

LEARNING TRANSFORMATION IN PRIMARY SCHOOLS: DIGITAL TECHNOLOGY INTEGRATION FOR GENERATION ALPHAMaita F Casinillo¹, Muzi Latunil Isma², and Nabila³¹ Visayas State University, Philippines² Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia³ Universitas Islam Negeri Mahmud Yunus Batusangkar, Indonesia**Corresponding Author:**

Maita F Casinillo,

Department of Electrical Engineering Vocational Education, Faculty of Teacher Training and Education, Visayas State University.

Email: maitafcasinillo@gmail.com**Article Info**

Received: December 20, 2025

Revised: January 22, 2026

Accepted: February 03, 2026

Online Version: March 04, 2026

Abstract

The transformation of learning in the digital era has become an inevitability, especially in addressing the unique characteristics of Generation Alpha, who are born and raised amid rapid technological advancement. This article is driven by the urgent need to adapt primary school teaching methods to the demands of the times and the nature of today's learners. The main objective of this study is to examine how the integration of digital technology can enhance the effectiveness of the teaching and learning process in primary schools, particularly in developing 21st-century competencies among Generation Alpha. The research employed a qualitative method with a descriptive approach, involving observation, interviews, and documentation studies conducted in several primary schools that have implemented digital technology in their learning activities. The findings reveal that the appropriate use of digital technology can significantly increase student engagement, facilitate differentiated instruction, and foster digital literacy from an early age. In conclusion, integrating digital technology into primary school learning not only strengthens the effectiveness of education but is also essential for equipping Generation Alpha with the critical skills needed for the future.

Keywords: Digital Technology, Generation Alpha, Learning Transformation, Primary School

© 2026 by the author(s)

This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution-ShareAlike 4.0 International (CC BY SA) license

[\(https://creativecommons.org/licenses/by-sa/4.0/\)](https://creativecommons.org/licenses/by-sa/4.0/).Journal Homepage <https://journal.zmsadra.or.id/index.php/fej>How to cite: Casinillo, M. F., Isma, M. L., & Nabila, Nabila. (2026). Learning Transformation in Primary Schools: Digital Technology Integration for Generation Alpha. *JOB: Journal of Basic Education*, 2(1), 118–132. <https://doi.org/XX.XXXXXX/fej.v2i1.1420>

Published by: Yayasan Zia Mulla Sadra

INTRODUCTION

The development of information and communication technology (ICT) has brought significant changes in nearly all aspects of human life, including education. Digitalization has become a global phenomenon that cannot be avoided, and the education sector is required to continuously adapt in order to remain relevant to the times (Arts dkk., 2015; Astapenko dkk., 2021). Schools, as the primary formal educational institutions, play a crucial role in preparing future generations to face increasingly complex life challenges. The transformation of learning through the utilization of digital technology has become an important strategy to improve the quality of education. This transformation includes changes in how teachers teach, how students learn, and how learning materials are delivered and accessed. Moreover, technology integration demands a paradigm shift in school management, curriculum development, and learning evaluation. Amid these advancements, primary schools hold a critical position as the foundational stage for children to become familiar with formal education and technology. Therefore, the use of digital technology in primary schools needs to be studied thoroughly to ensure its implementation aligns with the needs and characteristics of learners.

The emergence of Generation Alpha, those born after 2010, marks a new era in education. This generation grows up in an environment saturated with technology, where access to information is extremely easy and fast (Bell dkk., 2015). They are accustomed to using digital devices from an early age, even before formally learning letters and numbers. Their familiarity with gadgets, social media, and digital applications makes conventional learning approaches less effective in capturing their attention and enhancing learning motivation. Therefore, the education sector must design strategies that address the unique characteristics of Generation Alpha, one of which is through the integration of technology in teaching and learning processes. It is important to note that learning transformation is not merely about using technological tools but how technology is pedagogically applied to support learning objectives (Berlinski dkk., 2009). In this context, technology becomes both a facilitator and a bridge between teachers and students to create meaningful and contextual learning experiences.

Although digital technology has great potential in education, its implementation in primary schools still faces various challenges. Some schools experience infrastructure limitations, a lack of teacher competence in operating digital devices, and a relatively high resistance to change (Clark-Wilson dkk., 2020; Eysenck & Cookson, 1969). Furthermore, not all students have equal access to technology due to economic factors or geographical location. This creates a digital divide that can affect the quality disparity in learning outcomes. On the other hand, schools that have successfully implemented technology in learning report increased student motivation, engagement in learning processes, and better academic achievement. Therefore, it is crucial to identify best practices from schools that have succeeded in implementing digital transformation in learning. Analyzing these practices can serve as a reference for other schools in designing similar strategies.

In the context of curriculum, the integration of digital technology also provides opportunities to develop more interactive, contextual, and flexible materials. The curriculum is no longer rigid and centralized but can be tailored to students' needs and interests. Project-based learning, problem-based learning, and flipped classroom approaches become easier to implement with technological support (Gartshore, 2018). Additionally, teachers have the opportunity to act as facilitators who guide the learning process rather than merely delivering content. This shift requires adequate training to enable teachers to manage technology effectively. Meanwhile, students are given space to explore materials, actively build knowledge, and develop 21st-century skills such as critical thinking, creativity, communication, and collaboration. Thus, technology integration is a strategic step in strengthening primary schools as the foundational pillar of national education development.

