world of education (Puspitaningyas et al., 2019). Therefore, the ability of the principal must always be upgraded considering the changes that continue to occur, so with this, it is hoped that the principal will be able to carry out his duties and roles properly (Sobri, 2018).

Many current problems will be faced in educational institutions, especially in the Industry 4.0 era. According to Ningrum and Sobri quoted by Sunarijah (2018), one of education's problems today is the low quality of education at every level. In addition, the challenge faced is that not all school principals can adapt to the changes that occur. Besides that, the lack of knowledge of school principals about leadership transformation in the 21st century is also an issue that needs to be addressed (Nursyifa, 2019). Of course, this is a challenge for school leaders in developing quality and competitive talent in this global era (Ningrum & Sobri, 2015). Improving the quality of education in this globalization era focuses on the role of the school principal as the main actor in determining the direction and developing the quality of education.

The Industrial Revolution 4.0 Era is the time for surviving amid global currents. Apart from the problems above, other problems that arose in education in the Industrial Revolution 4.0 era, according to Wanyama quoted by Mustiningsih et al. (2020) is related to the ability of educators to develop innovations to improve learning outcomes. Besides that, another big challenge is improving the quality of learning amid the swift currents of globalization (Jannah, 2020). Therefore, school leaders must have special skills to be able to compete ,survive, and be able to advance amid globalization and technological developments that continue to advance.

Digital leadership is, of course, very influential on the development of student achievement. The results of research by Hartati et al. (2023) show that 98% strongly agree that digital leadership in learning is essential in improving teacher abilities in classroom management. Another study conducted by Robiah and Nurdin (2021)

explains that digital-based leadership can encourage teachers to make maximum use of information technology so that it affects student achievement. Therefore, the principal must be able to adapt to changing times as a challenge and opportunity in improving the quality of learning. For this reason, implementing a remote leadership model by utilizing advanced technology is a must. In this way, school principals can continue to teach and supervise teacher performance anytime and anywhere (Maisyaroh et al., 2020).

From the explanation above, this study tries to explore how the principal's digital leadership strategy is to improve the quality of learning in the industrial revolution 4.0 era, the implementation of the principal's digital leadership to improve the quality of learning in the industrial revolution era 4.0, and the obstacles to the principal's digital leadership to improve the quality of learning in the era of the industrial revolution 4.0.

B. Method

This research uses a qualitative approach with a multi-site study design, one of the methods used to develop theories based on data from several similar research locations. This designs expected to produce theories that can be widely applied and relevant (Ulfatin & Triwiyanto, 2021). The location of this research was SMA Muhammadiyah 1 Malang, located in Jl. Brigadier General Slamet Riadi 134, Oro-oro Dowo, Klojen, Malang City. In contrast, MA Al Irtiqo' Malang City is located on Jl. Letjend S. Parman No. 26 Purwantoro, Blimbing, Malang City. The subjects of this study were the principal, vice principal, and two subject teachers from each school as seen as on Table 1. Data collection techniques include observation, interviews, and documentation.

Table 1. Research subject

No	Name	Institutions	Position
1	Iswati, S.Pd	SMA Muhammadiyah 1 Malang	Vice Principal of Curriculum
2	Maya Marisa, S.Pd	SMA Muhammadiyah 1 Malang	Subject Teacher
3	Ngadiono, S.Pd.I., M.Pd	SMA Muhammadiyah 1 Malang	Subject Teacher
4	Budi Prasetyo, M.Pd	MA Al Irtiqo' Kota Malang	Principal of Madrasah
5	Budi Prasetyo, M.Pd	MA Al Irtiqo' Kota Malang	Vice Principal of Curriculum
6	Ubaidillah, M.Pd	MA Al Irtiqo' Kota Malang	Subject Teacher
7	Ashori, S.Pd	MA Al Irtiqo' Kota Malang	Subject Teacher

Data analysis is performed using case data analysis and cross-site analysis. In single-site analysis, researchers used an interactive model that Miles et al. (2014) developed. The steps in analyzing data carried out interactively are: 1) data collection,

2) data condensation, 3) data presentation, and 4) concluding. At the same time, cross-site data analysis is the process of comparing findings obtained from each site and also the process of integrating data between sites. Initially, the findings of SMA Muhammadiyah 1 Malang were processed and analyzed inductively and conceptually, then compared with theory and elaborated in the form of narrative explanations that formed certain propositions. Furthermore, a similar process was carried out with the findings of MA Al Irtiqo' Malang City, thus producing a substantive theory II.

