Implementation of the School Curriculum to Empower Education in the Digital Era 4.0 for Quality Human Resources

Febriani Dwi Sari[1*], Rugaiyah[2]
[1,2] Jakarta State University, Jakarta, Indonesia

Sections Info	ABSTRACT
	Objective: The development of the digitalization era cannot be avoided. The development of science in various fields, mainly Information and Communication Technology (ICT), is rapidly increasing. An educator needs to update and introduce students to be more technology literate. One is implementing a curriculum that empowers education in the digital era 4.0. This research aims to provide an understanding that the right curriculum for students will produce quality human resources in the era of globalization. **Method:** This research uses a qualitative approach with a literature study or literature review method. Data was collected by reviewing official sites such as Google Scholar, Research Gate, Public and Perish, and Sinta. **Result:** The results showed that implementing a curriculum relevant to the demands of the times is a must. The curriculum must reflect learners' needs and create creative, innovative, and competitive individuals. **Novelty:** This research offers new insight into implementing a school curriculum that supports enhancing students' digitalization capabilities in the Industry 4.0 era. In addition, this research also explores how curriculum can play a role in creating quality human resources. This research recommends that education should continue to be sensitive to the times and implement the curriculum according to the needs of current and future learners.

INTRODUCTION

The Era of Globalization can be called the Digital Era or the Industrial Revolution 4.0, where barriers between countries are no longer limited by distance and time. This aligns with the opinion of Larsson (2001) in the book "The Race to the Top: The Real Story of Globalization," which argues that globalization is a process of shrinking the world so that distances are getting shorter and everything feels closer. In this era, the development of science is extraordinary in various fields, especially in Information and Communication Technology (ICT), which is sophisticated, making this world increasingly narrow. Everyone can access science, news, and other information using technology. Of course, this has an impact on all sectors of life. One of them is the development of education in Indonesia.

Everyone cannot avoid changes in this era. Therefore, adequate preparation of human resources (HR) is needed to adjust and compete in this era of globalization. According to Amirudin (2019), quality human resources are those who have the expertise, ability, and skills to produce goods or services that curry and determine their quality of life. Amirudin further explained that improving the quality of human resources can be done through 3 main channels, namely the formal education channel, consisting of general and vocational education starting from elementary school, junior and senior high schools, and universities.

Improving the quality of human resources through education, from primary and secondary education to higher education, is the key to keeping up with the

Development of the Industrial Revolution 4.0 era. Education plays a vital role as a means to improve the quality of HR in ensuring the sustainability of a nation's development because education is the main instrument of human resource development; this development is not only based on human quality in mastering a particular skill but can also make humans reliable (desirable person quality) and creative, innovative, and competitive.

Building highly competitive human resources is an absolute and urgent need. This is because HR is one of the strategic resources owned by the organization that must be continuously fostered and developed on an ongoing basis. There are eight strategies for building highly competitive HR, namely: 1) build a recruitment and selection system, 2) determine the placement system; 3) determine the performance appraisal system; 4) improve HR competencies; 5) develop an education and training system; 6) make changes to work culture; 7) Develop a payroll system, and 8) develop an HR Information System. Making this a reality takes effort, hard work, and sufficient commitment from all elements of the business world, academia/universities, the community, especially company leaders and owners/shareholders. By using this eighth strategy, HR competitiveness can be increased.

Education is expected to allow individuals to recognize their potential and develop their creativity. This means that the definition of education quality is related to meeting the needs and expectations of students (Dian & Dwi, 2021). There are various approaches to measuring education quality. Education can be measured by examining the relationship between inputs and outputs. However, some experts emphasize the importance of the process component (Dian & Dwi, 2021). This suggests that inputs, processes, and outputs are essential interconnected components that influence the quality of education. Inputs include all the resources and software that a process needs to run.

The process involves actions or operations leading to school learning, training, education, and scholarly activities. Output is the result of the process that has been carried out. The consequence of this view is that if education wants a quality process, education needs to fulfill the inputs needed. A quality education process will produce the desired output. Thus, input is one of the fundamental components needed to realize quality education. These inputs include educators, students, learning facilities, curriculum, and the surrounding environment (Dian & Dwi, 2021).

According to Khoirurrijal (2022), the curriculum is a design regarding rules consisting of several components and ways that are used as a reference for carrying out learning activities to achieve national education goals. Furthermore, Atik et al. (2023) explained that the curriculum must contain students' competencies as future projections and how to realize or achieve these competencies. Because students are the reference of the curriculum, changes are often made in curriculum development to achieve the main content of the curriculum. A good curriculum is a curriculum that fits the times, which means that the curriculum must continue to be developed according to the context and characteristics of students in order to build competencies according to their needs, present and future. Optimizing the four pillars of education, namely learning to know, learning to do, learning to live together, and learning to be and facing all challenges, educational institutions must be able to develop a curriculum that is by current demands and refers to technological developments. Curriculum and learning are prepared and developed to achieve educational goals, namely, preparing students to

live in society. Therefore, it is essential to conduct an appropriate curriculum analysis based on the demands of the Era of Globalization.

This research provides a new perspective on how school curricula can be structured to support students' digitalization capabilities in the Industry 4.0 era and create quality human resources. In this context, it is essential for education to continuously update the curriculum to the demands of the times so that it can meet the needs of current and future learners. The era of digitalization has brought unavoidable changes. Scientific advances, especially in Information and Communication Technology (ICT), are developing rapidly. Therefore, educators must be active in updating their knowledge and integrating technology into their teaching to improve students' digital literacy. One way to achieve this is by implementing a curriculum that enables the utilization of technology in learning in the digital 4.0 era.