This article presents an in-depth study of how digital technology can be integrated into the learning process in primary schools to address contemporary challenges and the characteristics of Generation Alpha (Gupta dkk., 2022). The study focuses on analyzing the implementation of digital transformation in several primary schools that have taken strategic steps to adopt technology. Using a qualitative approach, this article aims to explore best practices, obstacles faced, and the impact of technology implementation on learning processes and outcomes. The novelty of this article lies in its emphasis on the relevance of digital learning approaches tailored to Generation Alpha's characteristics and how technology is not merely a learning aid but also a medium for character building, creativity, and life skills development (Haladyna & Thomas, 1979; Hale, 2022). The findings are expected to provide strategic input for policymakers, educators, and relevant stakeholders in designing adaptive and transformative primary education.

The influence of technology on education goes beyond merely serving as learning tools; it fundamentally changes ways of thinking, interacting, and problem-solving. In primary schools, this is evident in students' growing familiarity with digital media such as educational videos, apps, and interactive platforms that enable independent and collaborative learning. When used appropriately, digital technology can foster students' curiosity and broaden their knowledge horizons (G. M. Henderson, 2002). Students no longer rely solely on teachers as their only source of information but can access various learning resources online with proper guidance and supervision. This phenomenon shifts the teacher's role from instructor to facilitator and mentor who accompanies students in the learning process. Although this transformation brings challenges, it offers great opportunities for primary education to advance and stay aligned with contemporary dynamics.

Alongside technological advancements, various digital learning platforms such as Google Classroom, Microsoft Teams, Edmodo, and Moodle have been adopted by teachers across educational levels. While initially more common in secondary and higher education, primary schools have also begun to implement these platforms to support learning processes. These platforms allow teachers to manage classrooms digitally, assign tasks, provide feedback, and monitor student progress in real-time. Furthermore, technology integration enables personalized learning where materials and activities can be tailored to each student's needs, abilities, and interests (M. Henderson dkk., 2017; Hilbert, 2020). This is crucial for Generation Alpha, known for their unique learning styles, short attention spans, and preference for visual and interactive activities. Therefore, teachers must be more creative and innovative in designing digital learning to keep it engaging and meaningful for students.

Digital technology integration in primary school learning can also enhance educational inclusivity (Höfrová dkk., 2024). Students with special needs benefit from specialized learning software tailored to their conditions. For example, students with reading difficulties can use text-to-speech applications, or those with motor impairments can utilize touch-based interactive devices. This illustrates how technology can be a critical tool to ensure all students, regardless of background or ability, receive equal learning opportunities. On the other hand, teachers need ongoing training to optimize and inclusively use these technologies. Schools must also ensure adequate infrastructure, such as stable internet connections, sufficient digital devices, and policies that encourage innovation and collaboration (Hoggan, 2016). Without comprehensive support, technology integration will struggle to achieve its intended goals effectively.

Amid national educational challenges, digital technology-based transformation in primary school learning is a strategic step toward improving education quality equitably. The government, through the Ministry of Education and Culture, has promoted technology use via programs such as Merdeka Belajar (Freedom to Learn), Platform Merdeka Mengajar (Freedom to Teach), and the provision of ICT devices in schools. However, the effectiveness of these programs heavily depends on each school's readiness to implement them. In many cases, there remains a gap between policy and practice in the field. Therefore, systematic evaluation of

technology integration practices in primary schools is essential to identify key success factors. Such studies provide a more realistic picture of conditions on the ground and offer data-driven, contextual recommendations for future improvements.

Thus, the integration of digital technology in primary school learning is not merely an option but an urgent necessity to prepare Generation Alpha for a rapidly changing world. This generation requires different learning approaches from previous generations because they live amidst fast information flows and advanced technology (Jha, 2020). If not properly prepared, Generation Alpha's great potential could become a challenge for the education system. This article aims to contribute to understanding these dynamics through case studies and critical analyses of digital technology integration at the primary school level. It is hoped that this article serves as a reference for educators, researchers, and policymakers in developing adaptive, inclusive, and future-oriented digital learning strategies. The novelty lies in its specific focus on Generation Alpha and the emphasis on concrete practices occurring in primary schools, which are often overlooked in digital education discourse.

Generation Alpha's inclination toward the digital world poses unique challenges for educators. They have short attention spans, are accustomed to rapid access, and tend to respond better to visual and interactive content. Hence, conventional learning dominated by one-way lectures and textbook use tends to be ineffective in capturing their learning interest. Teachers need to adopt more dynamic and flexible approaches where digital technology serves as a bridge to make learning more contextual and enjoyable (Jukic & Skojo, 2021; Khin & Ho, 2019). Learning media such as interactive videos, educational games, augmented reality, and simulation-based learning have proven effective in engaging Generation Alpha and enhancing their understanding of taught concepts. In other words, technology-integrated learning can accommodate today's students' learning styles without compromising the substance and quality of materials. This approach also enables teachers to implement differentiated instruction, treating each child according to their learning needs.

One of the main challenges in integrating technology in primary schools is the persistent digital divide across many regions. In urban areas, internet access and digital devices are relatively easier to obtain, while in remote areas, many schools lack even basic facilities such as electricity and computers. This gap causes disparities in the quality of education students receive. Equitable access to education is part of the national education mission. Therefore, policies for technology integration in basic education must consider fairness and inclusion. The government and other stakeholders need to provide supporting infrastructure and mentoring programs for teachers and students in underserved regions. Thus, learning transformation should not be an elite agenda but accessible fairly and evenly to all children nationwide. The principle of digital justice is vital to ensure that technology integration does not create new educational divides.