C. Result and Discussion

The definition of digital leadership tends to be found more inusiness management because initially, digital leadership was more widely applied to the business sector (Ridho et al., 2023). Digital leadership is an umbrella term to refer to leadership models that refer to technologies such ase-leadership, technology leadership, virtual leadership, or leadership 4.0 (Karakose & Tülübaş, 2023). In comparison, Peng (2021) defines digital leadership as the ability that individuals or organizations must have in the digital technology era to lead other people, teams, or entire organizations to make a full impact on digital thinking by utilizing digital insights, digital decision-making, digital implementation, and digital guidance to ensure that the goals that have been set are achieved.

Meanwhile, Yusof et al. (2019) explained that digital leadership is the integration of digital technologies such as mobile devices, communication applications, and web applications that use networks in school leadership practices towards sustainable changes in the use of technology in schools, this is as shown in Figure 1 about the digital leadership pillar. The term digital leadership emerged due to a response to the rapid development of technology in the 21st century. Digital leadership generally focuses on utilizing information technology to serve customers in various sectors and organizations, including educational and non-educational organizations (Zubaidah & Putra, 2022). So, from the various definitions, it can be concluded that digital leadership is an interrelated combination of a leader, technology and resources.

Figure 1. Pillars of Digital Leadership

The principal comes from two words, namely principal and school. The head can be interpreted as the chairperson or leader, while the school is defined as an institution with teaching and learning activities. The principal is defined as a functional teacher who is tasked with leading a school where the teaching and learning process occursr where interactions occur between the teacher giving the lesson and the students receiving the lesson (Nababan et al., 2021). According to another definition, the principal is the highest official in a school and is tasked with overseeing all aspects of the ongoing management of the institution to achieve educational goals. A school principal must ensure that every aspect of managing an educational institution runs smoothly, including planning, implementing the curriculum, providing and utilizing teacher resources, enrolling students, fostering positive parent-school relationships, and producing quality graduates (Yani et al., 2021).

1. Principal's digital leadership strategy to improve the quality of learning in the industrial revolution era 4.0

Education, in general, is a structured activity designed to produce quality human beings (Sunu, 2022). These activities are carried out through a learning process that involves educators and students. In carrying out the educational activities, the leadership of the school principal is the key so that the teaching and learning activities run effectively and innovatively. Principals play an important role in improving the quality of educators, especially in the current era of information technology, which is developing rapidly. The 21st-century school principal must be a leader in technology implementation by using technology as the main tool to transform teaching and learning (Dasmo et al., 2021).

Strategy is one way for the principal to achieve the goals that have been determined; without a strategy that has been made, of course, there will be a deadlock. As school principals who have significant responsibility in advancing the educational

institutions they lead, they must certainly have a strategy to improve the quality of learning in the era of the Industrial Revolution 4.0.

Based on the findings of researchers at SMA Muhammadiyah 1 Malang and MA Al Irtiqo' Malang City about the principal's digital leadership strategy that, the two principals are trying to integrate digital leadership by utilizing technological advances, namely in the early stages of conducting training on learning media technology based as shown in Figure 2. The rapid development of technology must be responded to wisely by the principal as the highest stakeholder in the educational institution he leads, because the principal has the highest authority in making decisions and policies to achieve the school's vision and mission. The vision and mission of schools in the 21st century can be realized if the principal applies an approach through digital leadership and directs all components of the school (Timan et al., 2022).