This study aims to confirm that a curriculum relevant to students' needs will produce human resources ready to compete in the era of globalization. A good curriculum must be responsive to the times while considering learners' characteristics and needs to build competencies that meet present and future demands. Curriculum and learning methods should be strategically designed to achieve the goal of education, which is to equip learners with the necessary skills to contribute to society. Therefore, it is essential to continuously analyze the curriculum based on the dynamics of globalization and industry needs.

RESEARCH METHOD

This research uses a qualitative method approach with a literature study method, including analysis of scientific articles, journal research, and other relevant and sustainable sources with the title under research as primary data. Researchers conduct a literature study by collecting several books and magazines related to research problems and objectives. In line with Danial and Earsiah, Arikunto (2013) explains that literature studies are conducted by reading relevant sources to obtain the necessary data. Danuri et al. (2019) argue that a literature study serves as a review of literature on related issues and has a role in finding research problems that are clearly stated in each background problem.

The research began with selecting a relevant topic from the existing problems, followed by identifying literature sources that are suitable for the research topic. Scientific articles were collected by reviewing official sources such as Google Scholar, Research Gate, Public and Perish, and Sinta. The collected data were then analyzed using the method of Miles and Huberman, which includes the stages of data reduction, data presentation, and conclusion drawing (Annisa & Mailani, 2023). The results of the data analysis were presented in written form by the researcher (Figure 1).
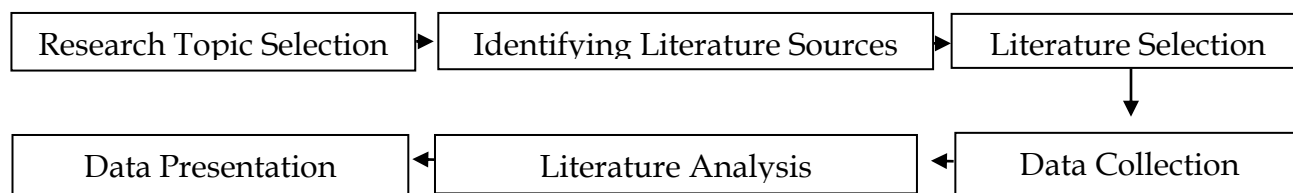
Research Topic Selection	→	Identifying Literature Sources	→	Literature Selection

Data Presentation	←	Literature Analysis	←	Data Collection

Figure 1. Research stages.

RESULTS AND DISCUSSION
Results

The process of relations between nations and between countries is a phenomenon that marks the era of globalization; it occurs without the linkage of bio-social, political, and geo-national ideological boundaries. The whole world forms itself into one and interdependent globalization; this dependence occurs not only in science, technology, and art but also in the political, economic, social, and cultural fields, including education. This depends on the teacher's role in producing creative, valuable, and successful outputs with high power to improve capabilities (Abdillah, 2021). A curriculum that contains global insights is a curriculum that is characterized by a global perspective in the general realm, not in the local and national. This curriculum must indirectly be able to encourage students to think thoroughly in the sense that students can describe as much knowledge as possible and that knowledge can be applied to their readiness for useful citizens and form a sense of social responsibility for the environment, able to work together and hold each other in harmony.

Changes in globalization in the 21st century are classified as fundamental and different from the past. The 21st century is the result of human work and effort demanded by the quality of this century; in other words, the 21st century asks for quality human resources managed by modern institutions to produce superior generations (Altındağ & Aktürk, 2020; Ammirato et al., 2023; Budhwar et al., 2023; Kroon & Paauwe, 2022; Purwanto et al., 2023; Setiono, 2019). The new provisions ask for output in all matters ranging from thinking, activities, and habituation of concepts. It aims to create a new model for responding to new provocations. The curriculum should be reviewed before being applied at school, where the curriculum is applied to solve educational problems, especially in the current and future curriculum development context. Thus, several theories are desired to answer several problems in education and prepare students to participate in learning in the 21st century.

Quality of Human Resources for Global Competitiveness

Building HR with good quality and high competitiveness is a job that companies must do in an organized and planned manner by considering the character, dignity, interests, talents, and different backgrounds of these human resources. Technology is essential in the journey towards Education 4.0, enabling closer collaboration between educators and learners through personalization. HR quality is the key for Indonesia to enter the digital economy era (Nagel, 2020). Increased competitiveness is only possible if society can formulate a new paradigm. First, it must be able to interpret the meaning behind globalization correctly. Second, the political format must adapt to the ability to adapt to globalization. Third, formulate possible new roles. Fourth, formulate strategic steps to build competitiveness. Of course, these four steps are one of the options that can be taken so that this nation can build its competitiveness well. Efforts to improve the quality of human resources include 1) facilitating the learning process by designing, developing, utilizing, managing, and evaluating various learning resources, 2) integrating various scientific fields holistically to solve learning problems, 3) paying attention to and evaluating all related and interrelated conditions in solving learning problems as a whole, 4) using technology as a tool and result to assist in solving learning problems, 5) providing a choice of solutions to improve organizational performance systematically through the use of performance technology and

instructional design, and 6) encouraging innovation in education and learning and distributing it widely.

