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Readiness of Early Childhood Education (ECE) Teachers in West Java for 21st Century Learning: A Survey Study

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Abstract
This study explores the readiness of Early Childhood Education (ECE) teachers in West Java for 21st-century learning. Utilising a survey research design, an online questionnaire was distributed via WhatsApp to ECE teachers across multiple regions in West Java. The survey assessed teacher readiness based on Jan's (2017) characteristics of 21st-century educators, covering aspects such as student-centred classrooms, personalised instruction, technology competence, social competence, and continuous learning. Responses from 186 teachers were analysed using a Likert scale approach, revealing high readiness in learning management and social competence but moderate readiness in technology-related competencies. The findings indicate that while teachers are well-prepared to manage student-centred learning environments, there is a need for improved ICT training, particularly in areas like using digital tools and social media for educational purposes. Additionally, while social competence is strong, continuous professional development in technology integration remains essential. The study highlights the necessity of targeted professional development programs to bridge these gaps and ensure teachers are equipped with the skills needed for 21st-century education. These implications highlight the need for comprehensive teacher training programs and supportive professional communities to ensure ECE teachers can effectively meet the demands of modern education. Despite the study's geographical limitation to West Java and reliance on self-reported data, it provides valuable insights into the preparedness of ECE teachers. It suggests directions for future research to expand understanding across diverse contexts.

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Introduction
In the context of rapid technological advancements and societal shifts, the preparedness of early childhood education (ECE) teachers for 21st-century learning has become a critical global concern. The role of ECE teachers extends beyond traditional teaching to encompass the holistic development of children, addressing cognitive, social, emotional, and technological competencies essential for thriving in the modern world (Shonkoff & Phillips, 2000; Munawaroh et al., 2018). As societies worldwide increasingly prioritise early childhood education, ensuring educators are equipped to foster critical 21st-century skills in young learners is imperative (B. A. & Widyasari, 2020; Atisabda et al., 2019). This prioritisation is driven by the recognition that early childhood is a foundational period for cognitive and social development, which has long-term implications for an individual's educational trajectory and societal contributions. Consequently, the readiness of ECE teachers to adopt and implement contemporary pedagogical methods is not only a matter of educational quality but also a broader societal need.

Research indicates that ECE teachers must be adept at integrating modern pedagogical approaches and digital technologies into their teaching practices. Studies highlight the necessity for ECE teachers to possess skills in personalised learning, project-based instruction, and digital tools to create engaging and interactive learning environments (Jan, 2017; Yulianisa,

2018). Additionally, the shift towards student-centred learning models underscores the need for teachers to continually innovate and adapt to emerging educational paradigms (Trilling & Fadel, 2011; Quint, 2011). The evolution of these paradigms is heavily influenced by the rapid dissemination of information and the increasingly interconnected global landscape, which demands that teachers not only keep up with but also anticipate changes in educational needs and practices. This continuous adaptation is crucial for fostering an educational environment that promotes critical thinking, creativity, collaboration, and communication among young learners.

Several studies have examined the competencies and readiness of teachers to implement 21st-century learning frameworks. For instance, findings show prospective teachers recognise the importance of critical thinking, creativity, collaboration, and communication—collectively known as the 4Cs—as foundational student skills (Akhyar & Suryani, 2019; Bedir, 2019). Adopting digital learning environments and tools, such as flipped classrooms and e-learning platforms, has enhanced teacher and student engagement and outcomes (Fung et al., 2022; Martin, 2021). However, the effectiveness of these digital tools and pedagogical strategies largely depends on the teachers' proficiency, which hinges on their initial training and ongoing professional development. This highlights the need for a robust and dynamic teacher education system that continuously updates and equips teachers with the latest technological and pedagogical skills.