Figure 2. Educator Workshop at SMA Muhammadiyah 1 Malang

In responding to technological developments that occur, school principals who use a digital leadership style must be able to read the situation and conditions of technological developments, namely by implementing strategies in response to globalization so that the schools they lead can compete with other schools and produce quality graduate profiles. Strategy is one way to mobilize all the capabilities of human resources in an organization so that they canork together and synergize with each other to achieve organizational goals (Aryawan, 2019). Identifying follower readiness for business-based Digital information can be done by adjusting between indicators of digital information readiness and proficiency with readiness-level followers in leadership (Farunik, 2019).

The strategies from site I and site II are more inclined to be the same as those applied by the school principal in achieving goals with digital leadership for the quality of learning. It can be seen on sites I and II, where the school principal facilitates training

and workshops on learning media, and that on sites I and II, the school principal directs that the use of technology in learning is maximized. The researcher saw that at site I, the principal was only more inclined to briefing. It was different from site II, where the principal took part directly in several instructional media trainings. A quality school is not only seen from the number of programs offered but also from the headmaster, who is skilled at taking advantage of opportunities to bring change to the organization he leads (Ridho et al., 2023).

Digitalization in education is a response to Education 4.0 and is in line with the Industrial Revolution 4.0, which requires educators to have additional capabilities, namely digital competence (Sunu, 2022). This is in line with the statement of Luecha et al. (2022) that educators and education staff must have the skills and competencies such as digital literacy, digital pedagogy and communication skills. Therefore, educators in this era must be able to make technological skills the basis for developing student achievement.

2. Implementation of principal's digital leadership to improve the quality of learning in the industrial revolution era 4.0

To improve the quality of learning in the Industrial Revolution 4.0 era, the presence of a digital leadership style is expected to provide innovation and develop creativity in terms of learning carried out by educators. Utilization of the computer laboratory as implemented on site I is a form of digital leadership implementation in improving the quality of learning. Figures 3 and 4 are examples of SidikMu application and e-library in SMA Muhammadiyah 1 Malang can help students improve literacy understanding. On site I, the principal has facilitated by providing fingerprints for educators to strengthen discipline. Besides that, the provision of projectors in each class helps educators in providing material in the form of slides.