Building highly competitive human resources is an absolute and urgent need. This is because human resources are one of the strategic resources owned by the organization that must be continuously nurtured and developed. This turbulent era demands changes in education. One of them is the need for highly competitive human resources. Therefore, character education is one of Indonesia's efforts to improve human resources (Dewi et al., 2024). There are eight strategies to build highly competitive human resources, namely: 1) build a recruitment and selection system, 2) determine the placement system; 3) determine the performance appraisal system; 4) improve HR competencies; 5) develop an education and training system; 6) make changes to work culture; 7) develop a payroll system, and 8) develop a payroll system. Develop a payroll system, and 8) develop an HR Information System. Realizing this requires effort, hard work, and sufficient commitment from all elements of the business world, academics/universities, the community, and especially company leaders and owners/shareholders. By using this eighth strategy, HR competitiveness can be increased.

School Curriculum

Sugarman et al. (2024) explained that the Industrial Revolution 4.0 often involves rapid changes in technology and business trends. It is essential to formulate HR development strategies to anticipate the challenges that arise in the era of the Industrial Revolution 4.0. This industrial revolution brings disruptive technological innovations that change how humans live and work, with artificial intelligence expected to take over many human jobs. The readiness of human resource development is the key to facing challenges in the 4.0 disruption era (Tahar et al., 2022). Education is an essential primary capital for developing the nation's next generation, and all parties need to be involved and supervised by reasonable regulations. Dito et al. (2021) explain that in primary and secondary education, the impact of the Industrial Revolution 4.0 is seen in digital learning, which allows access to learning without time and place limits. Educators must help students develop adaptability and lifelong learning to succeed in the changing world of work (Dabbagh & Castaneda, 2020; Dishon & Gilead, 2021; Fischer et al., 2020; Kilag et al., 2023; Lean et al., 2020). Education has a crucial role in life, and its quality is reflected in curriculum changes (Adilah et al., 2023).

In the era of Education 4.0, teachers are faced with demands to modify the perspectives and learning techniques they use. The development of innovation strategies is essential to improving the performance and competitiveness of digital creative industries in the era of the Industrial Revolution 4.0 (Rofaida et al., 2019), unlike the ancient education system, which only focused on producing educated workers with low salaries. Today's education focuses more on giving birth to a generation capable of creating change, not a generation waiting for change (Cholily et al., 2019). The era of the Industrial Revolution 4.0 is not only about providing supporting facilities, but the emphasis is more on preparing Indonesian education to be more advanced, catching up with developed countries, and adapting to the Era of the Industrial Revolution 4.0 (Kahar et al., 2021). Improving mindset, mentality, and values are fundamental things that must be prepared. A curriculum that develops logic, language, and creativity is needed (Astuti et al., 2019).

The curriculum is the foundation for education in schools. Curriculum development is needed so that education remains relevant to the challenges of the times that continue to develop, preventing the curriculum in educational institutions from becoming stagnant (Suherman, 2023). Raharjo (2020) further explains that curriculum development must be based on analysis, predictions, and various constantly changing internal and external challenges. The curriculum is the main foundation in education that must be evaluated continuously, innovatively, dynamically, and according to the times and needs of society and graduate users. According to Suryaman (2020), changes in the curriculum are a must, especially given the rapid developments in science and technology and the competencies required in the current era. Santoso (2020) explains that digital education curriculum development can significantly improve learning achievement and student experience. Digital education curriculum development has created a dynamic learning environment that allows students to access learning content more easily, enhances collaboration, and promotes creativity and problem-solving. It also helps students develop critical digital skills in the digital era (Prihatini et al., 2023).

This challenge in the 4.0 era is an opportunity to develop a combination of Industry 4.0 and the education curriculum in Indonesia. In order to deal with the rapid development of science, an independent curriculum is a solution that the Government seeks to adjust to the needs of industry with education (Husain et al., 2023). In Indonesia, the Independent Curriculum is currently being developed (Lukita, 2020). The Independent Curriculum is designed to suit students' needs in the digital era. This curriculum provides greater autonomy to teachers and schools in determining curriculum, learning methods, and assessment (Illahi et al., 2023). Based on research conducted by Harahap et al. (2023), an Independent Curriculum can be implemented with the help of an LMS, which helps integrate various elements in the curriculum, enabling a more flexible and structured learning approach. Using LMS has proven effective in facilitating and improving the quality of Independent Curriculum implementation in the educational environment. Curriculum changes and development often occur when there are technological developments, especially in the development of educational technology. The curriculum moves dynamically following the direction of increasingly rapid technological development; curriculum development needs to be implemented to adjust the quality of education in Indonesia to technological developments (Rosmana et al., 2023).

Cholilah et al. (2023) explained that to accelerate the development of the Independent Curriculum adopted in educational institutions, where teachers are expected to lead learning by utilizing technology, one of which is the Platform Merdeka Mengajar. The purpose of Platform Merdeka Mengajar is to assist educators in developing their competence in implementing the Independent Curriculum (Marisana et al., 2023). This platform offers learning opportunities according to the needs and pace of each teacher, becomes a forum for communication and networking between teachers, and provides the latest information and documents for teachers (Firmansyah et al., 2023). However, research results from Rahmah et al. (2024) show that there are still gaps in digital facilities and school infrastructure, which hinder the effective implementation of digital learning. Research results from Pratikno et al. (2022) showed that human resources in Indonesia, from independent curriculum design to school implementation, encountered significant barriers where the Government successfully designed the curriculum but limited its implementation. Curriculum change must involve all stakeholders and start from the realization that change is part of society's life cycle (Setiawati, 2022). The

synergy of local government policies in welcoming and implementing the independent curriculum is a series of systems that cannot be separated in the policy line to implement the Independent curriculum (Hilmin et al., 2022).