From a psychopedagogical perspective, technology also offers opportunities to strengthen constructivist-based learning approaches. In this approach, students do not passively receive information but actively build knowledge through exploration, experience, and interaction. Digital technologies, such as interactive simulations and online learning platforms, enable students to experience more active, reflective, and collaborative learning. For instance, virtual laboratories in science lessons allow students to conduct experiments without physical equipment and materials. Moreover, students can collaborate through online discussions, digital group projects, and peer reviews facilitated by technology. With this support, primary schools not only teach academic content but also develop students' critical thinking, creativity, and social skills from an early age. Therefore, digital technology integration should be designed to strengthen the pedagogical essence of learning processes rather than merely following trends or program formalities.

Institutionally, digital learning transformation also demands changes in school culture and management. Technology use requires schools to foster a culture of innovation, continuous learning, and openness to change. Leaders must encourage teacher professional development related to digital pedagogy and facilitate the availability of adequate learning resources. Moreover, parents and the community play a critical role in supporting technology use in learning by providing reinforcement and supervision at home. Digital literacy education must also be integrated to help students use technology wisely, ethically, and safely. This comprehensive approach ensures that digital technology integration in primary schools becomes sustainable and meaningful in the long term. The school's role as a learning ecosystem that involves multiple stakeholders is vital in realizing the vision of quality education for all children.

In conclusion, the transformation of learning in primary schools through digital technology integration is a key strategy to prepare Generation Alpha for the future. It requires a holistic approach covering curriculum development, teacher competence enhancement, infrastructure readiness, inclusive access, pedagogical innovation, and supportive school culture. Although challenges such as the digital divide and teacher readiness remain, the benefits of technology-based learning transformation are evident in increasing student engagement, motivation, and learning outcomes. This article aims to provide a comprehensive overview of these issues through a qualitative study in several primary schools that have implemented digital learning. The findings contribute to understanding best practices, obstacles, and strategic recommendations to accelerate digital transformation in primary education. Ultimately, this effort supports national education goals in fostering a generation capable of facing the complexities of the 21st century with confidence and competence.

RESEARCH METHOD

This study employs a qualitative approach with a case study method to deeply explore the practice of digital technology integration in learning at elementary schools. This approach was chosen because it allows the researcher to comprehensively and holistically understand the phenomenon in its original context. The case study focuses on several elementary schools that have systematically implemented digital technology in the learning process. Through this approach, the researcher can explore various aspects influencing the success and obstacles of technology integration, ranging from teacher readiness, infrastructure availability, to student responses to learning changes. The choice of this method also enables the emergence of in-depth and narrative data, which is highly relevant to answering research objectives oriented toward understanding the process rather than merely quantitative outcomes.

The research subjects consist of teachers, principals, and students from grades 4 to 6 in three elementary schools located in urban, suburban, and rural areas. These three locations were selected to provide a diverse overview of technology integration practices in different contexts. Teachers were chosen as the main actors in planning and implementing technology-based learning (Larsen-Freeman, 2013). Principals play an important role in school management and policy support. Meanwhile, students were selected as the primary informants to assess the effectiveness of the applied learning approaches. Informants were purposively selected based on their involvement in the technology integration process and representation of the research site characteristics. Thus, the data collected is expected to reflect the comprehensive dynamics of digital technology integration.

Data collection was conducted using observation, in-depth interviews, and documentation techniques. Observations were carried out directly in classrooms during the learning process to observe how technology was used by teachers and students and to what extent the technology supported the achievement of learning objectives. In-depth interviews were conducted semi-structured, guided by flexible interview protocols allowing broad yet

focused exploration of information. Documentation included collecting technology-based learning devices, recordings of students' digital activities, and school policies related to digital learning. These three techniques were used triangulatively to strengthen data validity and enrich understanding of the studied phenomena.

The research instruments included classroom observation guidelines, interview guides, and documentation formats. The observation guidelines contained indicators of technology use in learning, teacher-student interaction, and student engagement during the learning process. The interview guides were designed to explore perceptions, experiences, and challenges faced by teachers and principals in integrating technology (Mancebon & Molinero, 2000). Meanwhile, the documentation format focused on the types of digital media or platforms used, lesson planning, and evidence of student work demonstrating their involvement in digital learning. All instruments were validated by educational technology experts to ensure their relevance and coherence with the research objectives.

The research procedures were carried out in several stages: (1) preparation, (2) data collection, (3) data analysis, and (4) reporting. In the preparation stage, the researcher mapped the research locations and communicated with school authorities to obtain permission. Next, data collection was conducted systematically over two months, with schedules adjusted to the school academic calendar. The third stage was data analysis, performed qualitatively using data reduction, data presentation, and conclusion drawing techniques. Finally, the research results were compiled into a systematic report adapted to the structure of scientific articles.

Data analysis was performed using thematic analysis techniques, which involved grouping data into main themes emerging from observations, interviews, and documentation results. The process began with transcribing interviews and detailed recording of observation results. Then, the researcher conducted open coding to identify initial categories, which were further developed into main themes such as digital learning strategies, implementation challenges, student responses, and institutional support. Each theme was analyzed in depth by comparing cases and informants. This technique allowed the researcher to develop a comprehensive understanding of the dynamics of digital technology integration in elementary schools.