Despite these advancements, challenges remain in effectively preparing ECE teachers to meet the demands of 21st-century education. Research has identified significant gaps in teacher training programs, particularly in digital literacy and the practical application of innovative teaching methods (Rahimi & Mosalli, 2024; Zilka, 2021). Additionally, there is a recognised need for ongoing professional development to ensure teachers can keep pace with technological advancements and evolving educational standards (Stutchbury et al., 2023; Khalid et al., 2018). These gaps are often exacerbated by disparities in access to resources and training opportunities, leading to unequal levels of preparedness among teachers. Furthermore, the dynamic nature of technological advancements means that what is considered cutting-edge today may become obsolete tomorrow, necessitating a continuous learning approach among educators.

However, while existing studies provide valuable insights into the competencies required for 21st-century teaching, there is a paucity of research specifically focusing on the readiness of ECE teachers in this context. Many studies have concentrated on general teacher competencies without adequately addressing early childhood educators' unique challenges (Rahmawati et al., 2021; Moiseenko et al., 2019). Furthermore, the variability in teacher preparedness based on demographic factors and educational backgrounds has not been sufficiently explored (Mukminin et al., 2019; Akbay et al., 2020). This oversight is significant, as early childhood educators operate in a distinct pedagogical landscape that requires tailored skills and approaches. Addressing these gaps is crucial for developing comprehensive strategies that support all ECE teachers in meeting the demands of 21st-century education.

This study aims to fill these gaps by investigating ECE teachers' readiness to adopt 21st-century learning practices, focusing on their skills, knowledge, and attitudes. This research seeks to offer actionable insights for policymakers, educators, and training institutions by comprehensively analysing the factors influencing teacher preparedness. The findings are expected to contribute to developing targeted professional development programs and policy initiatives that enhance the quality of early childhood education and better prepare young learners for future challenges (Gyurova, 2020; Haviz et al., 2020). Such insights will be instrumental in shaping an educational framework that not only meets the current needs of young learners but also anticipates and adapts to future educational trends and requirements. By ensuring that ECE teachers are well-prepared, we can lay a strong foundation for the lifelong learning and development of the next generation.

Methods

This study employed a survey research design to assess the readiness of Early Childhood Education (ECE) teachers for 21st-century learning. An online survey was disseminated through WhatsApp to maximise reach and participation among ECE teachers. The questionnaire utilised in this study adhered to Sugiyono's (2016) framework, consisting of structured, written questions to gather detailed information from respondents. The survey targeted ECE teachers across various regions in West Java, including Majalengka, Purwakarta, Karawang, Indramayu, Bekasi, Bogor, Bandung, Cirebon, Subang, Sumedang, Cianjur, Kuningan, and Pangandaran. A random sampling technique was employed to ensure representativeness. The survey remained open for a designated period to allow ample time for participation. Expert reviewers provided feedback on the questionnaire based on predetermined assessment criteria for each aspect. The feedback was used to refine the questionnaire, ensuring it effectively measured the intended variables.

The primary tool for data collection was a closed-ended questionnaire designed with a rating scale format, following Ridwan's (2011) guidelines. The rating scale, interpreted qualitatively, allowed respondents to choose from five quantitative response options: Very Ready, Ready, Moderately Ready, Less Ready, and Not Ready. The indicators for the survey items were derived from Jan's (2017) characteristics of 21st-century teachers, encompassing student-centred classrooms, personalised instruction, student production, project-based learning, new technology adoption, globalisation, innovative use of smartphones, blogging, digitalisation, collaboration, Twitter chats, digital ecosystem building, innovation, and continuous learning. Data were collected from 186 ECE teachers who completed the online questionnaire. The responses were coded and analysed using Microsoft Excel. The analysis followed a Likert scale approach, with scores interpreted according to Ridwan's (2009) percentage-based criteria: 0-20% (Very Weak), 21-40% (Weak), 41-60% (Moderate), 61-80% (Strong), and 81-100% (Very Strong). This analysis aimed to quantify the readiness of ECE teachers to adopt 21st-century teaching practices. The survey instrument underwent expert review and pilot testing to ensure reliability and validity. Ethical principles, including respondent privacy and confidentiality, were strictly adhered to. Participation was voluntary, with clear information provided about the study's purpose and procedures. Data were securely stored and used solely for research purposes.