In detail, Law No. 20/2003 on the National Education System Article 38 Paragraphs (1) and (2) state the following: 1) The Government determines the basic framework and structure of the primary and secondary education curriculum. 2) The curriculum for primary and secondary education is prepared according to its relevance by each group or unit of education and school/madrasah committee under the coordination and supervision of the education office or the Ministry of Religious Affairs office at the district/city level for primary education and at the provincial level for secondary education. The law emphasizes the importance of the Government's basic framework and curriculum structure for primary and secondary education. This ensures uniform and consistent national standards. However, the preparation of the curriculum must also be relevant to local needs, which is done by each group or unit of education and school/madrasah committee (Abrori & Hadi, 2020; Albar et al., 2021; Nasir, 2021; Umar & Gumelar, 2023; Zaid, 2021). Thus, the curriculum can be adapted to the context and specific needs of the region under the coordination and supervision of the local education office or the Ministry of Religious Affairs office. This allows for flexibility in curriculum implementation, ensuring that education remains relevant and responsive to local developments and challenges. With wise implementation and strong collaboration between teachers, students, and other stakeholders, we can achieve better education goals in the digital 4.0 era (Legi, 2023).

With an awareness of the challenges and the ability to capitalize on opportunities, the transformation of education in the digital era can be the foundation for creating a learning environment that is inclusive, innovative, and appropriate to the demands of the times (Surachman et al., 2024). Twining et al. (2021) further emphasize the importance of continuous curriculum renewal and adaptation to technological advances to ensure the relevance and quality of learning. According to Shidqiyah et al. (2023), developing learning models that emphasize curriculum integration with information technology can effectively improve students' digital literacy and critical thinking skills in the information technology era. Efforts to optimize HR management include adopting digitalization and automation systems and developing learning (Jenita et al., 2022). Hilmin et al. (2022) explain that an independent curriculum is a form of strengthening the learning system in responding to the challenges of the times by referring to the direction of development and the local potential of the region, with the primary objective of producing students who are superior in competence and able to compete nationally and globally.

Discussion

This research shows that implementing a digitization-focused curriculum positively impacts students' digital competencies. Integrating technology into learning improves technical skills and develops critical thinking, creativity, and student collaboration. Using technology in learning can develop students' conceptual knowledge.

This finding aligns with research conducted by Singhal et al. (2020), which states that information and communication technology (ICT)-based learning is substantially effective in improving concept clarity and student academic outcomes. In addition, these results support constructivist learning theory, which suggests that technology in education can create a more interactive and exciting learning environment. The results

of Lubis et al. (2022) also show that technology increases learner engagement in learning and supports learning effectiveness. The success of curriculum implementation is highly dependent on improving the quality of educators through training, certification, and continuous development strategies (Kastur et al., 2023).

Based on the findings, the researcher highlighted essential aspects to consider in organizing the learning curriculum. Curriculum implementation should integrate technology into learning. Although the current curriculum already emphasizes developing 21st-century skills, such as critical thinking and creativity, there is still room to improve technology as a practical learning tool. The curriculum should also strengthen essential skills for learners to face the challenges of the modern world. This aligns with research from Kilag et al. (2024), which states that a curriculum should be relevant and effective in preparing learners to face the challenges of an increasingly complex and globally connected future. These results are from research conducted in the Philippines. There is a trend in science curriculum development that adopts the STEM approach in response to contemporary advances in science and technology. Judijanto et al.'s (2024) research highlights the importance of technology integration in the science curriculum to empower students to understand and apply technology in scientific problem-solving. Not only in science, research from Singh et al. (2023) showed similar results in physical education midwives. The study's results highlighted the importance of technology impact relationships in improving the national curriculum. The research shows that implementing technology in physical education programs improves the ability to learn sports skills theoretically and practically.

These efforts are essential to ensure educators can advance the education system and support effective independent learning. Based on the results of this research, it is necessary to revitalize curriculum implementation in educational units. Research conducted by Wardhany et al. (2024) confirms the importance of revitalization steps in facing the challenges of globalization in education, especially in vocational high schools. The revitalization process involving human resource development and the application of industry-based curricula and teaching factories can improve the quality of education and the relevance of graduate competencies to the needs of the labor market. Sustainable revitalization is significant in ensuring the improvement of the quality of human resources and the nation's competitiveness. This is supported by research from Nasution et al. (2024), which states that it is crucial to understand the technical aspects of vocational technology and consider its philosophical framework. This provides the basis for developing relevant curricula and effective teaching methods that meet the evolving needs of the modern world of work.

Torreon et al. (2024) explain that there are six main thematic areas in technology-enhanced learning (TEL) and its integration into the educational curriculum. The six themes are the historical evolution of technology in education, the benefits of TEL integration, challenges, professional development for educators, digital literacy, and shaping 21st-century skills. Torreoan further explained that TEL Integration has excellent potential to improve learning outcomes by using multimedia and experiential learning. Begunova (2024) introduced the IDEA approach (Instruct, Demonstrate, Experience, and Assess) to integrate technology into the educational process. Begunova (2024) further explains that this approach helps foreign language teachers, especially English, to make technology a part of daily lessons.