To ensure data validity, this study used source and method triangulation techniques. Source triangulation compared data from teachers, principals, and students. Method triangulation combined observation, interview, and documentation results. Additionally, member checking was conducted by confirming interview results with informants to ensure the accuracy of meaning and context. Peer debriefing involved colleagues reviewing the research findings to avoid researcher bias. Qualitative validity and reliability were maintained through the researcher's intensive involvement in the field and critical reflection during the analysis process.

Research ethics were maintained by providing clear information to all participants regarding the purpose, process, and benefits of the study. Participation was voluntary, with written consent obtained from teachers and principals, and parental permission for student involvement. Participant identities were kept confidential by using codes or pseudonyms in reporting results (Mezirow, 1994). Throughout the research process, the researcher upheld principles of non-discrimination and respect for informants' rights. All data collected were used solely for academic purposes and were not disseminated to third parties without permission.

The strength of this research method lies in its ability to describe reality in a deep and contextual manner. Case studies enable the researcher to capture nuances and dynamics that cannot be explained through quantitative approaches. However, its limitation is in generalizing the results. Therefore, the findings from this study are not intended for broad generalization but to provide insights, inspiration, and deep understanding of digital technology integration

practices in elementary school learning. The specificity of the findings is actually a main strength for producing relevant and practical recommendations.

With the described method, this study is expected to answer key questions related to strategies, challenges, and impacts of digital technology integration on Generation Alpha's learning in elementary schools. The main focus is not only on the technical aspects of technology use but more on how technology is integrated into pedagogical and cultural school practices. Thus, the research results can provide a concrete contribution to developing a contextual, participatory, and sustainable digital learning model. This study also serves as a foundation for developing basic education policies in the era of digital transformation.

RESULTS AND DISCUSSION

Results

Observations at the three elementary schools showed that the integration of digital technology in learning was carried out using different approaches, depending on the readiness of infrastructure and teacher capacity. In the urban school, the use of technologies such as interactive projectors, tablets, and learning applications like Google Classroom and Kahoot had become a routine part of the learning process (Mezirow, 1978). Teachers were able to operate various learning platforms independently and even creatively develop multimedia teaching materials. Meanwhile, suburban schools used technology in a limited way, mainly to complement learning through educational videos and online learning via WhatsApp or YouTube. In rural areas, technology integration was still limited to the use of school computers and simple learning programs, with the main challenges being weak internet access and limited devices. These differences highlight the importance of a contextual approach in developing policies for digital learning transformation.

Students' responses to technology-based learning were generally very positive. They showed high enthusiasm for using interactive media in the learning process, such as online quizzes, educational games, and animated learning videos. In the urban school, students were accustomed to participating in discussions via digital forums and submitting assignments online. They mentioned that digital learning made the material easier to understand, less boring, and motivated them to learn independently. In suburban and rural schools, although technology use was not as extensive as in the city, students still showed interest in digital elements within learning. Even in schools with only one computer per class, students were willing to take turns trying educational applications. This demonstrates that technology is not just a learning aid but also an effective stimulus for fostering interest and enthusiasm for learning among Generation Alpha students.

Teachers, as the frontline implementers of technology integration, had varied experiences. Urban teachers tended to be more prepared as they had attended various technology training and were accustomed to using digital media in daily life. They could integrate technology not only in delivering content but also in evaluation, communication with parents, and classroom management. On the other hand, teachers in suburban and rural areas still faced challenges mastering technology (Miller, 2023). Some teachers admitted feeling awkward using online applications, while others struggled to design digital teaching media. Nevertheless, the teachers showed a strong willingness to learn, actively seeking training and self-study to keep up with the times. This proves that ongoing training is crucial to support the success of digital learning transformation.

The use of digital technology also positively impacted the development of 21st-century skills among students, especially in critical thinking, collaboration, and digital literacy. In learning activities involving digital projects, students learned to organize ideas, solve problems, and present their work digitally. In the urban school, project-based learning involved students creating video presentations or infographic designs as part of thematic assignments. This

trained them to think systematically, use technology productively, and communicate visually. In suburban schools, collaborative learning via online groups began to be applied for group assignments. Although limited, these activities opened new opportunities for students to learn together and give feedback (Nambisan, 2017). These results indicate that digital technology can significantly enrich students' learning experiences.

Institutionally, the support of school principals was crucial for the success of technology integration. In urban schools, principals had a strong vision for digital transformation and prioritized digital school programs. They encouraged teachers to innovate, provided special budgets for purchasing devices, and collaborated with external parties such as the Education Office and educational startups. In suburban and rural schools, principals also played significant roles, though limited to facilitating training and providing available devices. Some principals involved parent and alumni communities to help procure digital devices. This support demonstrates that educational transformation depends not only on teachers but also on visionary and collaborative leadership.

During observations, it was found that digital technology facilitated teachers in conducting assessments. Urban teachers used platforms like Google Forms to distribute quizzes, automatically grade student work, and monitor learning progress through data analysis features. This not only saved time but also increased efficiency and accuracy in assessments. Suburban teachers began experimenting with simple apps such as Quizizz or Wordwall to create interactive quizzes. Although not yet fully optimal, this was a good start for embedding digital assessment approaches (Ng, 2015). In rural areas, teachers still relied on manual assessments but showed interest in technology that could help them evaluate student learning more quickly. These findings reveal the great potential of technology to revolutionize evaluation systems in elementary schools.

