OPEN ACCESS
Journal of Early Childhood Development and Education Vol 3 No 2 (2026) https://doi.org/10.58723/junior.v3i2.763

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Research Article

Early Childhood Education in The Digital Era: A Systematic Review of Cognitive Development, Inclusive Pedagogy, Family Influence, and Child Well-Being

Received: May 8, 2026	Revised: June 22, 2026	Accepted: June 30, 2026	Publish: July 1, 2026

Eko Risdianto*, Mona Ardina, Mohammad Qais Rezvani, Hamed Barjesteh

Abstract:

Background: Early Childhood Education (ECE) has undergone significant transformation in the digital era due to rapid technological advancement, evolving family dynamics, and increasing attention to inclusive education and child well-being. Despite these developments, existing studies remain fragmented and often fail to integrate cognitive development, digital learning, family influence, inclusive pedagogy, and child well-being within a unified framework.

Objective: This study aims to systematically analyze research trends, identify existing research gaps, and explore future directions in ECE in the digital era, with a focus on cognitive development, inclusive pedagogy, family influence, and child well-being.

Method: A Systematic Literature Review (SLR) combined with bibliometric analysis was employed using publications indexed in the Scopus database. Relevant articles were identified through a structured keyword search and screened based on predefined inclusion and exclusion criteria. Data cleaning was conducted using OpenRefine, while VOSviewer and Biblioshiny were utilized to perform network visualization, thematic mapping, and trend analysis.

Results: The findings reveal a notable shift in ECE research from clinically oriented and fragmented approaches toward more integrative and multidisciplinary perspectives. The literature predominantly emphasizes child development, parental involvement, and early intervention. Recent studies increasingly focus on the role of digital technologies in learning environments, particularly in the post-pandemic period. However, technology integration remains insufficiently connected to pedagogical principles. Furthermore, gaps persist in incorporating inclusive education, cultural diversity, and child well-being into digital learning contexts.

Conclusion: Advancing ECE in the digital era requires a holistic and integrated approach that combines cognitive and social development, technology-enhanced pedagogy, family and cultural engagement, and child well-being. Such integration is essential for developing adaptive, inclusive, and sustainable early childhood education systems while contributing to educational psychology and child development research.

Keywords: Early Childhood Education, Child Well-Being, Cognitive Development, Digital Learning, Family Influence, Inclusive Education.

1. INTRODUCTION

The development of Early Childhood Education (ECE) globally in recent decades has seen a significant increase in attention, both in policy, research, and educational practice (Nian & Liu, 2025). ECE is no longer viewed merely as the initial stage of formal education, but rather as a key foundation for developing children's cognitive, social, emotional, and character skills, which will influence their future success (Tang et al., 2023). Various international institutions emphasize the importance of investing in early childhood education as a long-term strategy for improving the quality of human resources (Thulebona et al., 2021). Concurrently, global dynamics such as digitalization, social change, and public health challenges are influencing the direction of ECE development, necessitating innovation in learning approaches that are more adaptive, inclusive, and based on children's needs (Spiteri, 2021).

One of the important transformations in the context of early childhood education (ECE) is the increasing role of technology in children's learning processes (Bedel et al., 2024). The integration of digital technology into education has opened up new opportunities for creating

more interactive, flexible, and contextual learning environments (Balcha et al., 2025). The use of digital devices, learning applications, and technology-based platforms enables children to learn through a variety of engaging media tailored to their developmental characteristics (Morais et al., 2025). Furthermore, technology also supports teachers in designing more varied and data-driven learning (Strouse et al., 2024). However, the use of technology in ECE remains a matter of debate, particularly regarding its appropriateness for children's developmental stages and its potential impact on social interactions and emotional development (Lindeman et al., 2021). Therefore, a wise and targeted approach is needed to integrate technology into early childhood learning.

From a child development perspective, cognitive and social aspects are two interrelated dimensions that are crucial for balanced development (Padayachee, 2022). Cognitive development relates to the ability to think, solve problems, and understand concepts, while social development encompasses the ability to interact, communicate, and build relationships with the surrounding environment (Cutting & Lowrie, 2022). The two are inseparable in the learning process, as social interaction often serves as a medium for cognitive development itself (Δημητρίου et al., 2022). However, in practice, the learning approach applied tends to focus on only one aspect, thus failing to optimize child development holistically. This demonstrates the need for learning designs that integrate various dimensions of child development in a balanced and sustainable manner (Balcha et al., 2025).