Implementing a digital curriculum requires comprehensive support from various parties. Schools must ensure adequate technology infrastructure accessible to all

students (Adarkwah, 2021; Agormedah et al., 2020; Bariu, 2020; Laksana, 2021; Maphosa, 2021). In addition, training and professional development for teachers are crucial to enable them to integrate technology effectively into the learning process. In this context, Jackson (2019) emphasizes the importance of a rapid review of relevant research as an evidence base supporting reforms towards greater curriculum flexibility. Curricula must also remain flexible and adaptive to changing technological developments.

CONCLUSION

Fundamental Finding: Relevant curriculum development that is in line with the demands of the times is a must. The curriculum must reflect learners' needs and create creative, innovative, and competitive individuals. In addition, curriculum development must also align with technological developments and changes in the global society. This means integrating competencies in information technology, social skills, and critical thinking into the curriculum. In addition to curriculum development, this article also emphasizes the importance of improving the quality of human resources through formal education, ranging from primary to tertiary levels. In building highly competitive human resources, eight essential strategies are highlighted, including developing recruitment systems, performance appraisal, competency improvement, and changes in work culture. **Implications**: The article also states that the quality of education depends not only on inputs (educators, learners, learning facilities, curriculum) or outputs but also on quality education processes. Therefore, curriculum change and development must keep up with the changing times and technology, meet the needs of learners, and create an effective learning process. In conclusion, this article underlines the importance of curriculum development to the demands of the Era of Globalization and the Industrial Revolution 4.0. This is a crucial step to prepare human resources who are competitive and ready to compete in an increasingly connected and technologically sophisticated world. In addition, the article also emphasizes the importance of improving the quality of human resources through formal education, which is the key to keeping up with the times. Policymakers must consider developing a curriculum integrating technology and developing non-technical skills such as communication, leadership, and problem-solving. In addition, a robust evaluation framework is needed to measure the effectiveness of digital curriculum implementation in the long term. **Limitations**: This research only measures the impact of digital curriculum implementation through literature studies. To understand the long-term impact, further research is needed with a period of direct field observation to compare the results obtained. **Further research:** Further research is needed to explore how the digital curriculum affects student learning outcomes in different contexts and levels of education. Longitudinal studies involving more extensive and diverse samples will provide deeper insights into the long-term impact of the digital curriculum. In addition, research focusing on effective teaching methods in digital environments is also urgently needed to ensure that the implementation of the digital curriculum truly empowers students and prepares them to become qualified human resources in the digital 4.0 era.

REFERENCES
Abdillah, A. (2021). Pengembangan kurikulum menghadapi tuntutan kompetensi abad ke 21 Indonesia. *Jurnal Pendidikan Islam Al Ilmu, 4*(1), 1-10.

Abrori, M. S., & Hadi, M. S. (2020). Integral values in madrasah: To foster community trust in education. *Istawa: Jurnal Pendidikan Islam, 5*(2), 1-13. https://doi.org/10.24269/ijpi.v5i2.2736

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post COVID-19. *Education and Information Technologies, 26*(2), 1665–1685. https://doi.org/10.1007/s10639-020-10331-z

Adilah, N., Galvez, J., Suliyanah, S., & Deta, U. A. (2023). Analisis implementasi kurikulum Cambridge pada salah satu sekolah internasional di Jakarta. *Jurnal Ilmu Pendidikan dan Pembelajaran, 2*(1), 48-64. https://doi.org/10.58706/jipp.v2n1.p48-64

Agormedah, E. K., Henaku, A. E., Ayite, D. M. K., & Ansah, A. E. (2020). Online learning in higher education during COVID-19 pandemic: A case of Ghana. *Journal of Educational Technology and Online Learning, 3*(3), 183–210. https://doi.org/10.31681/jetol.726441

Albar, M. K., Purnomo, S., Munif, F., & Azizah, I. N. (2021). Madrasah development through trust building at MAI Ma'arif NU Teluk Purworkrto, Indonesia. *Journal of Learning and Development Studies, 1*(1), 100–108. https://doi.org/10.32996/jlds.2021.1.1.10

Altındağ, E., & Aktürk, H. B. (2020). The impact of new generation management approaches on the firm performance: The moderating role of strategic human resource management applications. *Sage Open, 10*(3), 1-10. https://doi.org/10.1177/2158244020948845

Amirudin, M. F. (2019). Hubungan pendidikan dan daya saing bangsa. *Belajea: Jurnal Pendidikan Islam, 4*(1), 1-12.

Ammirato, S., Felicetti, A. M., Linzalone, R., Corvello, V., & Kumar, S. (2023). Still our most important asset: A systematic review on human resource management in the midst of the fourth industrial revolution. *Journal of Innovation & Knowledge, 8*(3), 1-23. https://doi.org/10.1016/j.jik.2023.100403

Annisa, I. S., & Mailani, E. (2023). Analisis faktor penyebab kesulitan siswa dalam pembelajaran tematik dengan menggunakan metode Miles dan Huberman di kelas IV SD Negeri 060800 Medan Area. *Innovative: Journal of Social Science Research, 3*(2), 6460-6477. https://doi.org/10.31004/innovative.v3i2.1130

Arikunto, S. (2013). *Prosedur penelitian suatu pendekatan praktik* (Revised edition). PT. Rineka Cipta.

Astuti, A., Waluya, S. B., & Asikin, M. (2019). Strategi pembelajaran dalam menghadapi tantangan era revolusi industri 4.0. In *Prosiding Seminar Nasional Pascasarjana*, 469-473.