Result

This results section presents the identity of the respondents, their qualifications, and the distribution of the research area. Additionally, it discusses the analysis of the readiness of Early Childhood Education (ECE) teachers for 21st-century learning. This section outlines the collected data, data collection methods, data analysis, key findings, interpretation, and the validity of the results. The data obtained in this study depict the identity of respondents, their qualifications, and the distribution of the research area. The data are presented in the following sections.

3.1. Respondent Identity

The data in this study were obtained through a questionnaire instrument. Respondents were given a series of alternative answers, each scored according to predetermined weights. Data collection was conducted across various regions in West Java, covering a diverse range of public and private ECE institutions.

Table 1. Academic Qualifications of Respondents

Respondent Identity Table				
Education Level	High School/Vocational	Bachelor's Degree	Master's Degree	Doctoral Degree
Number	10	176	1	0
Percentage	5.4%	94.6%	0.5%	0%

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The data from this research were obtained through a questionnaire instrument. This activity involved assigning scores to each alternative answer provided by the respondents according to the predetermined weights. The academic qualifications of Early Childhood Education (ECE) teachers influence their ability to design learning plans (Tasya et al., 2023).

The qualifications of ECE teachers in this study range from High School/Vocational, Bachelor's, and Master's degrees. ECE teachers with a high school background have attended special education or training programs in early childhood education. Meanwhile, teachers with a bachelor's degree in education or related fields have gained a deeper understanding of early childhood education theory and practice. Additionally, ECE teachers with a master's degree possess more specific and in-depth knowledge in certain aspects of early childhood education, including specialisation areas such as developmental psychology or curriculum and instruction. Academic qualifications influence the expertise of teachers related to their capabilities. Therefore, this educational background is essential in understanding the context of this research.

The respondents involved in this survey research are spread across various regions of West Java, including Majalengka, Purwakarta, Karawang, Indramayu, Bekasi, Bogor, Bandung, Cirebon, Subang, Sumedang, Cianjur, Kuningan, and Pangandaran. Data were collected from various Early Childhood Education institutions, including public and private schools, Early Childhood Education centres, and non-formal Early Childhood Education institutions in West Java. With this regional coverage, this study aims to obtain a representative understanding of the readiness of Early Childhood Education teachers for 21st-century learning in West Java, allowing for a comprehensive analysis of various aspects under investigation. The regional distribution can be seen in the figure below.

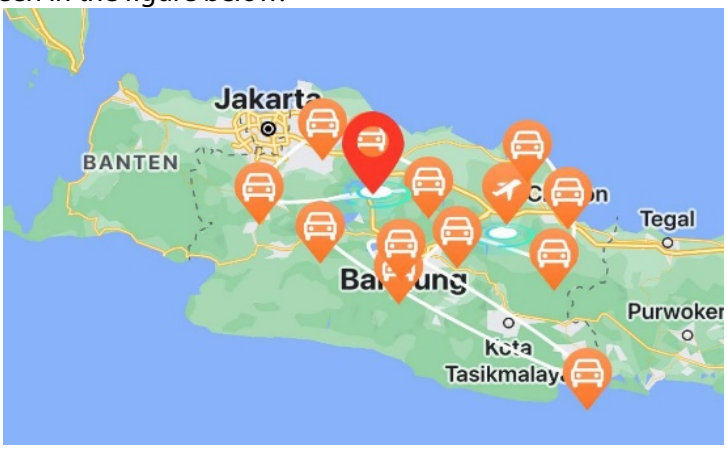

Figure 1. Regional Distribution of Research

The image shows a map of West Java with several markers indicating the locations where research data was collected. These markers, depicted as car and airplane icons, are spread across various cities and regions, including areas to the east of West Java. Each marker likely represents a specific data collection point, such as an Early Childhood Education (ECE) institution.