In addition to school factors, early childhood development is also significantly influenced by the family, community, and cultural environment (Derilo, 2024). The family is the primary and primary environment for children to acquire learning experiences, values, and patterns of social interaction. Meanwhile, community and culture provide a broader context for shaping children's identities, norms, and ways of thinking (Cubillos et al., 2024). Differences in cultural and social backgrounds also influence how children learn and interact, so universal learning approaches often fail to address these diverse needs (Bantali et al., 2025). Therefore, integration between schools, families, and communities is crucial in creating a learning ecosystem that supports optimal child development.

Aspects of children's health, nutrition, and well-being are also crucial factors in early childhood education. A child's physical and mental well-being significantly impacts their ability to learn and interact (Jirarattanawanna et al., 2024). Children who are physically and emotionally healthy tend to have better learning abilities, while those who are not can hinder the educational process. However, the integration of health and education aspects in early childhood education practices is still suboptimal, necessitating a more holistic approach to integrating both aspects into the learning system (Olaboye et al., 2024).

Despite various developments and innovations, several fundamental issues remain in the implementation of Early Childhood Education (ECE) (Worku, 2025). One major issue is the lack of integration of various learning components, such as cognitive, social, and technological aspects, into a comprehensive system (Eden et al., 2024). Learning tends to be partial and unable to accommodate children's comprehensive developmental needs (Cantor et al., 2021). Furthermore, an inclusive approach to education has not been optimally implemented, resulting in children with special needs or diverse backgrounds not receiving full, equal access to learning (Negrete, 2024). Furthermore, family and community involvement in the learning process remains limited, despite their crucial role in supporting child development.

From a research perspective, significant gaps remain regarding the integration of various aspects within Early Childhood Education (ECE) (Mustafa et al., 2024). Research systematically integrating technology with pedagogy is still limited, resulting in technology utilization in learning often lacking a strong pedagogical foundation (Horm et al., 2024). Furthermore, the integration of inclusive approaches with cultural contexts remains understudied, resulting in limited learning models that accommodate diverse learners (Crompton & Burke, 2023). Furthermore, the relationship between health and education has also been underexplored within a single, integrated framework. This suggests that existing approaches remain fragmented and unable to provide comprehensive solutions to early childhood education needs (Flores, 2021).

Based on these conditions, this study aims to systematically identify research development trends in the field of Early Childhood Education (ECE), particularly those related to the integration of technology, pedagogy, inclusion, and child welfare (Chiu et al., 2022). Furthermore, this study seeks to uncover existing research gaps and formulate the need for a more integrated and holistic learning system (Alam et al., 2023). Using a *Systematic Literature Review (SLR) approach*, this study is expected to provide a comprehensive overview of current developments and future research directions (Sethi & Jain, 2024).

In line with these objectives, this study was formulated to answer several main research questions. First, how are the development trends of Early Childhood Education (PAUD) in the digital era reflecting shifting learning paradigms and technology utilization? Second, how is technology integrated into early childhood learning, particularly in supporting cognitive and social development? Third, what gaps remain in the inclusive approach and child welfare aspects within the educational context. By answering these questions, this

research is expected to make a significant contribution to the development of more adaptive, inclusive, and sustainable PAUD learning models.

2. METHODS

This study uses a Systematic Literature Review (SLR) approach combined with bibliometric analysis to obtain a comprehensive overview of research developments in the field of Early Childhood Education in the Digital Era (Öztürk et al., 2024). The bibliometric approach was chosen because it is able to identify publication patterns, research trends, relationships between topics, and intellectual structures within a field quantitatively and visually (Cui & Dong, 2025). Thus, this method not only allows for systematic literature mapping but also provides deeper insights into the direction of research development, scientific collaborations, and dominant and under-explored themes.

The data sources for this study were obtained from the Scopus database, one of the largest and most reputable scientific databases providing high-quality publications across various disciplines. Scopus was selected based on its extensive international journal coverage, standardized indexing quality, and ease of data extraction for bibliometric analysis. The literature search was conducted using four keyword combinations systematically designed to cover all key aspects of the research: early childhood education, digital learning, cognitive and social development, educational inclusion, family roles, and child welfare. The search was conducted using the TITLE-ABS-KEY column to ensure the relevance of the articles obtained.

The search results are then downloaded in Comma-Separated Values (CSV) format, which is compatible with various bibliometric analysis software (Liu, 2022). The next step is data cleaning to ensure the quality and accuracy of the dataset for analysis. This process is performed using the OpenRefine application, which identifies and eliminates data duplication, corrects writing inconsistencies (e.g., author names, keywords, and institutions), and reduces bias that may arise from variations in keyword terminology. This step is crucial in bibliometric analysis, as good data quality will result in more accurate visualizations and interpretations (Öztürk et al., 2024).