Atiek, R. P., Firmansyah, N. F., Widiastuti, N., Christyowati, Y. I., & Fatirul, A. N. (2023). Pendekatan terintegrasi dalam pengembangan kurikulum abad 21. *Jurnal Ilmiah Pendidikan Holistik (JIPH), 2*(2), 171–182. https://doi.org/10.55927/jiph.v2i2.3942

Bariu, T. N. (2020). Status of ICT infrastructure used in teaching and learning in secondary schools in Meru County, Kenya. *European Journal of Interactive Multimedia and Education, 1*(1), 1-23. https://doi.org/10.30935/ejimed/8283

Begunova, M. (2024). The "Idea" model of technology and curriculum synchronization in language teaching: Theoretical framework. *Bulletin of Pedagogical Sciences, 72*(1), 1-23.

Budhwar, P., Chowdhury, S., Wood, G., Aguinis, H., Bamber, G. J., Beltran, J. R., Boselie, P., Lee Cooke, F., Decker, S., DeNisi, A., Dey, P. K., Guest, D., Knoblich, A. J., Malik, A., Paauwe, J., Papagiannidis, S., Patel, C., Pereira, V., Ren, S., ... Varma, A. (2023). Human resource management in the age of generative artificial intelligence: Perspectives and research directions on ChatGPT. *Human Resource Management Journal, 33*(3), 606–659. https://doi.org/10.1111/1748-8583.12524

Cholilah, M., Tatuwo, A. G. P., Komariah, Rosdiana, S. P., & Fatirul, A. N. (2023). Pengembangan kurikulum merdeka dalam satuan pendidikan serta implementasi kurikulum merdeka pada pembelajaran abad 21. *Sanskara Pendidikan dan Pengajaran, 1*(2), 56–67. https://doi.org/10.58812/spp.v1i02.110

Cholily, Y. M., Putri, W. T., & Kusgiarohmah, P. A. (2019). Pembelajaran di era revolusi industri 4.0. *Seminar & Conference Proceedings of UMT*, 1-8.

Dabbagh, N., & Castaneda, L. (2020). The PLE as a framework for developing agency in lifelong learning. *Educational Technology Research and Development, 68*(6), 3041–3055. https://doi.org/10.1007/s11423-020-09831-z

Danuri, P. P., Maisaroh, S., & Prosa, P. G. S. D. (2019). *Metodologi penelitian pendidikan*. Samudra Biru.

Dewi, N. P., Nadina, G., & Rachman, I. F. (2024). Membentuk sumber daya manusia yang berdaya saing tinggi melalui pendidikan karakter bersifat religius di era disruptif. *Jurnal Multidisiplin Ilmu Akademik, 1*(3), 100-110.

Dian, D., & Dwi, D. (2021). Education quality improvement in junior high schools and the common problems. *Jurnal Pendidikan dan Kebudayaan, 6*(1), 1-13

Dishon, G., & Gilead, T. (2021). Adaptability and its discontents: 21st-century skills and the preparation for an unpredictable future. *British Journal of Educational Studies, 69*(4), 393–413. https://doi.org/10.1080/00071005.2020.1829545

Dito, S. B., & Pujiastuti, H. (2021). Dampak revolusi industri 4.0 pada sektor pendidikan: Kajian literatur mengenai digital learning pada pendidikan dasar dan menengah. *Jurnal Sains Dan Edukasi Sains, 4*(2), 59-65.

Firmansyah, S. A., Hidayati, D., & Maya, N. (2023). Digitalisasi pendidikan pada implementasi kurikulum merdeka. *Jurnal Syntax Admiration, 4*(11), 2207-2217. https://doi.org/10.46799/jsa.v4i11.908

Fischer, G., Lundin, J., & Lindberg, J. O. (2020). Rethinking and reinventing learning, education and collaboration in the digital age—from creating technologies to transforming cultures. *International Journal of Information and Learning Technology, 37*(5), 241–252. https://doi.org/10.1108/IJILT-04-2020-0051

Harahap, D. G. S., Sormin, S. A., Fitrianti, H., Rafi'y, M., & Irawan, F. (2023). Implementation of merdeka curriculum using learning management system (LMS). *International Journal of Educational Research Excellence (IJERE), 2*(1), 93–99. https://doi.org/10.55299/ijere.v2i1.439

Hilmin, H., Noviani, D., & Nafisah, A. (2022). Kebijakan pemerintah daerah dalam penerapan kurikulum merdeka. *Khatulistiwa: Jurnal Pendidikan Dan Sosial Humaniora, 2*(2), 148-162.

Irawan, F., Pratama, M. F., & Rafi'y, M. (2024). Peningkatan daya saing mahasiswa dengan penerapan kurikulum digital. *Jurnal Ilmu Pendidikan Terapan, 1*(1), 57-68. https://doi.org/10.58455/jipt.v1i1.523

Iqbal, A., & Rachman, S. R. (2020). Challenges of implementing the 2013 curriculum: A study on teachers in Aceh, Indonesia. *Indonesian Journal of Educational Review, 7*(1), 63-77. https://doi.org/10.21009/IJER.07.01.07

Kashif, M., Ali, H., & Syed, N. A. (2021). Managing change in higher education institutions: A study of COVID-19 induced transitions in Pakistan. *International Journal of Educational Management, 35*(5), 1098-1111. https://doi.org/10.1108/IJEM-08-2020-0360

Kenedi, A. K. (2020). Blended learning in a large class setting: A pedagogical framework. *Journal of Physics: Conference Series, 1521*(1), 1-7. https://doi.org/10.1088/1742-6596/1521/1/012048

Koltovskaia, S. (2020). Autonomy support in online language learning contexts: A self-determination theory perspective. *Computer Assisted Language Learning, 33*(5-6), 560-589. https://doi.org/10.1080/09588221.2020.1770299

Komariah, A., & Triatna, C. (2006). *Visionary leadership menuju sekolah efektif*. PT Remaja Rosdakarya.