The markers on the map indicate extensive regional coverage throughout West Java. This suggests that the research includes diverse geographic locations, ensuring a representative sample from various parts of the region. The spread of markers across the map implies a comprehensive approach to data collection, aiming to capture a broad understanding of the readiness of ECE teachers from various locations in West Java. This regional distribution enhances the validity of the research findings by incorporating data from a wide array of settings, thereby reflecting a more holistic view of the readiness of ECE teachers in the region for 21st-century learning.

3.2. Description of Teacher Readiness

Teacher readiness in this study is identified from the analysis of questionnaire responses. As mentioned earlier, the indicators measured regarding teacher readiness for 21st-century

learning refer to Jan (2017), which include student-centred classrooms, personalised instruction, students as producers, project-based learning, learning new technologies, globalisation, innovative use of smartphones, blogs, digitisation, collaboration, using Twitter chats, being connected, building a digital ecosystem, innovating, and continuous learning. The description of the results of the teacher readiness analysis can be seen in the following table.

Table 2. Analysis of Teacher Readiness

Dimension	**Indicator**	**Percentage**	**Criteria**
Learning Management	Student-Centered Classroom	88%	Very Ready
	Personalised Instruction	89%	Very Ready
	Students as Producers	70%	Ready
Technology Competence	Learning New Technology	60%	Quite Ready
	Globalisation	69%	Ready
	Smart Use of Smartphones	66%	Ready
	Blogs	53%	Quite Ready
	Digitisation	60%	Quite Ready
	Building a Digital Ecosystem	57%	Quite Ready
	Using Twitter Chats	37%	Not Ready
Social Competence	Collaboration	74%	Ready
	Being Connected	75%	Ready
Self-Development	Innovation	73%	Ready
	Continuous Learning	78%	Ready
Dimension	Indicator	Percentage	Criteria

The analysis indicates that ECE teachers in West Java are very ready in terms of learning management, especially regarding student-centred classrooms and personalised instruction. However, there are weaknesses in technology competence, particularly in the use of Twitter chats, which are categorised as not ready. This highlights the need for further training in specific technologies.

Based on the data analysis in the diagram, it can be seen that the indicators related to learning management include student-centred classrooms, personalised instruction, students as producers, and project-based learning, with percentages ranging from 70-89%, categorised as very ready. For indicators related to technology competence, including learning new technologies, globalisation, innovative use of smartphones, blogs, digitisation, and building a digital ecosystem, the percentages range from 53-69%, or quite ready, except for the indicator of using Twitter chats, which is 37%, categorised as not ready. For indicators related to social competence, including collaboration and being connected, the percentages range from 74-75% or ready. Finally, for indicators related to self-development, such as innovation and continuous learning, the percentages range from 73-78%, categorised as ready.

This study's results have several limitations, such as the sample not fully representing the entire population of ECE teachers in West Java. Additionally, the data collection method using questionnaires may have response biases. Nonetheless, efforts were made to ensure data validity by distributing the questionnaire across various regions and types of institutions.

The results of this study indicate that ECE teachers in West Java are highly prepared in terms of learning management, particularly in student-centred classrooms and personalised instruction. However, there are weaknesses in technology competence, especially in using Twitter chats. Overall, technology competence is generally rated as moderately ready, while social competence and self-development show good readiness. Despite limitations in sample representation and potential biases in the data collection method, this study provides a representative overview of the readiness of ECE teachers for 21st-century learning in West Java

Discussion

The study aimed to assess the readiness of Early Childhood Education (ECE) teachers in facing the challenges of 21st-century learning. With the rapid evolution of technology and the increasing complexity of societal demands, teachers must possess the necessary skills and knowledge to facilitate innovative and effective learning environments (Jan 2017). Previous research highlights the importance of Information and Communication Technology (ICT) proficiency, pedagogical competence, and continuous professional development in preparing teachers for contemporary educational demands (Smith et al., 2018; Jones, 2020).

The readiness of teachers to adopt new teaching methods and technologies is essential for fostering critical thinking, creativity, and problem-solving skills among young learners (Yulianisa, 2018). Additionally, the shift towards student-centred and project-based learning approaches requires teachers to be adaptable and skilled in designing personalised learning experiences (Trilling & Fadel, 2011). This study seeks to contribute to the existing literature by providing a comprehensive analysis of the readiness of ECE teachers in West Java, focusing on various dimensions such as academic qualifications, technology integration, and professional development activities.

The findings revealed that the overall readiness of ECE teachers for 21st-century learning is quite favourable, with significant strengths in academic qualifications and professional development participation. A notable 94.6% of teachers hold a bachelor's degree, and 0.5% possess a master's degree, reflecting a solid foundation in educational theory and practice (Jembar et al., 2023). Most teachers have actively engaged in seminars and workshops, enhancing their skills and knowledge in early childhood education (Notanubun, 2019). Furthermore, the ability to design student-centred learning environments, personalised instruction, and project-based learning was reported as highly developed, with readiness percentages ranging from 70% to 89% (Fadhia Indriyani et al., 2022). These high levels of academic qualifications and professional development activities suggest that teachers are well-prepared to implement innovative teaching practices that align with the demands of 21st-century education (Arslan, 2020). However, it is essential to note that while teachers are academically and professionally prepared, areas still require further improvement, particularly in integrating technology into the classroom (Rahimi & Mosalli, 2024).

Despite the overall readiness, the study identified moderate proficiency in ICT skills among ECE teachers, with a significant gap in using social media platforms like Twitter for educational purposes. Integrating new technologies, such as blogs, smartphones, and digital ecosystems, was rated as "quite ready," with percentages ranging from 53% to 66% (Kurniati et al., 2018; Muhtadi, 2006). The limited use of Twitter was attributed to its popularity among Generation Z rather than older generations like Boomers and Millennials, who prefer more user-friendly platforms like WhatsApp, Instagram, and TikTok (Pandu, 2021). This discrepancy indicates a need for targeted training to enhance the effective use of various digital tools in teaching. Moreover, using digital tools effectively is essential for creating engaging and interactive learning experiences that cater to the diverse needs of young children (Zilka, 2021). The findings suggest that while teachers have a basic understanding of technology, there is a need for more specialised training programs that focus on the practical application of digital tools in the classroom (Martin, 2021).

The social competence of ECE teachers, including collaboration, communication, and interpersonal skills, was found to be well-developed, with readiness percentages of 74% and 75% (Hanny et al., 2020). This capability is crucial for fostering a holistic and supportive learning environment for young children. Effective communication and collaboration skills enable teachers to work seamlessly with colleagues, parents, and other stakeholders to enhance the educational experience (Aasen & Sadownik, 2019). Self-development indicators, such as innovation and continuous learning, were also highly rated, demonstrating the teachers' commitment to professional growth and adaptation to new educational paradigms (Notanubun, 2019). The emphasis on continuous learning reflects a proactive approach to

professional development, ensuring teachers remain updated with the latest educational trends and practices (Stutchbury et al., 2023). These findings underscore the importance of ongoing professional development in maintaining and enhancing teaching quality and the need for a supportive professional community that encourages knowledge-sharing and collaborative learning (Akbay et al., 2020).

The results align with previous studies that emphasise the critical role of teacher qualifications and continuous professional development in ensuring readiness for 21st-century education. For instance, Smith et al. (2018) and Jones (2020) highlighted the importance of ICT proficiency and pedagogical competence, which were similarly observed in this study. However, the moderate ICT skills noted in this research contrast with the findings of Tyan et al. (2020), who reported high levels of ICT competence among language teachers. This discrepancy suggests the need for more focused ICT training for ECE teachers to bridge the gap. Additionally, studies by Asante and Osei-Poku (2019) and Khalid et al. (2018) emphasised the importance of integrating various pedagogical methods to enhance teacher readiness, aligning with the high student-centred and project-based learning scores observed in this study. Furthermore, the importance of professional development in improving teacher readiness is echoed in studies by Gyurova (2020) and Mukminin et al. (2019), reinforcing the need for continuous training and development programs tailored to the specific needs of ECE teachers.

The readiness of ECE teachers in West Java can be attributed to their strong academic qualifications and active participation in professional development activities. The significant involvement in workshops and seminars indicates a proactive approach to enhancing teaching skills and adapting to new educational trends (Notanubun, 2019). However, moderate proficiency in ICT skills suggests that while foundational knowledge is strong, there is a need for more specialised training in digital tools and platforms (Pandu, 2021). This highlights the importance of a comprehensive and continuous professional development program that addresses specific technological competencies required in the 21st-century classroom. Moreover, the findings suggest that institutional support and infrastructure play a crucial role in enhancing teacher readiness, as highlighted by the correlation between school leadership and technology integration found in other studies (Thannimalai & Raman, 2018; Ismail et al., 2018). The ability to effectively integrate technology into teaching practices is essential for creating dynamic and engaging learning environments that cater to the diverse needs of young children (Fung et al., 2022).

While the findings indicate a generally high level of readiness, it is essential to interpret these results cautiously. The study's scope was limited to ECE teachers in West Java, which may not fully represent the national context. Additionally, the rapid evolution of technology and educational tools necessitates ongoing assessment and adaptation of training programs to ensure that teachers remain up-to-date with the latest advancements (Arslan, 2020). Future research should expand the geographical scope and consider longitudinal studies to capture changes in teacher readiness over time. The variability in ICT skills and the limited use of specific social media platforms indicate that more nuanced and targeted training programs are needed to address these gaps (Moiseenko et al., 2019). Moreover, considering the rapid pace of technological advancements, it is crucial for educational institutions to continuously update their curricula and professional development programs to keep pace with new developments and ensure that teachers are adequately prepared (Rahmawati et al., 2021).

The study's findings have significant implications for policymakers, educational institutions, and teacher training programs. The high readiness levels among ECE teachers suggest a firm foundation upon which further enhancements can be built. Emphasising ICT training and integrating new digital tools into teacher education programs will be crucial in addressing the identified gaps (Rahimi & Mosalli, 2024). Moreover, fostering a culture of continuous learning and professional development will ensure that teachers can effectively meet the evolving demands of 21st-century education. These efforts will ultimately improve young children's educational outcomes, preparing them for future challenges and

opportunities. The need for a supportive professional community and institutional infrastructure to facilitate ongoing professional development and technology integration cannot be overstated (Bedir, 2019; McGowan, 2018). Therefore, policymakers and educational leaders must prioritise developing comprehensive training programs and provide the necessary resources and support to ensure that ECE teachers are fully equipped to navigate the complexities of 21st-century learning environments (Rizal et al., 2024).

Conclusion

This study explored the readiness of Early Childhood Education (ECE) teachers in West Java for 21st-century learning. The findings indicate that most ECE teachers are well-prepared, with an overall high readiness level, though areas such as technology integration require further improvement. The implications of these findings emphasise the need for enhanced ICT training and continuous professional development to address the evolving demands of modern education. Developing comprehensive teacher training programs incorporating digital literacy and new technologies is essential to bridging the gaps identified in this research. Continuous learning and professional development must be fostered to ensure teachers remain adaptable and capable of meeting future educational challenges. While the study provides valuable insights, it is geographically limited to West Java and relies on self-reported data, which may introduce biases. Future research should expand to include a broader range of regions and employ mixed methods to provide a more comprehensive understanding of ECE teacher readiness across different contexts. Additionally, longitudinal studies could offer deeper insights into the long-term impact of professional development initiatives. In conclusion, this study highlights the critical need for targeted support and resources to enhance the readiness of ECE teachers for 21st-century learning. Policymakers and educational leaders must prioritise robust training programs and infrastructure to support ongoing professional growth, ensuring that ECE teachers can deliver high-quality education and prepare young learners for a successful future.

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