After undergoing a cleaning and validation process, the dataset, free from duplication and bias, was then analyzed using two main software tools: VOSviewer and Biblioshiny. VOSviewer was used for network visualization, such as keyword co-occurrence analysis, co-authorship analysis, and co-citation analysis, which aimed to identify relationships between concepts, research topic trends, and the structure of scientific collaboration. Meanwhile, Biblioshiny (based on the Bibliometrix package in R) was used for more in-depth descriptive and exploratory analysis, such as author productivity analysis, publication distribution by country, journal sources, and temporal research trends. The results of this bibliometric analysis were then interpreted qualitatively to identify research trends, research gaps, and opportunities for future development. Interpretation was carried out by linking the visualization and statistical results with theoretical and practical contexts in the field of early childhood education. With this approach, the research not only produced a systematic literature mapping but also provided a conceptual contribution in formulating the direction of the development of a learning system that is more integrated, innovative, and relevant to the needs of education in the digital era.

The keyword combination is as follows:

("early childhood" OR preschool)

AND (education OR learning)AND (digital OR technology OR "online learning")AND ("child development" OR cognitive OR social)AND (family OR home OR parenting)

The inclusion criteria for this study were established to ensure that the articles analyzed were of high quality and relevant to the focus of the study. Selected articles were limited to publications indexed in the Scopus database, with publication years ranging from 2015 to 2026 to capture the latest research developments. Furthermore, only English-language articles were included to maintain consistency and ease the analysis process. Furthermore, selected articles must be directly related to the research topic, specifically those covering aspects of early childhood, education, digital learning, and child development, so that the study results can provide a comprehensive and relevant picture to the research objectives.

Exclusion criteria in this study were used to filter articles that did not meet established quality and relevance standards. Articles that had not undergone a peer-reviewed process were excluded from the analysis to ensure the scientific validity of the sources used. Furthermore, publications that were not available in full-text form were also excluded, as limited access could hinder the thorough analysis process. Furthermore, articles that were not directly related to the research focus, namely early childhood, education, digital learning, and child development, were also eliminated, so that only truly relevant literature was analyzed in this study.

The PRISMA flow stages in this study were used to ensure the literature selection process was carried out systematically, transparently, and can be replicated. The process began with the identification stage, namely the collection of articles from the Scopus database using a combination of predetermined keywords, resulting in a number of initial publications relevant to the research topic. Next, in the screening stage, filtering was carried out based on the title, abstract, and removal of duplicate data to eliminate articles that did not match the study focus. The next stage was eligibility, where the remaining articles were evaluated more in-depth through full-text reading to ensure compliance with the established inclusion and exclusion criteria. The final stage is inclusion, which is the final selection of articles that meet all criteria for further analysis in this study. By following the PRISMA process, the research can ensure

the quality and credibility of the literature used as the basis for the analysis.

("early childhood" OR preschool)
AND (education OR learning)
AND (digital OR technology OR "online learning")
AND ("child development" OR cognitive OR social)
AND (family OR home OR parenting)
=617 → 385