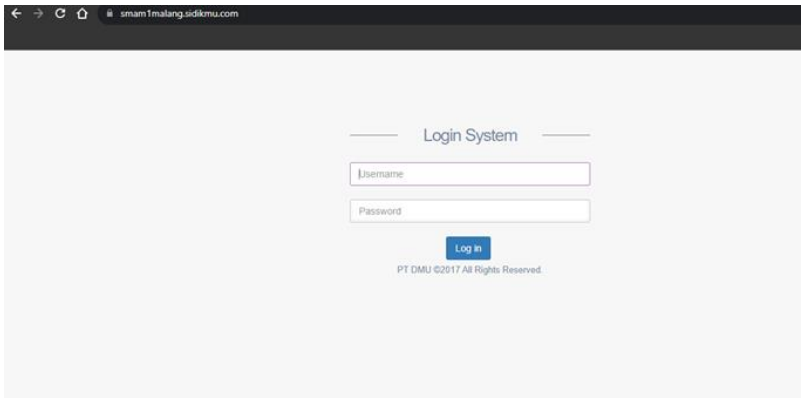

Figure 3. Application of SidikMu SMA Muhammadiyah 1 Malang

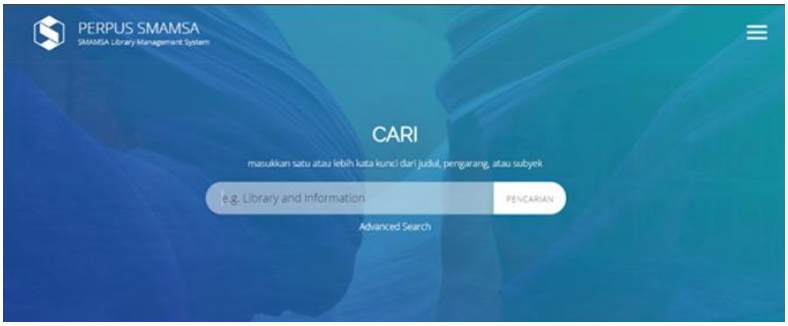

Figure 4. Application of e-Library SMA Muhammadiyah 1 Malang

It is different from site II, where the implementation of the principal's digital leadership has been fully integrated with technology such as guest books in Figure 6, teacher teaching journals in Figure 5, Ma'had activity journals, and the use of e-books. Besides that, to support the improvement of the quality of learning, MA Al Irtiqo' Malang City provides students with laptops, which it is hoped can support the success of learning as shown as in Figure 7. It is by (Husban et al., 2021) opinion, which explains that the synergy of leadership and technology in organizational leadership through global vision, constructive collaboration, and in-depth knowledge will lead the organization to success. This certainly affects increasing organizational effectiveness and efficiency by utilizing technological developments and digital platforms to motivate followers and optimize resources.

Another innovation implemented by the principal's digital leadership on site II is the purchase of an application in the form of a barcode for student attendance so parents can see it immediately. The use of the Siponsel application implemented by MA Al Irtiqo' Malang City also impacts the quality of learning. Besides that, educators' understanding of technology is very good, and this can be seen from all educators who deliver material using technology assistance. Hamzah, et al (2021) states that the use of teaching aids such as digitalization in the process of learning activities is important to attract students' interest and improve achievement. Educators achieve their goals in teaching a subject.

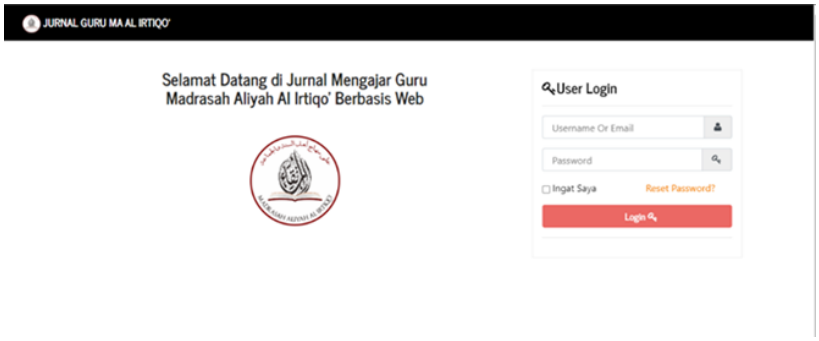

Figure 5. Teaching Journal of MA Al Irtiqo' Teachers in Malang City

Figure 6. Digital Guest Book of MA Al Irtiqo' Malang City

Another thing in implementing digital leadership for school principals is to carry out several international activities such as comparative studies to Turkey, student exchanges to Thailand, and cultural studies to Malaysia, as well as conducting guest teacher programs presented both from within the country and abroad. This activity can be seen in Figure 8 and Figure 9. It is following one of the pillars of digital leadership, namely a global outlook and dual citizenship (Sheninger, 2019).

Figure 7. Use of Laptops by MA Al Irtiqo' Students in Malang City

The flow of developments in this modern era requires humans to always reconstruct new things that can improve the quality of human life, so that they become superior human beings and canompete amidst the rise of globalization (Ridho et al., 2023). It is undeniable that developments that occur certainly impact the quality of education, so leadership is needed in this case, namely school principals who are professional, reliable, and able to read all the changes that occur (Ridho et al., 2023). Principals in this era must have knowledge, skills and understanding of technology-based leadership to organizeducation and learning (Wiyono et al., 2023).

Figure 8. Implementation of MA Al Irtiqo' Guest Teacher in Malang City

Figure 9. Study Tour and Learning MA Al Irtiqo' Malang City to Turkey

A quality school is seen not only from the number of programs offered, but alsorom the headmaster, who is skilled at taking advantage of opportunities to bring change to the organization he leads (Ridho et al., 2023). So, in relation to the quality of education, the digital leadership of school principals is an important key to facing the current era of technological disruption. The results of the research conducted (Agustina et al., 2020; AlAjmi, 2022; Sunu, 2022; Tanti & Sethupathy, 2022; Zhong, 2017) show that the principal's digital leadership has a positive impact on the learning process. It is due to leaders who have digital characters so that educators feel motivated and excited, and tend to free them to manage the class and reflect on their learning. In addition, school principals who have the skills and knowledge of technology directly impact the integration of educators in teaching.