Interviews with students revealed that they felt more motivated to learn when using technology. They enjoyed challenges in educational games and felt proud when completing digital assignments like making presentations or short videos. Urban students were even accustomed to independently accessing learning resources from the internet to deepen their understanding. This phenomenon reflects a shift in learning culture from passive to active. In suburban and rural schools, despite limited access making students more dependent on teachers, they still showed high curiosity toward technology-based learning. Some students even learned independently by using their parents' phones to seek information outside school hours. This indicates that Generation Alpha has great potential to become independent learners if given adequate access and guidance.

Regarding obstacles, the main challenge faced by schools was uneven infrastructure. In urban schools, despite fairly complete technological devices, issues often arose in the form of unstable internet connections or limited licenses for premium applications. In suburban and rural schools, the most significant problems were limited devices and internet connectivity. Some schools had to share one or two devices among the entire class. This condition obviously limited the frequency and quality of technology use in learning. Teachers in these areas also reported that the lack of technical support from the education office was a major obstacle to consistently applying technology. Therefore, policies favoring equitable access to technology across all education levels are needed.

Some teachers also complained about the lack of relevant and ongoing training in educational technology. Many trainings were formalities and did not meet practical needs in the field. In urban schools, teachers stated that practical, project-based training was more beneficial than purely theoretical ones. In suburban and rural schools, limited training forced teachers to learn independently, which often caused frustration due to limited digital literacy. The success of digital transformation heavily depends on human resource quality, especially teachers, so intensive and contextual training is essential (Pagani & Pardo, 2017; Pan dkk., 2019). Teachers

need to be equipped with technical skills as well as pedagogical understanding to design effective digital learning.

Another important finding was the increased involvement of parents in digital learning, especially during online learning or digital project-based assignments. In urban schools, parents supported their children by providing devices and stable internet connections at home. They also monitored children's activities through learning platforms. In suburban and rural schools, parental support was more moral and simple technical help, such as operating devices or lending phones. However, many parents still did not understand their role in supporting digital learning. This remains a challenge because educational transformation requires synergy between schools and families. Therefore, digital literacy for parents is also an important part of supporting the success of technology integration in elementary schools.

Technology use also impacted student character formation. In urban schools, project-based digital learning encouraged students to be responsible, cooperative, and manage their time well. They learned that technology is not only for entertainment but also for creativity and learning. In suburban and rural schools, teachers tried to instill values of discipline and honesty through technology use, such as not cheating during online quizzes or respecting peers' digital work. Although challenges remain, technology-based learning provides space for character strengthening through direct experience. This proves that technology can be a tool for character building if used with the right pedagogical approach.

Another interesting finding was the emergence of teacher creativity in creating digital learning content. In urban schools, some teachers created their own YouTube channels to share lesson materials, complete with engaging animations and visuals. In suburban schools, teachers used simple applications like Canva to create learning infographics. This creativity grew from the need to adapt materials to increasingly visual and digital learning styles of students. These creative teachers became drivers of digital learning transformation in their schools. Some were even invited by local education offices to train other teachers (Pearson & Somekh, 2006). This shows that digital transformation does not always require sophisticated technology but can start from teacher initiative and creativity.

Technology implementation also affected communication patterns within the school ecosystem. In urban schools, communication among teachers, students, and parents was largely conducted through digital platforms such as WhatsApp, Telegram, and Google Meet. Teachers gave announcements, assignments, and student progress reports in real-time. Students also found it easier to reach teachers for questions or discussions. In suburban schools, digital communication was beginning to form but remained limited. In rural schools, communication was still mostly face-to-face but was gradually being directed toward simple digital platforms. This transformation shows that the digital ecosystem includes not only learning processes but also social interaction and overall school organization.

In terms of policy, the three schools studied showed differences in developing internal regulations related to technology use. Urban schools had written policies on the use of digital devices in classrooms, student data protection, and digital ethics. Suburban schools had policies that were still oral and flexible. Rural schools had no systematic digital regulations. These differences affected the consistency and sustainability of digital transformation programs. Schools with clear policies tended to be more orderly in implementation and better prepared to face ethical challenges in digital learning. Therefore, it is important for every school to begin developing comprehensive and adaptive digital policies in line with current developments.

Overall, the study's results show that the transformation of learning in elementary schools through digital technology integration has significantly impacted student motivation, skills, and participation. Although there are gaps between urban, suburban, and rural schools in infrastructure and human resource readiness, the spirit of change was evident in all locations. Teachers, students, and principals showed high enthusiasm and adaptability to these changes. Technology is not just a teaching aid but has become an integral part of 21st-century learning

strategies. These findings form an important basis for formulating policy recommendations and more systematic, equitable, and sustainable implementation strategies to support Generation Alpha in achieving a competitive future.

Discussion

The results of this study confirm that the integration of digital technology in elementary school learning is an inevitable necessity in facing the dynamic development of Generation Alpha. This generation grows up in a digital environment that shapes their way of thinking, learning, and interacting differently from previous generations. Therefore, the education sector must be able to adjust its approaches and learning strategies according to the characteristics of this generation (Selwyn, 2016). The use of interactive media, learning applications, and digital platforms has proven to increase students' motivation and participation. This aligns with constructivist theory, which emphasizes the importance of contextual and meaningful learning experiences. Technology provides space for students to explore material independently and actively, which is the foundation of modern learning.

Practically, these findings show that schools' readiness to adopt technology varies greatly, depending on geographic factors, school policies, and human resource capabilities. Schools in urban areas tend to be more prepared due to easier access to infrastructure and information. Conversely, suburban and rural schools still face many obstacles. This gap reinforces the importance of equitable policies and capacity-building programs so that digital transformation is not exclusive to a handful of advanced schools. Local and central governments need to play strategic roles in providing facilities, training, and regulations that support the sustainable and equitable continuation of education digitalization programs.