3. RESULTS AND DISCUSSION

3.1 Result

Network Visualization

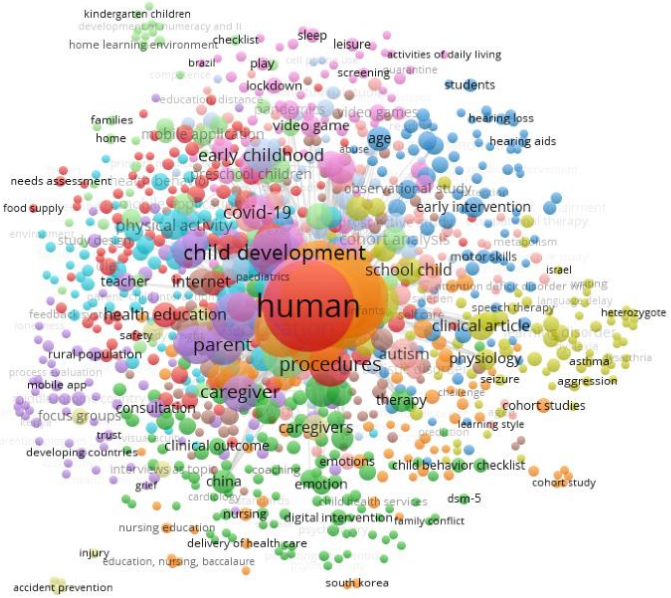

Figure 1. Network Visualization

The bibliometric map visualization using VOSviewer shows the structure and relationships between keywords in research focused on child development. The most dominant node is “human”, followed by “child development” =, “procedures”, “parent”, and “caregiver”, indicating that the analyzed literature is highly focused on the study of child development in a human context with strong involvement of parents and caregivers and a procedure-based or intervention approach. The closeness between nodes shows that these topics are closely interconnected and are at the core of the research discourse. Furthermore, this map groups several main clusters that reflect the direction of research. The clinical and medical cluster highlights aspects such as clinical article, therapy, autism, and early intervention, indicating a focus on the diagnosis and early intervention of child developmental disorders. The psychosocial cluster displays the important role of the family through keywords such as parent, caregiver, emotion, and family conflict, confirming that the family environment has a significant influence on child development. On the other hand, the education cluster includes school children, students, and learning styles, which refer to the context of learning and cognitive development in the school environment. Furthermore, there is a cluster related to technology and the pandemic, marked by the emergence of keywords such as covid-19, internet, mobile applications, and video games. This indicates a shift in research focus due to the pandemic, which has encouraged the increased use of digital technology in children's lives. Another cluster also highlights aspects of physical health through physical activity and health education, emphasizing the importance of a balance between physical and cognitive development. Overall, this map illustrates that research on child development is multidisciplinary, integrating the fields of health, education, psychology, and technology. Emerging trends emphasize the importance of early intervention, the role of the family, and the impact of the digital environment on children. Thus, the direction of future research tends to be towards developing a holistic and adaptive approach, especially in responding to increasingly rapid social and technological changes.

Overlay visualization

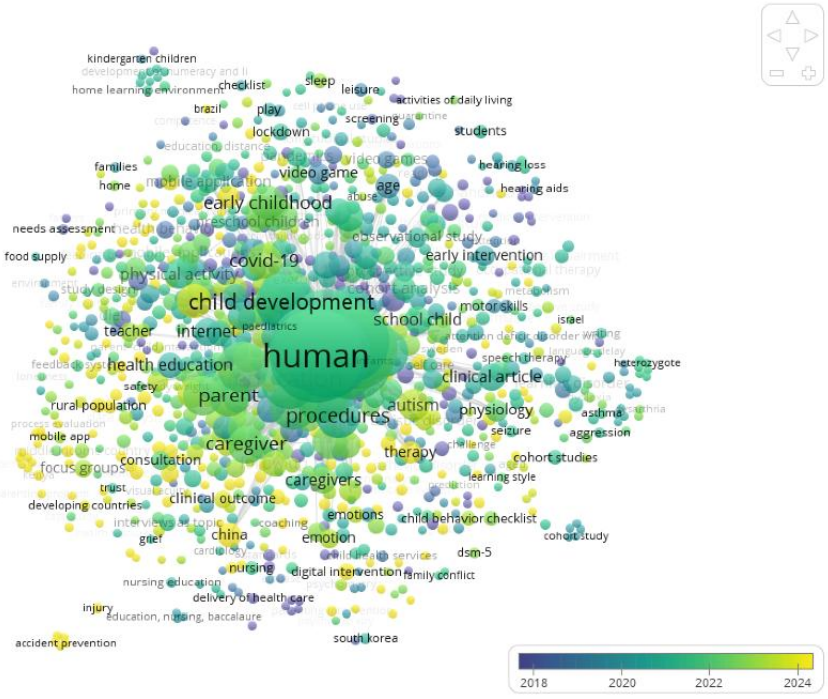

Figure 2. Overlay visualization

The VOSviewer visualization in this image is an overlay visualization, which not only displays the relationships between keywords but also shows the publication time trend (2018–2024) through color gradation. Blue indicates old topics, green indicates transitional phases, and yellow indicates the latest emerging topics. In general, this map still places “human”, “child development”, “procedures”, “parent”, and “caregiver” at the center of the network, which emphasizes that research still focuses on child development in a human context with family involvement and intervention approaches. However, what differentiates it from previous visualizations is the time dimension, which provides insight into the evolution of research themes. In the early period (around 2018–2020, marked in blue), research focused more on clinical and medical aspects, such as clinical articles, physiology, therapy, and cohort studies. This shows that early studies were dominated by health approaches and child development diagnosis. Entering the transition period (2020–2022, green), there is increasing attention to child development, early childhood, parents, and caregivers, indicating a shift towards a more holistic approach involving family and social environmental factors. In the most recent period (2022–2024, yellow), keywords such as mobile app, digital intervention, learning style, family conflict, health education, and physical activity have emerged. In addition, keywords such as covid-19, internet, and video games are also in relatively new areas, indicating that the digital era and the pandemic are major catalysts for changes in research direction. The focus of research has shifted to the integration of technology in children's education, as well as its impact on children's well-being, behavior, and cognitive development. When linked to the major theme of early childhood education in the digital era, this map shows that: Cognitive development is now not only studied from a biological perspective, but is also influenced by technology and the digital environment. Inclusive pedagogy is evolving from a clinical approach to more adaptive interventions, including the use of technology for children with special needs. The influence of the family is increasingly strong and a focus of recent research, particularly in the context of home learning and technology use at home. Child well-being is becoming an increasingly important issue, encompassing emotional, physical, and social aspects amidst changing digital lifestyles. Overall, this overlay visualization demonstrates that research on child development has evolved from a medical approach to a more integrative, digital, and contextual approach, with significant attention paid to the interaction between technology, family, and child well-being in the modern era.