Kusdiyanto, S. (2023). Peran guru dalam pengembangan kurikulum berbasis teknologi digital. *Jurnal Pendidikan dan Kebudayaan, 1*(1), 67-77.

Latip, A., & Yusof, H. (2020). 21st-century skills in teaching English as a second language in Malaysia: Teacher perspectives. *Arab World English Journal, 11*(3), 338-350. https://doi.org/10.24093/awej/vol11no3.21

Lase, D. (2019). Pendidikan di era revolusi industri 4.0. *Sundermann: Jurnal Pendidikan, Sains Humaniora dan Kebudayaan, 1*(1), 28-43. https://doi.org/10.36588/sundermann.v1i1.18

Lina, A. (2021). Pemanfaatan teknologi dalam pendidikan di masa pandemi COVID-19. *Jurnal Pendidikan Informatika Dan Sains, 2*(2), 118-128. https://doi.org/10.31943/informatika.v2i2.94

Mailani, E., & Annisa, I. S. (2023). Analisis faktor penyebab kesulitan siswa dalam pembelajaran tematik dengan menggunakan metode Miles dan Huberman di kelas IV SD Negeri 060800 Medan Area. *Innovative: Journal of Social Science Research, 3*(2), 6460-6477. https://doi.org/10.31004/innovative.v3i2.1130

Mambu, J. E. (2020). Disruption and innovation in English language teaching: Surviving and thriving amid and beyond pandemic challenges. *Teflin Journal, 31*(2), 144-162. https://doi.org/10.15639/teflinjournal.v31i2/144-162

Naji, J., & Nasser, R. (2020). Remote teaching during COVID-19: Implications for Islamic education. *Journal of Muslim Minority Affairs, 40*(4), 557-570. https://doi.org/10.1080/13602004.2020.1846209

Noh, N. M., & Saedah, S. (2021). Teachers' readiness towards the implementation of a digital-based curriculum in Malaysia. *Journal of Science and Mathematics Education in Southeast Asia, 44*(2), 1-12. http://dx.doi.org/10.11591/ijere.v10i1.21014

Nuryana, Z., & Muslim, I. (2021). Kurikulum merdeka: Kajian konsep dan implementasi dalam pendidikan. *Al-Tahrir: Jurnal Pemikiran Islam, 21*(2), 205-221. https://doi.org/10.21154/altahrir.v21i2.2730

Nworie, J. (2021). Beyond COVID-19: Advancing online learning in higher education. *Educause Review, 56*(1), 24-34.

OECD. (2018). *The future of education and skills: Education 2030*. OECD Publishing.

Pandia, R. S. A. (2019). Pendidikan karakter berbasis kearifan lokal dalam kurikulum 2013. *Jurnal Pendidikan Karakter, 9*(2), 165-174. https://doi.org/10.21831/jpk.v9i2.22712

Panjaitan, R. T., Simanjuntak, A. P., & Sitorus, E. (2022). Pengaruh penggunaan media pembelajaran berbasis teknologi terhadap hasil belajar siswa. *Jurnal Teknologi Pendidikan, 13*(1), 52-63. https://doi.org/10.24036/jtp.v13i1.111170

Patsavellas, J., & Shapiro, D. (2021). Industry 4.0: The new industrial revolution. *Journal of Manufacturing Technology Management, 32*(1), 1-12. https://doi.org/10.1108/JMTM-04-2021-0128

Perdana, Y. R., & Indra, A. (2019). Implementasi kurikulum 2013 dalam pembelajaran Pendidikan Jasmani di SMA Kabupaten Malang. *Jurnal Pendidikan Jasmani dan Olahraga, 4*(2), 201-214. https://doi.org/10.21009/jpjo.v4i2.12270

Pratama, M. F., & Irawan, F. (2024). Peningkatan daya saing mahasiswa dengan penerapan kurikulum digital. *Jurnal Ilmu Pendidikan Terapan, 1*(1), 57-68. https://doi.org/10.58455/jipt.v1i1.523

Rizki, M. I., & Nurhadi, D. (2023). Implementasi kurikulum merdeka dalam meningkatkan kualitas pembelajaran abad 21. *Jurnal Pendidikan Dan Kebudayaan, 1*(2), 99-112.

Rothwell, W. J., & Rothwell, A. W. (2016). *Beyond training and development: The groundbreaking classic on human performance enhancement* (2nd ed.). American Management Association.

Saleh, M., Farid, M., & Setyawan, A. (2022). Adaptasi kurikulum di era revolusi industri 4.0 dan Society 5.0: Studi kasus pada pendidikan tinggi di Indonesia. *Jurnal Pendidikan dan Kebudayaan, 7*(1), 54-67. https://doi.org/10.36637/jpnk.v7i1.456

Sari, P., & Prasetyo, D. (2022). Model evaluasi implementasi kurikulum merdeka di sekolah dasar. *Jurnal Evaluasi Pendidikan, 13*(1), 22-33. https://doi.org/10.21009/jep.001

Sasmita, F. R., & Putra, A. T. (2020). Penerapan teknologi informasi dan komunikasi dalam pembelajaran di era revolusi industri 4.0. *Jurnal Teknologi Informasi Dan Komunikasi Dalam Pendidikan, 7*(1), 1-14. https://doi.org/10.24036/jtikp.v7i1.113263

Shidqiyah, S., Thalib, B., Wiratama, R., Alam, S. N., & Riyanto, R. (2023). Development Of The Latest Curriculum-Based Learning Model To Improve Students'digital Literacy And Critical Thinking Skills In The Information Technology Era. *International Journal of Teaching and Learning*, 1(4), 412-425.

Sihombing, L. (2020). Peran pendidikan dalam meningkatkan daya saing bangsa. *Jurnal Pendidikan, 5*(1), 12-22. https://doi.org/10.31943/jdsi.v5i1.39

Singh, G., & Mahajan, R. (2020). Role of artificial intelligence in transforming healthcare: Shaping a new horizon. *Journal of Medical Systems, 44*(9), 158-168. https://doi.org/10.1007/s10916-020-01609-9

Susilowati, E. (2023). Implementasi kurikulum merdeka di sekolah dasar dalam pembelajaran abad 21. *Jurnal Pendidikan, 4*(2), 75-89. https://doi.org/10.36637/jpd.v4i2.234

Suyatno, S. (2022). Implementation of independent curriculum in Indonesian elementary schools: Problems and solutions. *International Journal of Learning, Teaching and Educational Research, 21*(1), 24-40. https://doi.org/10.26803/ijlter.21.1.2

Tandriyo, T. (2023). Peran teknologi informasi dalam pengembangan kurikulum abad 21 di Indonesia. *Jurnal Pendidikan dan Kebudayaan, 2*(1), 15-25.

Thomson, P. (2020). Leadership for the fourth industrial revolution. *Educational Management Administration & Leadership, 48*(6), 1008-1025. https://doi.org/10.1177/1741143220913550

Tilaar, H. A. R., & Nugroho, R. (2009). *Membangun pendidikan nasional yang relevan dan bermutu*. Rineka Cipta.

Trianto. (2010). *Model pembelajaran terpadu dalam teori dan praktek*. Prestasi Pustaka.

Tuomi, I. (2018). The impact of artificial intelligence on learning, teaching, and education: Policies for the future. *European Commission, JRC Science for Policy Report*, EUR 29062 EN, Publications Office of the European Union. https://doi.org/10.2760/12297

Ullah, H., & Khan, F. (2020). Disrupting education: Reimagining the future of learning in the post-COVID-19 world. *Eurasian Journal of Educational Research, 20*(85), 123-140. https://doi.org/10.14689/ejer.2020.85.8

Ummi, K., & Azizah, K. (2023). Analisis evaluasi penerapan kurikulum merdeka pada sekolah dasar di Surabaya. *Jurnal Pendidikan, 3*(2), 45-56. https://doi.org/10.26666/jp.v3i2.455

Usman, Y. D. (2021). Leadership in educational institutions during the COVID-19 pandemic: Perspectives and challenges. *Educational Management Administration & Leadership, 49*(5), 813-828. https://doi.org/10.1177/1741143221992970

Utomo, A. P., & Nuraini, N. (2022). Pemanfaatan teknologi digital dalam pendidikan tinggi di Indonesia: Peluang dan tantangan. *Jurnal Pendidikan, 13*(3), 234-245. https://doi.org/10.21009/jep.v13i3.456

Wicaksono, B. (2018). Implementasi kurikulum 2013: Studi kasus di sekolah menengah atas di Jakarta. *Jurnal Pendidikan dan Kebudayaan, 3*(2), 101-112. https://doi.org/10.21009/jep.002

Widodo, H. P. (2015). The development of vocational English teaching materials: The influence of contextual teaching and learning (CTL) approach in the Indonesian context. *Electronic Journal of Foreign Language Teaching, 12*(2), 193-200. https://doi.org/10.33394/jo-elt.v6i2.2362

Wijaya, A., & Suparno, S. (2023). Penerapan kurikulum merdeka di sekolah dasar di Yogyakarta: Analisis dampak dan tantangan. *Jurnal Pendidikan, 4*(1), 13-24. https://doi.org/10.36637/jpd.v4i1.123

Yamin, M. (2012). *Strategi pembelajaran berbasis kompetensi*. GP Press.

Yuliana, Y., & Wirawan, W. (2021). Implementasi kurikulum merdeka di sekolah dasar di kota Bandung. *Jurnal Pendidikan, 2*(1), 1-12. https://doi.org/10.21009/jp.v2i1.1001

*Febriani Dwi Sari (Corresponding Author)
Department of Education Faculty of Science Education,
Jakarta State University,
Jl. R.Mangun Muka Raya No.11, RT.11/RW.14, Rawamangun, Kec. Pulo Gadung, Kota Jakarta Timur, Daerah Khusus Ibukota Jakarta 13220, Indonesia
Email: febrianidwisari11@gmail.com

Rugaiyah
Department of Education Faculty of Science Education,
Jakarta State University,
Jl. R.Mangun Muka Raya No.11, RT.11/RW.14, Rawamangun, Kec. Pulo Gadung, Kota Jakarta Timur, Daerah Khusus Ibukota Jakarta 13220, Indonesia
Email: rugaiyah@unj.ac.id