From a pedagogical perspective, technology integration has created a paradigm shift in the teaching and learning process. Teachers are no longer the sole source of knowledge but facilitators who guide students in the exploration and construction of knowledge. Students are trained to think critically, collaborate, and be creative through digital projects and interactive media (Šramová & Pavelka, 2023). This is in line with 21st-century learning demands emphasizing the 4Cs (Critical Thinking, Creativity, Collaboration, Communication). In this context, technology-based learning not only helps in understanding the material but also shapes transformative competencies relevant to global challenges.

However, the effectiveness of digital transformation heavily depends on teacher readiness. The study shows that teachers in urban schools have relatively better capacity due to adequate training access. Meanwhile, teachers in suburban and rural areas still face challenges in digital literacy. This emphasizes that teachers are the key agents in educational change. Investment in teacher capacity development should not be limited to one-off training but must be continuous and practice-based. Collaboration among teachers, digital learning communities, and inter-school mentoring can be effective strategies to accelerate teacher quality improvement.

Besides teachers, the leadership of school principals plays a vital role in creating a digital culture in schools. Schools led by visionary and proactive principals are proven to adopt technology faster and build a conducive digital learning ecosystem. This leadership involves the ability to formulate a digital vision for the school, strategically manage resources, and empower teachers and students in utilizing technology (Taylor dkk., 2020; Tootell dkk., 2014). Therefore, digital leadership training for principals is also crucial. Digital transformation will not be effective if it relies solely on teachers without structural support from school management.

The discussion also cannot ignore the role of parents in supporting digital learning. The shift to digital learning methods requires adaptation from families, both in providing facilities and understanding the importance of accompaniment. In urban schools, parents tend to be more active and supportive, whereas in suburban and rural schools, parental involvement is still

limited. This indicates that digital literacy is needed not only by teachers and students but also by parents (“Computer-Based Learning Environments in Mathematics,” 1996; Vanderlinde & Van Braak, 2010). Socialization programs and digital training for parents can be strategic steps to strengthen synergy between schools and homes in supporting children’s learning.

Teachers’ creativity in creating digital content is one of the indicators of successful learning transformation. Teachers who can produce their own teaching media demonstrate a high level of adaptability to change. This proves that technology is not only a teaching aid but also a space for teacher expression. This innovative spirit should be facilitated by providing access to digital content production platforms such as Canva, Powtoon, or video editing applications (“Teaching with Digital Technology,” 2014). Additionally, appreciation and incentives for innovative teachers are important to sustain creativity as a school culture.

The impact of technology integration on student character is also an important aspect to explore. Although technology has positive potential to foster responsibility and independence, it also carries risks such as internet misuse, plagiarism, or gadget dependency. Therefore, digital learning must be accompanied by character education and digital ethics. Students need to be equipped with an understanding of wise and productive technology use. In this regard, teachers act as role models and guides in digital ethics, while schools need to establish regulations that protect students from the negative effects of technology.

Findings on infrastructure and access disparities also remind us that digital transformation cannot be separated from social justice aspects. Schools in rural and suburban areas require special attention in the provision of devices, connectivity, and resources. Government technology assistance programs must be targeted and based on data needs. Furthermore, partnerships with the private sector, universities, and non-profit organizations can be alternatives to bridge infrastructure gaps. The ultimate goal is to ensure that all students, regardless of geographic location, have equal rights and opportunities to access quality digital learning.

The implications of this research also include the importance of adaptive education policy planning in response to the digital revolution. Curricula implemented in elementary schools should begin to accommodate digital literacy, basic technology mastery, and project-based learning relevant to real-world contexts (“Digital Technology in Mathematics Education,” 2015). Learning evaluations must also adapt, measuring not only cognitive aspects but also process and collaborative skills gained through digital activities. The Ministry of Education needs to formulate minimum standards for technology use in elementary schools and support schools in implementation.

Digital learning transformation also demands a more flexible, competency-based curriculum approach. A curriculum that is too dense and focused only on cognitive achievements is no longer relevant to the challenges of 21st-century education. The study shows that students are more engaged when learning is directed toward solving real problems through digital media. Therefore, the curriculum must allow room for thematic, project-based, and collaborative learning integrated with technology. Schools that successfully implement this approach show significant increases in student motivation and participation. It is time for policymakers to formulate a curriculum responsive to the times while maintaining core educational values.

This research also highlights the need for technology-based formative assessment in the learning process (“Generation Alpha,” 2021; Putri dkk., 2023). Evaluations should not only be conducted at the end of learning but throughout the process using various interactive applications such as Kahoot, Quizziz, Google Forms, and similar tools. The advantage of this method is its ability to provide immediate feedback to students and help teachers map students’ understanding in real-time. This practice is common in urban schools, while suburban and rural areas are still in the introductory phase. This shows the need for intensive technical guidance and systematic mentoring so that teachers in all regions can master effective digital evaluation.

The discussion also touches on the sustainability aspect of digital transformation programs. Many schools face difficulties maintaining consistent technology integration due to policy changes, budget limitations, or teacher rotations. Therefore, long-term planning involving all stakeholders—principals, teachers, parents, government, and communities—is necessary. Schools need a clear and measurable digital roadmap that includes infrastructure targets, human resource training, and monitoring-evaluation systems. This ensures that transformation is not reactive or sporadic but becomes part of the school’s culture and strategy in the long run.