Density visualization

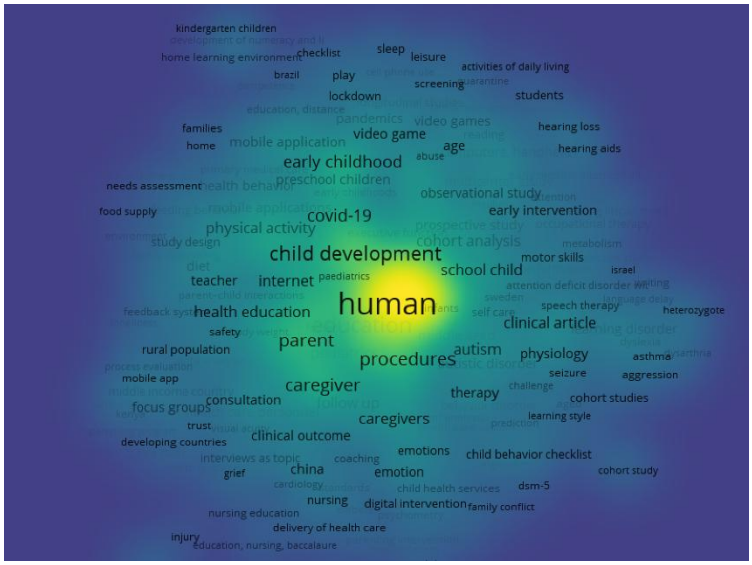

Figure 3. Density visualization

The VOSviewer visualization in this image is a density visualization, which shows the density of keyword occurrences and their relevance within a research field. Bright yellow areas indicate the most frequently occurring and most closely related topics, while green to blue areas indicate less frequent or more specific topics. The map shows that the keyword “human” is the centerpiece with the brightest color, followed by “child development”, “procedures”, “parent”, and “caregiver”. This indicates that the research focuses heavily on child development in a human context, using intervention approaches and family involvement. The high density in these areas indicates that these topics are central to the analyzed literature and frequently appear together in various studies.

Around the center, there is a medium-density area (green), which includes keywords such as health education, internet, school child, clinical article, therapy, and autism. This indicates that research is evolving toward the integration of health, education, and clinical aspects, including interventions for children with special needs. Furthermore, the presence of keywords such as early intervention and motor skills demonstrates the importance of early approaches in supporting child development. Meanwhile, the lower-density area (blue) indicates more specific or emerging topics, such as mobile apps, digital intervention, family conflict, learning styles, and contextual issues such as COVID-19, video games, and screening. Although not as dense as the core topics, the emergence of these keywords indicates a shift in research direction to the digital era, where technology is starting to play a significant role in education and child development. Overall, this density visualization shows that research on child development is dominated by strong core themes (child development, family roles, and intervention), but simultaneously evolving in a broader and multidisciplinary direction, encompassing aspects of education, health, and digital technology. This confirms that the study of children today is no longer a single study, but is increasingly complex, taking into account the interaction between biological, social, and digital factors in shaping children's development and well-being.

3.2 Discussion

The bibliometric map visualization using VOSviewer strongly reflects and supports the focus in the title “Early Childhood Education in the Digital Era: A Systematic Review of Cognitive Development, Inclusive Pedagogy, Family Influence, and Child Well-Being”. This can be seen from the dominance of keywords such as “human”, “child development”, “parent”, and “caregiver”, which shows that research on early childhood education does not only focus on cognitive aspects alone, but also on holistic human involvement, especially the role of the family and social environment in supporting child development. In the context of cognitive development, the presence of keywords such as school child, learning style, attention deficit, and early intervention indicates that the literature discusses a lot about children’s cognitive development which is related to the learning process and the need for early intervention. This is in line with the objective of the systematic review which examines how children’s cognitive development is formed through various educational approaches and environmental conditions, including developmental challenges such as attention disorders. Furthermore, the aspect of inclusive pedagogy is reflected in clusters related to autism, speech therapy, early intervention, and clinical outcome. These keywords demonstrate a focus on children with special needs and the importance of an inclusive and adaptive learning approach. This emphasizes that early childhood education in the digital

age is inseparable from efforts to create a learning system that accommodates the diversity of children's abilities and circumstances.