3. Obstacle digital leadership of school principals to improve the quality of learning in the industrial revolution era 4.0

Not everything will go well when implementing the school principal's digital leadership that has been determined. Internal and external factors will cause obstacles or obstacles. The principal's digital leadership must be able to provide solutions to the obstacles that occur because the principal has the highest authority as a leader.

On-site I, it can be seen that the obstacles in implementing digital leadership are caused by internal factors, namely the wifi, which is not fast enough, and there are still senior educators who still use conventional teaching methods. As a school principal who applies digital leadership, he must always have a solution to the obstacles that occur at SMA Muhammadiyah 1 Malang.

On-site II there are several obstacles in digital leadership, one of which is students who are not used to using technology in everyday life because some students do not live in urban areas and are used to using technology daily. Students only know the use of technology, just browsing. Even though the benefits of digital technology are very diverse, this is an obstacle to implementing digital leadership.

In improving the quality of learning, a digital leader must pay attention to 3 (three) aspects related to improving the quality of education, including 1) students and educators have access to digital technology and the internet, 2) quality material is available, and 3) educators have the knowledge and skills in operating digital technology (Nugroho, 2014). According to Husban et al., (2021) explains that the synergy of leadership and technology in organizational leadership through global vision, constructive collaboration, and in-depth knowledge will lead the organization to success. It certainly affects increasing organizational effectiveness and efficiency by utilizing technological developments and digital platforms to motivate followers and optimize resources.

D. Conclusion

The principal's digital leadership strategy to improve the quality of learning in the industrial revolution 4.0 era includes training and workshops at the end of each semester, which aim to improve the abilities and skills of educators in teaching, optimizing all educators to conduct teaching on a digital basis which aims to familiarize teachers in the use of technology and as a form of implementation of the training that

has been carried out. Implementation of school principals' digital leadership to improve the quality of learning in the Industrial Revolution 4.0 era, including utilization of facilities and infrastructure that have been provided, such as computer laboratories, LCDs, projectors, laptops, and applications that can support the success of digital leadership in the industrial revolution era 4.0, conduct several collaborations with educational institutions and carry out several international programs such as comparative studies, student exchanges, and guest teachers which aim to broaden thinking and add to the learning experience for students, integrating technology into activities in the school environment such as document archiving digital-based, digital-based financing, digital guestbook, digital teacher teaching journal, Fingerprint as educator attendance and barcode for student attendance, integrating technology in computer-based assessments, using e-libraries and parent meetings with the Hybrid system.

Obstacles to school principals' digital leadership in improving the quality of learning in the Industrial Revolution 4.0 era include software that has not been updated, diverse backgrounds of students, and inadequate internet connectivity. The suggestion for this research is that school principals must master more about understanding digital leadership to provide more innovation to educators; besides that, principals must be fast and able to adapt amid rapid technological developments by constantly upgrading abilities and understanding. In addition, teachers must always be literate about technology and use technology as the primary basis for improving the quality of learning. Teachers must also enhance their understanding and skills regarding digital-based learning innovations. The research results are expected to be a reference and add to the wealth of knowledge about the principal's digital leadership to improve the quality of learning in the era of the Industrial Revolution 4.0. Other researchers should conduct research with a broader scope and review the results of this research, especially now that the Industrial Revolution has entered the era of Society 5.0.

References

Agustina, R., Kamdi, W., Hadi, S., Muladi, & Nurhadi, D. (2020). Influence of the Principal's Digital Leadership on the Reflective Practices of Vocational Teachers Mediated by Trust, Self Efficacy, and Work Engagement. *International Journal of*

Learning, Teaching and Educational Research, *19*(11), 24–40. https://doi.org/10.26803/ijlter.19.11.2

AlAjmi, M. K. (2022). The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait. *International Journal of Educational Research*, *112*(January), 1–10. https://doi.org/10.1016/j.ijer.2022.101928

Ardiansyah. (2020). Kepemimpinan Kepala Sekolah Pada Era Revolusi Industri 4.0 di Sekolah Menengah Pertama (SMP) As-Sulthon Kecamatan Mersam Batanghari. *Prosiding Seminar Internasional: Tantangan Manajemen Pendidikan Islam, Hukum Islam Dan Bahasa Melayu Di Era Revolusi 4.0*, 167–176.