From a theoretical perspective, the findings of this study reinforce previous research on the importance of technology integration in learning. However, the novelty of this study lies in its contextual approach based on school location categories (urban, suburban, rural) and how each context influences readiness, strategy, and outcomes of digital transformation. By mapping dynamics across these three areas, this research provides a comprehensive overview while offering more specific and applicable recommendations. The study also adds dimensions of student character and parental roles often overlooked in similar studies. This enriches discourse and practice of digital learning transformation at the elementary education level.

In conclusion, it can be affirmed that the transformation of learning through digital technology integration in elementary schools is a complex process requiring synergy among various elements: skilled and innovative teachers, visionary principals, flexible curricula, parental support, and supportive government policies. The research findings show that although there are significant challenges, especially regarding access and digital literacy gaps, the spirit of adaptation and creativity among education stakeholders is the main asset in driving change. With the right approach and sustained support, this transformation is not only possible but inevitable in creating more relevant, inclusive, and meaningful education for Generation Alpha.

CONCLUSION

The transformation of learning in elementary schools through the integration of digital technology is a response to the need for a more adaptive, contextual, and relevant education for Generation Alpha. This generation grows up in a digital environment that demands interactive, flexible learning approaches oriented toward the development of 21st-century skills. The research findings indicate that digital technology has positively impacted the enhancement of student motivation, participation, and competencies, particularly in critical thinking, collaboration, communication, and creativity. On the other hand, teachers, school principals, and parents play crucial roles in supporting the success of this integration.

Although there are differences in readiness levels among schools in urban, suburban, and rural areas, the spirit of transformation is evident across all locations. Challenges such as limited infrastructure, low digital literacy, and access gaps can be addressed through continuous training, equitable policy development, and multi-stakeholder collaboration. Digital technology is not only a learning aid but also a medium for character building and early development of students’ potential.

Thus, the integration of digital technology in elementary schools is not merely a trend but a strategic necessity to respond to the demands of the times. This effort must be based on a transformative educational vision, sustained systemic support, and the commitment of all stakeholders to create an inclusive, creative, and competitive learning ecosystem. Generation Alpha needs learning spaces that align with their world—and technology is the bridge toward a better future in education.

REFERENCES

- Arts, K., Van Der Wal, R., & Adams, W. M. (2015). Digital technology and the conservation of nature. *Ambio*, 44(S4), 661–673. <https://doi.org/10.1007/s13280-015-0705-1>
- Astapenko, E. V., Klimova, T. V., Molokhina, G. A., & Petrenko, E. A. (2021). Personal characteristics and environmentally responsible behavior of children of the generation alpha with different leisure orientation. *E3S Web of Conferences*, 273, 10042. <https://doi.org/10.1051/e3sconf/202127310042>
- Bell, V., Bishop, D. V. M., & Przybylski, A. K. (2015). The debate over digital technology and young people. *BMJ*, h3064. <https://doi.org/10.1136/bmj.h3064>
- Berlinski, S., Galiani, S., & Gertler, P. (2009). The effect of pre-primary education on primary school performance. *Journal of Public Economics*, 93(1–2), 219–234. <https://doi.org/10.1016/j.jpubeco.2008.09.002>
- Clark-Wilson, A., Robutti, O., & Thomas, M. (2020). Teaching with digital technology. *ZDM*, 52(7), 1223–1242. <https://doi.org/10.1007/s11858-020-01196-0>
- Computer-Based Learning Environments in Mathematics. (1996). Dalam N. Balacheff & J. J. Kaput, *International Handbook of Mathematics Education* (hlm. 511–564). Springer Netherlands. https://doi.org/10.1007/978-94-009-1465-0_15
- Digital Technology in Mathematics Education: Why It Works (Or Doesn't). (2015). Dalam P. Drijvers, *Selected Regular Lectures from the 12th International Congress on Mathematical Education* (hlm. 135–151). Springer International Publishing. https://doi.org/10.1007/978-3-319-17187-6_8
- Eysenck, H. J., & Cookson, D. (1969). PERSONALITY IN PRIMARY SCHOOL CHILDREN: 1.—ABILITY AND ACHIEVEMENT. *British Journal of Educational Psychology*, 39(2), 109–122. <https://doi.org/10.1111/j.2044-8279.1969.tb02054.x>
- Gartshore, L. (2018). Understanding Generation Alpha. *BDJ Team*, 5(1). <https://doi.org/10.1038/bdjteam.2018.198>
- Generation Alpha: Understanding the Next Cohort of University Students. (2021). *European Journal of Contemporary Education*, 10(3). <https://doi.org/10.13187/ejced.2021.3.783>
- Gupta, A., Kumar, J., Tewary, T., & Virk, N. K. (2022). Influence of cartoon characters on generation alpha in purchase decisions. *Young Consumers*, 23(2), 282–303. <https://doi.org/10.1108/yc-06-2021-1342>
- Haladyna, T., & Thomas, G. (1979). The Attitudes of Elementary School Children toward School and Subject Matters. *The Journal of Experimental Education*, 48(1), 18–23. <https://doi.org/10.1080/00220973.1979.11011707>
- Hale, M. (2022). Generation Alpha. *EDULEAD: Journal of Christian Education and Leadership*, 3(2), 240–245. <https://doi.org/10.47530/edulead.v3i2.126>
- Henderson, G. M. (2002). Transformative Learning as a Condition for Transformational Change in Organizations. *Human Resource Development Review*, 1(2), 186–214. <https://doi.org/10.1177/15384302001002004>
- Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education*, 42(8), 1567–1579. <https://doi.org/10.1080/03075079.2015.1007946>
- Hilbert, M. (2020). Digital technology and social change: The digital transformation of society from a historical perspective. *Dialogues in Clinical Neuroscience*, 22(2), 189–194. <https://doi.org/10.31887/dcns.2020.22.2/mhilbert>
- Höfrová, A., Balidemaj, V., & Small, M. A. (2024). A systematic literature review of education for Generation Alpha. *Discover Education*, 3(1). <https://doi.org/10.1007/s44217-024-00218-3>
- Hoggan, C. (2016). A typology of transformation: Reviewing the transformative learning literature. *Studies in the Education of Adults*, 48(1), 65–82. <https://doi.org/10.1080/02660830.2016.1155849>
-