In the family influence dimension, the map shows the central position of the keywords parent, caregiver, family, and home learning environment. The proximity of these nodes to the network center indicates that family is a key factor in supporting child development, especially in the digital era where learning occurs not only at school but also at home. This strengthens the argument that parental involvement is a crucial element in the success of early childhood education.

Meanwhile, aspects of child well-being are reflected in the emergence of keywords such as emotion, physical activity, health education, and issues such as COVID-19, screening, and video games. This demonstrates that child well-being encompasses physical, emotional, and social dimensions that are influenced by environmental changes, particularly due to digitalization and the pandemic. The presence of technology-related keywords such as the internet and mobile applications also confirms that the digital era has a significant impact on the balance of children's activities, both positively and negatively. Overall, this VOSviewer map demonstrates that research on early childhood education in the digital era is multidisciplinary and integrated, encompassing cognitive development, inclusive pedagogical approaches, family influences, and child well-being. Thus, this visualization provides a strong empirical foundation to support your systematic review, while also demonstrating that the four dimensions in the title are interconnected and a primary focus of current research trends.

Research Gap Analysis

Based on the results of the bibliometric analysis and systematic literature review that have been conducted, several significant research gaps were found in the study of Early Childhood Education in the Digital Era. First, there is a gap in technology integration, where although the use of technologies such as mobile applications, the internet, and digital intervention is starting to increase, their use in early childhood education still tends to be partial and has not been systematically integrated with a pedagogical approach based on child development. This indicates that technology is used more as an aid, rather than as part of a holistic and theory-based learning design. Second, there is a gap in the aspect of inclusion, as evident in the still limited research that integrates an inclusive pedagogical approach with the digital context and cultural diversity. Although issues such as autism, speech therapy, and early intervention have been widely studied, the implementation of inclusive technology-based learning that can accommodate the needs of children with diverse backgrounds and abilities is still not optimal. Third, there is a gap found in the study of child well-being, where research tends to emphasize cognitive and academic aspects rather than the integration of children's physical, emotional, and social health. In fact, the visualization results show a link between physical activity, emotion, and the use of digital technology, which indicates the importance of a more holistic approach in understanding the impact of the digital era on child well-being. Fourth, there is a gap in the policy aspect (policy gap), where there are still limited studies that connect empirical findings with the implementation of education policies that support the comprehensive integration of technology, inclusion, and child well-being. This indicates that the development of early childhood education policies is not fully evidence-based and has not been able to address the dynamics of change in the digital era. Overall, these four gaps emphasize the need to develop an early childhood education model that is more integrative, adaptive, and based on the synergy between technology, pedagogy, inclusion, and child well-being.

3.2.1 Implimication

Theoretical Implications The results of the bibliometric analysis and systematic literature review in this study provide significant theoretical contributions to strengthening the fields of educational psychology and child development, particularly in the context of early childhood education in the digital era. First, from an educational psychology perspective, the research findings indicate that children's learning processes can no longer be understood linearly and separately between cognitive, social, and environmental aspects, but rather as a complex and interacting system. The dominance of keywords such as child development, learning style, early intervention, and their relationship to digital technology indicates that educational psychology approaches need to adapt to new dynamics influenced by the digital environment. This reinforces the importance of developing learning theories that not only focus on the individual's internal processes but also consider interactions with technology, family, and the broader social context. Thus, this study expands the framework of educational psychology towards a more integrative, contextual, and ecosystem-based learning approach.

Second, in the context of child development, the results of this study confirm that early childhood development is a multidimensional process influenced by a combination of biological, social, and digital factors. Bibliometric visualizations show a strong link between cognitive development and the role of the family, early intervention, and the digital environment, indicating that children's development cannot be separated from the context of their daily lives. Furthermore, the emergence of new themes such as digital intervention, mobile applications, and online learning indicates that the digital environment is now an integral part of the child development process. This implies that child development theory needs to be reconstructed to accommodate the influence of technology as one of the main determinants of development. Thus, this study strengthens the paradigm that child development must be understood holistically, by considering the interaction between cognitive, social, emotional, family, and digital technology aspects as a mutually influencing entity.

Overall, the theoretical contribution of this research lies in strengthening and expanding the perspectives of educational psychology and child development toward a more integrative and adaptive approach to changing

times. These findings emphasize that early childhood education in the digital era requires a new theoretical framework capable of bridging child development, pedagogical practice, and technological transformation, thus producing more relevant, inclusive, and sustainable learning models.

Practical Implications

The findings of this study provide significant practical implications, particularly in the development of learning models and digital systems in early childhood education (PAUD). First, in terms of learning model development, the analysis results indicate the need to design an integrative model that combines aspects of children's cognitive, social, and emotional development with the use of digital technology. The developed learning model should not only focus on knowledge transfer but also support interactive, contextual learning experiences based on children's developmental needs. Furthermore, the learning approach needs to be designed inclusively, taking into account the diverse characteristics of students, including children with special needs, and integrating the role of the family as part of the learning ecosystem. Thus, the resulting learning model is expected to improve the quality of the learning process while remaining relevant to the demands of education in the digital era.

Second, in the context of developing a digital early childhood education system, this study emphasizes the importance of developing a technology-based learning platform and environment that not only serves as a medium for delivering materials but also as a system that supports comprehensive monitoring of children's development. The developed digital system needs to integrate various features, such as a learning management system (LMS) for early childhood, interactive learning media, and data-driven evaluation tools that can be used by teachers and parents. Furthermore, this system must also be designed to support collaboration between schools, families, and communities, so that the learning process is not limited to the school environment. With an integrated digital system, the early childhood education process can be more adaptive, personalized, and data-driven, and able to support optimal child development in a real-life context.

Proposed Conceptual Framework

Based on the results of the bibliometric analysis and systematic literature review, this study proposes an integrative conceptual framework to support the development of early childhood education in the digital era. This conceptual framework is built on four main interacting dimensions: the integration of cognitive and social aspects (cognitive + social), the synergy between technology and pedagogy (technology + pedagogy), the relationship between family and culture (family + culture), and the balance between children's health and well-being (health + well-being).

In the first dimension, the integration of cognitive and social development emphasizes that children's learning processes focus not only on thinking skills but also on social interaction, communication, and character development. These two aspects complement each other and must be developed simultaneously through a collaborative and contextual learning approach. Furthermore, the second dimension emphasizes the importance of integrating technology and pedagogy, where technology serves not merely as a tool but as part of a systematically designed learning strategy based on educational theory. This allows for a more interactive, adaptive, and relevant learning experience.

The third dimension, the relationship between family and culture, demonstrates that early childhood learning cannot be separated from the social context in which children grow and develop. The family, as the primary environment, plays a strategic role in shaping children's values, behaviors, and learning habits, while culture provides a framework of meaning that influences how children understand the world. Therefore, learning systems need to accommodate diverse family and cultural backgrounds to create a more inclusive and contextual approach. Finally, the health and well-being dimension emphasizes that a child's educational success is measured not only by academic achievement but also by the child's overall physical, emotional, and social well-being.

Overall, this conceptual framework emphasizes that early childhood education in the digital age must be developed through a holistic and integrated approach, taking into account the interactions between various factors that influence child development. This model is expected to serve as a foundation for designing a more adaptive, inclusive, and sustainable learning system, capable of addressing the challenges of education in the era of digital transformation.

3.2.2 Research Contribution

This study contributes to the literature in several important ways. First, it provides a comprehensive bibliometric mapping of Early Childhood Education (ECE) research in the digital era by integrating cognitive development, inclusive pedagogy, family influence, and child well-being into a single analytical framework. Previous studies have generally examined these dimensions separately, whereas this review demonstrates their interconnected nature. Second, this study identifies four major research gaps, namely the technology integration gap, inclusive education gap, child well-being gap, and policy gap. These findings offer a clearer research agenda for future scholars interested in developing more holistic and evidence-based early childhood education.

Third, the study proposes an integrated conceptual perspective emphasizing that effective ECE in the digital era should simultaneously integrate technology-enhanced pedagogy, cognitive and social development, family engagement, cultural diversity, and children's

well-being. This framework provides a useful foundation for future empirical studies and educational policy development.

3.2.3 Limitations

This study has several limitations that need to be considered when interpreting the results. First, the data source used is limited to the Scopus database. Therefore, despite its broad coverage and high quality, it is possible that some relevant publications indexed in other databases were not included in the analysis. This could affect the completeness of the literature reviewed. Second, the variation in research methods in the articles analyzed also presents a challenge, as differences in methodological approaches, research contexts, and instruments can affect the consistency and comparability of the findings. This variation has the potential to introduce interpretation bias in the synthesis of results. Therefore, the results of this study need to be understood within the context of these limitations, while also opening up opportunities for further research to expand data sources and employ more diverse and comprehensive methodological approaches.

Future Research

Based on the findings of this study, several important future research directions need to be developed to enrich the study of early childhood education in the digital era. First, the use of Artificial Intelligence (AI) in early childhood education (PAUD) presents a highly promising area for exploration, particularly in the development of adaptive learning systems, personalized learning materials, and real-time monitoring of children's development. Second, the concept of digital parenting is becoming an increasingly relevant issue, given the increasing use of technology in children's daily lives. Further research is needed to examine the role of parents in wisely managing technology use and its impact on children's cognitive, social, and emotional development. Third, the development of inclusive digital learning needs to be a primary focus, particularly in creating technology-based learning systems that can accommodate the diverse needs of children, including those with special needs. The integration of technology, pedagogy, and inclusive principles is expected to produce a more equitable, adaptive, and sustainable learning model. Thus, future research is expected to strengthen the development of early childhood education that is more innovative and responsive to the challenges of the digital era.

3.2.4 Suggestion

Future studies should extend the present findings by incorporating multiple databases such as Web of Science, ERIC, and Dimensions to provide broader literature coverage. Researchers are also encouraged to conduct empirical investigations examining the effectiveness of AI-assisted learning, digital parenting, inclusive digital education, and technology-enhanced pedagogical practices in diverse cultural contexts. Furthermore, longitudinal and mixed-method studies are needed to better understand the long-term influence of digital technologies on children's cognitive, social, emotional, and well-being development.

4. CONCLUSION

This study aims to systematically examine the development of Early Childhood Education in the digital era through a systematic literature review combined with bibliometric analysis. The results indicate that the trend in Early Childhood Education (ECE) studies has shifted from a clinical and fragmented approach to a more integrative approach, incorporating aspects of cognitive and social development, family roles, and the influence of digital technology. Bibliometric visualization reveals that research is dominated by the themes of child development, parental involvement (parents and caregivers), and increasing attention to technology integration in early childhood learning. The findings of this study also provide answers to the proposed research questions. First, the trend in the development of ECE in the digital era shows a significant increase in technology utilization, particularly since the post-pandemic period, which has encouraged the emergence of digital-based learning and technology interventions in children's education. Second, the integration of technology in early childhood learning is still developing and tends to be partial, where technology is not yet fully integrated with a pedagogical approach based on child development. Third, there are still gaps in the inclusive approach and child welfare, particularly in terms of integrating health, emotional, social aspects, and the use of digital technology within a holistic learning framework.

Based on these findings, this study emphasizes the importance of developing a holistic and integrated learning approach in early childhood education. Integration of cognitive and social development, pedagogically based use of digital technology, family involvement and cultural context, and attention to children's health and well-being are key elements in creating a relevant education system in the digital age. Therefore, this study makes an important contribution to strengthening the conceptual and practical foundations for developing more adaptive, inclusive, and sustainable early childhood education models in the future.

5. Acknowledgment

The author expresses his appreciation and gratitude to all parties who have provided support, contributions, and inspiration in the preparation and completion of this research. This research is an independent study and does not receive funding from any specific institution, agency, or sponsor. Therefore, the entire research process was conducted independently with a full commitment to scientific integrity and academic quality.

6. Author Contribution

This research was compiled by three authors with the following division of contributions. The first author played a role in conceptualization, namely formulating the research idea, determining the focus of the study, and

developing the research conceptual framework. The second author was responsible for the methodology aspect, including designing the systematic literature review method, developing the literature search strategy, and implementing the bibliometric analysis. The third author contributed to the writing process, namely drafting the manuscript, processing the analysis results into a scientific narrative, and revising and refining the article as a whole. All authors have read and approved the final version of this manuscript.

AUTHOR INFORMATION

Corresponding Authors

Eko Risdianto, University of Bengkulu, Indonesia
https://orcid.org/0000-0002-5950-2238
Email: eko_risdiatno@unib.ac.id

Authors

Mona Ardina, University of Bengkulu, Indonesia
https://orcid.org/0009-0000-6685-9131
Email: monaardina@unib.ac.id

Mohammad Qais Rezvani, Rana University, Afghanistan
https://orcid.org/0000-0001-7256-0582
Email: rezvaniqais@ru.edu.af

Hamed Barjesteh, Islamic Azad University, Iran
https://orcid.org/0000-0002-4018-4487
Email: Hamed.Barjesteh@iau.ac.ir

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