Aryawan, I. W. (2019). Strategi Kepemimpinan Kepala Sekolah Di Era Revolusi Industri 4.0 Berlandaskan Pada Konsep Panca Upaya Sandhi. *Jurnal Ilmiah Ilmu Sosial*, *5*(2), 132–141. https://doi.org/10.23887/jiis.v5i2.22519

Dasmo, D., Notosudjono, D., Sunardi, O., & Binoardi, H. (2021). Analisis Indikator Kepemimpinan Teknologi Kepala Sekolah Sebagai Pemimpin Implementasi Teknologi Abad 21. *Idaarah: Jurnal Manajemen Pendidikan*, *5*(2), 240–252. https://doi.org/10.24252/idaarah.v5i2.24095

Farunik, C. G. (2019). Strategi Digital Leadership menurut Pendekatan Kepemimpinan Situasional. *Primanomics: Jurnal Ekonomi Dan Bisnis*, *17*(1), 1–13. https://jurnal.buddhidharma.ac.id/index.php/PE/article/view/95

Hamzah, N. H., Nasir, M. K. M., & Wahab, J. A. (2021). The Effects of Principals' Digital Leadership on Teachers' Digital Teaching during the Covid-19 Pandemic in Malaysia. *Journal of Education and E-Learning Research*, *8*(2), 216–221. https://doi.org/10.20448/journal.509.2021.82.216.221

Hartati, S., Nurdin, D., & Arisandi, D. (2023). Edukasi Kepemimpinan Digital pada Pembelajaran di Sekolah Menengah Kejuruan Abdurrab Pekanbaru. *Jurnal Pengabdian Nasional (JPN) Indonesia*, *4*(2), 238–244. https://doi.org/10.35870/jpni.v4i2.155

Husban, D. A. O. A., Almarshad, M. N. D., & Altahrawi, M. A. (2021). Digital Leadership and Organizations's Performance: The Mediating Role of Innovation Capability. *International Journal of Entrepreneurship*, *25*(5), 1–16. https://www.researchgate.net/publication/359774002

J, F., Arafat, Y., & Furqan, N. (2023). Principal's Strategy in Improving Educational Quality. *JMKSP: Jurnal Manajemen, Kepemimpinan, Dan Supervisi Pendidikan*, *8*(2), 492–499. https://doi.org/10.31851/jmksp.v8i2.11321

Jannah, L. K. (2020). Kepemimpinan Kepala Sekolah dalam Menghadapi Era Revolusi Industri 4.0 : Perspektif Manajemen Pendidikan. *Islamika: Jurnal Keislaman Dan Ilmu Pendidikan*, *2*(1), 129–139. https://doi.org/10.36088/islamika.v2i1.471

Juharyanto, A, I., Bafadal, I., Sobri, A. Y., & Nurabadi, A. (2018). Effective Leadership on Curriculum 2013 Implementation in Religious Based Schools. *The Journal of Social Sciences Research*, *2*, 40–48. https://doi.org/10.32861/jssr.spi2.40.48

Karakose, T., Polat, H., & Papadakis, S. (2021). Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the covid-19 pandemic. *Sustainability*, *13*(23). https://doi.org/10.3390/su132313448

Karakose, T., & Tülübaş, T. (2023). Digital Leadership and Sustainable School Improvement-A Conceptual Analysis and Implications for Future Research. *Educational Process: International Journal*, *12*(1), 7–18. https://doi.org/10.22521/edupij.2023.121.1

Luecha, C., Chantarasombat, C., & Sirisuthi, C. (2022). Program Development of Digital Leadership for School Administrators Under the office of Primary Educational Service Area. *World Journal of Education*, *12*(2), 15–27. https://doi.org/10.5430/wje.v12n2p15

Maisyaroh, Juharyanto, Bafadal, I., Wiyono, B. B., Adha, M. A., Saputra, B. R., & Ariyanti, N. S. (2020). Implementation of Principal Instructional Leadership in Facilitating Learning Independency Policy on 4.0 Industrial Era Orientation in Indonesia. *Proceedings of the 2nd Early Childhood and Primary Childhood Education (ECPE 2020)*, 206–211. https://doi.org/10.2991/assehr.k.201112.037

Miles, M. B., Huberman, A. M., & Saldana, H. (2014). *Qualitative Data Analysis: a methods sourcebook* (3rd ed.). Sage.

Muslim, M. (2021). Visi Kepemimpinan Digital Kepala Sekolah Dasar Di Era Teknologi Digital. *Elementeris: Jurnal Ilmiah Pendidikan Dasar Islam*, *3*(1), 1–13. https://doi.org/10.33474/elementeris.v3i1.8796

Mustiningsih, M., Maisyaroh, M., & Ulfatin, N. (2020). Peran Kepemimpinan Visioner Kepala Sekolah Hubungannya Dengan Kesiapan Guru Menyongsong Revolusi Industri 4.0. *Jurnal Manajemen Dan Supervisi Pendidikan*, *4*(2), 101–112. https://doi.org/10.17977/um025v4i22020p101

Nababan, T. M., Zainuddin, Purba, S., Batu, J. S. L., & Sianipar, G. (2021). School Leadership Strategies in the Digital Era. *Proceedings of the 6th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2021)*, *591*, 103–106. https://doi.org/10.2991/assehr.k.211110.068

Ningrum, E. S., & Sobri, Ah. Y. (2015). Implementasi Kurikulum 2013 di Sekolah Dasar. *Manajemen Pendidikan*, *24*(5), 416–423.

Nugroho, M. A. (2014). Pemanfaatan Teknologi Informasi dalam Peningkatan Mutu Pendidikan Islam di Madrasah. *Mudarrisa: Jurnal Kajian Pendidikan Islam*, *6*(1), 30–60. https://doi.org/10.18326/mdr.v6i1.30-60

Nursyifa, A. (2019). Kepemimpinan Kepala Sekolah dalam Menghadapi Era Revolusi Industri 4.0: Perspektif Sosiologi Pendidikan. *Jurnal Pendidikan Kewarganegaraan*, *6*(2), 143–154. https://doi.org/10.32493/jpkn.v6i2.y2019.p143-154

Oberer, B., & Erkollar, A. (2018). Leadership 4.0: Digital Leaders in the Age of Industry 4.0. *International Journal of Organizational Leadership*, *7*(4). https://doi.org/10.33844/ijol.2018.60332

Peng, B. (2022). Digital leadership: State governance in the era of digital technology. *Cultures of Science*, *5*(4), 210–225. https://doi.org/10.1177/2096608321989835

Puspitaningyas, I., Arifin, I., & Mustiningsih. (2019). The Strengthening of the Principal's Competence in Order to Improve Teacher's Learning in the Era Of Industrial Revolution 4.0. *5th International Conference on Education and Technology (ICET 2019)*, *382*, 571–574. https://doi.org/10.2991/icet-19.2019.142

Ridho, M. R., Lesmana, I., Safitri, H. D. A., Meirani, R. K., & Prestiadi, D. (2023). Digital Leadership in the Scope of Education. In *Proceedings of the International Conference on Educational Management and Technology (ICEMT 2022)* (pp. 52–61). Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-95-4_7

Robiah, P. S., & Nurdin, D. (2021). Implementation of Digital Leadership in developing student learning at SMP Manggala Kab. Bandung. *Proceedings of the 5th International Conference on Research of Educational Administratuon and Management (ICREAM 2021)*, 23–27.

Satya, V. E. (2018). Strategi Indonesia Menghadapi Industri 4.0. *Info Singkat: Kajian Singkat terhadap Isu Aktual dan Strategis*, *10*(09), 19-24.

Sheninger, E. (2019, August 31). *Pillars of Digital Leadership*. International Center for Leadership in Education. https://leadered.com/pillars-of-digital-leadership/

Sobri, A. Y. (2018). Penguatan Kompetensi Kepala Sekolah dalam Meningkatkan Kualitas Pembelajaran. *Seminar Nasional Administrasi Pendidikan Dan Manajemen Pendidikan*, 98–104. https://ojs.unm.ac.id/semapfip/article/view/6099

Suharyati, H., & Laihad, G. H. (2020). Model of School Principal Leadership Shaping Pedagogic Competence and Teacher Digital Literacy. *Advances in Social Science, Education and Humanities Research*, *438*, 328–333. https://doi.org/10.2991/assehr.k.200513.075

Sunarijah. (2018). Upaya Meningkatkan Mutu Sekolah Dasar Menghadapi Era Revolusi Industri 4.0. *Ta'dibia: Jurnal Ilmiah Pendidikan Agama Islam*, *8*(2), 15–26.

Sunu, I. G. K. A. (2022). The Impact of Digital Leadership on Teachers' Acceptance and Use of Digital Technologies. *Mimbar Ilmu*, *27*(2), 311–320. https://doi.org/10.23887/mi.v27i2.52832

Tanti, R., & Sethupathy, K. (2022). A Study on the Impact of Teachers' Online Teaching and Principals' Digital Leadership During Covid 19. *International Journal of Engineering, Business and Management (IJEBM)*, *6*(6), 36–41. https://doi.org/10.22161/ijebm.6.6

Taufikurrahman. (2021). Kepemimpinan Kepala Sekolah di Era Digital. *Proceeding: Islamic University of Kalimantan,* *1*(1), 155-161. http://dx.doi.org/10.31602/.v0i0.4713

Timan, A., Mustiningsih, M., & Imron, A. (2022). Digital Leadership Kepala Sekolah Hubungannya dengan Kinerja Guru dan Kompetensi Siswa Era Abad 21. *JAMP : Jurnal Administrasi Dan Manajemen Pendidikan*, *5*(4), 323–333. https://doi.org/10.17977/um027v5i42022p323

Ulfatin, N., & Triwiyanto, T. (2021). *Metode Penelitian Kualitatif untuk Keguruan & Pendidikan*. Erlangga.

Wiyono, B. B., Komariah, A., Alghamdi, A. A., Sultoni, & Fahlevi, M. (2023). The Influence of Principals' e-Leadership on the Effectiveness of Schools' Public Relations and Organizational Improvement. *Sustainability*, *15*(2), 1296. https://doi.org/10.3390/su15021296

Yani, N. A., Kristiawan, M., & Martha, A. (2021). Leadership of the principal in improving the professional competence of teachers in the digital age. *JPGI (Jurnal Penelitian Guru Indonesia)*, *6*(1), 268–274. https://doi.org/10.29210/021040jpgi0005

Yusof, M. R., Yaakob, M. F. M., & Ibrahim, M. Y. (2019). Digital leadership Among School Leaders in Malaysia. *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, *8*(9), 1481–1485. https://doi.org/10.35940/ijitee.i8221.078919

Yustika, Y., & Syamsiyah, S. N. (2020). Peran Kepemimpinan dalam Organisasi Lembaga Pendidikan Islam. *Produ: Prokurasi Edukasi Jurnal Manajemen Pendidikan Islam*, *2*(1), 55–64. https://doi.org/10.15548/p-prokurasi.v2i1.2248

Zhong, L. (2017). Indicators of Digital Leadership in the Context of K-12 Education. *Journal of Educational Technology Development and Exchange*, *10*(1), 27–40. https://doi.org/10.18785/jetde.1001.03

Zubaidah, Z., & Putra, R. S. (2022). Model Kepemimpinan Digital Kepala Sekolah di Era Teknologi. *Jurnal Mudarrisuna: Media Kajian Pendidikan Agama Islam*, *12*(4), 803–824. https://doi.org/10.22373/jm.v12i4.17206