- Jha, A. K. (2020). *Understanding Generation Alpha*. Center for Open Science. <https://doi.org/10.31219/osf.io/d2e8g>
- Jukic, R., & Skojo, T. (2021). The Educational Needs of the Alpha Generation. *2021 44th International Convention on Information, Communication and Electronic Technology (MIPRO)*, 564–569. <https://doi.org/10.23919/mipro52101.2021.9597106>
- Khin, S., & Ho, T. C. (2019). Digital technology, digital capability and organizational performance: A mediating role of digital innovation. *International Journal of Innovation Science*, 11(2), 177–195. <https://doi.org/10.1108/ijis-08-2018-0083>
- Larsen-Freeman, D. (2013). Transfer of Learning Transformed. *Language Learning*, 63(s1), 107–129. <https://doi.org/10.1111/j.1467-9922.2012.00740.x>
- Mancebon, M. J., & Molinero, C. M. (2000). Performance in primary schools. *Journal of the Operational Research Society*, 51(7), 843–854. <https://doi.org/10.1057/palgrave.jors.2600980>
- Mezirow, J. (1978). Perspective Transformation. *Adult Education*, 28(2), 100–110. <https://doi.org/10.1177/074171367802800202>
- Mezirow, J. (1994). Understanding Transformation Theory. *Adult Education Quarterly*, 44(4), 222–232. <https://doi.org/10.1177/074171369404400403>
- Miller, D. (2023). Embracing the Technological Metamorphosis: Envisioning Higher Education for Generation Alpha in a Shifting Educational Landscape. *International Journal Software Engineering and Computer Science (IJSECS)*, 3(2), 88–96. <https://doi.org/10.35870/ijsecs.v3i2.1492>
- Nambisan, S. (2017). Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029–1055. <https://doi.org/10.1111/etap.12254>
- Ng, W. (2015). *New Digital Technology in Education: Conceptualizing Professional Learning for Educators*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-05822-1>
- Pagani, M., & Pardo, C. (2017). The impact of digital technology on relationships in a business network. *Industrial Marketing Management*, 67, 185–192. <https://doi.org/10.1016/j.indmarman.2017.08.009>
- Pan, G., Seow, P.-S., & Koh, G. (2019). Examining learning transformation in project-based learning process. *Journal of International Education in Business*, 12(2), 167–180. <https://doi.org/10.1108/jieb-06-2018-0022>
- Pearson, M., & Somekh, B. (2006). Learning transformation with technology: A question of sociocultural contexts?¹. *International Journal of Qualitative Studies in Education*, 19(4), 519–539. <https://doi.org/10.1080/09518390600773353>
- Putri, N. A., Cale, W., & Nitin, M. (2023). The Importance of National Integration to Strengthen Religious Diversity in Community Life. *International Journal of Educational Narratives*, 1(2), 100–107. <https://doi.org/10.55849/ijen.v1i2.263>
- Selwyn, N. (2016). Digital downsides: Exploring university students' negative engagements with digital technology. *Teaching in Higher Education*, 21(8), 1006–1021. <https://doi.org/10.1080/13562517.2016.1213229>
- Šramová, B., & Pavelka, J. (2023). Generation Alpha Media Consumption During Covid-19 and Teachers' Standpoint. *Media and Communication*, 11(4), 227–238. <https://doi.org/10.17645/mac.v11i4.7158>
- Taylor, D., Grant, J., Hamdy, H., Grant, L., Marei, H., & Venkatramana, M. (2020). Transformation to learning from a distance. *MedEdPublish*, 9, 76. <https://doi.org/10.15694/mep.2020.000076.1>
- Teaching with Digital Technology: Obstacles and Opportunities. (2014). Dalam M. O. J. Thomas & J. M. Palmer, *Mathematics Education in the Digital Era* (hlm. 71–89). Springer Netherlands. https://doi.org/10.1007/978-94-007-4638-1_4

Tootell, H., Freeman, M., & Freeman, A. (2014). Generation Alpha at the Intersection of Technology, Play and Motivation. *2014 47th Hawaii International Conference on System Sciences*, 82–90. <https://doi.org/10.1109/hicss.2014.19>

Vanderlinde, R., & Van Braak, J. (2010). The e-capacity of primary schools: Development of a conceptual model and scale construction from a school improvement perspective. *Computers & Education*, 55(2), 541–553. <https://doi.org/10.1016/j.compedu.2010.02.016>

Copyright Holder :

© Maita F Casinillo et.al (2026).

First Publication Right :

© JOBE: Journal of Basic Education

This article is under:

