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Structured ICT learning as local content curriculum: The practice at SD Budiluhur

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ABSTRACT

The integration of Information and Communication Technology (ICT) into primary school learning is a key effort in addressing the challenges of 21st-century education. This study is driven by the need to understand how ICT is concretely integrated in primary schools, particularly in curriculum planning and the implementation of learning that aligns with students' needs. Employing a qualitative research design with a case study method, this research aims to provide an in-depth and contextual description. Data collection techniques include interviews and observations. The objective of this study is to describe the ICT integration process at Budiluhur Primary School and to identify the supporting and inhibiting factors that influence its success. The findings reveal that Budiluhur Primary School has developed a structured model of ICT integration through internal policies, continuous teacher training, infrastructure development, and the establishment of a school ICT development team. The study also highlights that despite challenges such as technical limitations and varying levels of teacher competence, successful integration can still be achieved through collaborative strategies, visionary leadership, and strong internal support from the school.

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ABSTRAK

Penerapan Teknologi Informasi dan Komunikasi (TIK) dalam pembelajaran pada jenjang sekolah dasar menjadi salah satu upaya penting dalam menghadapi tantangan pendidikan abad ke-21. Penelitian ini dilatarbelakangi oleh kebutuhan untuk memahami integrasi TIK yang dilakukan secara nyata di sekolah dasar, khususnya dalam perencanaan kurikulum dan pelaksanaan pembelajaran yang relevan dengan kebutuhan peserta didik. Penelitian ini menggunakan desain penelitian kualitatif dengan metode studi kasus untuk memberikan gambaran yang mendalam dan kontekstual. Teknik pengumpulan data dilakukan melalui wawancara dan observasi. Tujuan penelitian ini adalah untuk mendeskripsikan proses integrasi TIK di SD Budiluhur serta mengidentifikasi faktor-faktor pendukung dan penghambat yang memengaruhi keberhasilannya. Hasil penelitian menunjukkan bahwa SD Budiluhur telah mengembangkan model integrasi TIK yang terstruktur melalui kebijakan internal, pelatihan guru secara berkelanjutan, pengembangan infrastruktur, dan pembentukan tim pengembang TIK sekolah. Temuan ini juga mengungkapkan bahwa meskipun terdapat kendala seperti keterbatasan teknis dan perbedaan tingkat kompetensi guru, keberhasilan integrasi tetap dapat dicapai melalui strategi kolaboratif, kepemimpinan yang visioner, dan dukungan internal yang kuat dari pihak sekolah.

Kata Kunci: *implementasi kurikulum TIK; integrasi teknologi; pembelajaran TIK; sekolah dasar*

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INTRODUCTION

The rapid development of Information and Communication Technology (ICT) has impacted various aspects of life, including education. In 21st-century learning, ICT, also known as Information and Communication Technology (ICT), plays a supporting role in facilitating learning processes that emphasize the mastery of essential skills required by students in the modern era (Aviana *et al*., 2024). In education, the use of ICT is a crucial factor in rebuilding education and encouraging the creation of quality learning for the nation's future generations (Wulandari, 2023). This digital transformation not only brings innovation in teaching methods but also creates new opportunities for accessing information, increasing student participation, and fostering creativity (Roza *et al*., 2023).

In line with these benefits, several studies have demonstrated how the implementation of ICT in elementary schools can positively impact the learning process and outcomes. One study conducted by an elementary school in Surakarta implemented an innovative approach by integrating ICT into its curriculum through learning programming, graphic design, and basic Microsoft Office skills. These findings suggest that ICT integration in learning can be implemented effectively and creatively, provided it is supported by internal school policies that also facilitate consistent teacher training (Kurniawati *et al*., 2022).

Furthermore, various studies have shown that teachers' use of ICT can have a positive impact on student learning outcomes. The use of ICT in the learning process significantly contributes to increased student motivation and academic achievement (Amelia & Utama, 2024). This study found that teachers who are proficient in utilizing ICT optimally can create a more engaging and relevant learning environment that meets the needs of today's digital generation.

However, the use of ICT, especially in elementary schools, still faces various challenges, particularly related to the gap in technology and internet access among students, as well as limited school infrastructure (Paramitha & Mustari, 2023). Furthermore, the elimination of ICT subjects from the 2013 curriculum has resulted in the subject not being taught in several elementary schools (Dwitami *et al*., 2025). Teachers often face limitations and obstacles in integrating ICT into learning, including a lack of skills and creativity in designing effective learning media. As a result, teachers tend to present material solely in text form without incorporating supporting visualization or interactivity, which can quickly leave students bored and unmotivated (Susanti *et al*., 2024).

Unlike previous studies, which generally emphasize the general benefits and challenges of ICT implementation in elementary schools, this study offers a novel approach by providing a comprehensive and contextual description of the ICT implementation practices undertaken by Budiluhur Elementary School in Cimahi. Most previous studies have not explored in detail how ICT learning strategies are designed and implemented sustainably in elementary schools that consistently integrate ICT as local content. Budiluhur Elementary School has made ICT a local content subject taught in a tiered and systematic manner from grades three to six. The school not only provides adequate facilities, such as a computer laboratory and internet access, but also develops interactive learning strategies and teacher competency development to support the success of this implementation.

The focus of this research is to comprehensively answer questions regarding the implementation of ICT learning at Budiluhur Cimahi Elementary School, including the learning strategies designed and implemented, their impact on students, as well as the challenges and innovative efforts undertaken by the school in the integration process. The purpose of this article is to provide a comprehensive description of the implementation of ICT learning at Budiluhur Cimahi Elementary School, covering aspects of the curriculum, learning strategies, the impact on students, as well as the challenges and innovations undertaken by teachers and school management. This study is expected to serve as an example of good

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practice for other elementary education units in designing relevant and sustainable ICT integration strategies tailored to the needs of students in the digital era.

LITERATURE REVIEW

Curriculum and Learning Strategies in Elementary Schools

Law Number 20 of 2003 concerning the National Education System defines the curriculum as a set of tools and methods designed to achieve predetermined educational goals. The rapid development of Science and Technology (IPTEK) demands that school curricula continually adapt. Therefore, the curriculum is now responsible for addressing various challenges in adapting the learning process to advances in science and technology (Azalia *et al*., 2023). The same applies to the curriculum at the elementary school level. The curriculum serves important functions for various parties. For school principals, the curriculum serves as a guideline for managing and supervising the education system, and it also serves as an indicator of learning success. For teachers, the curriculum serves as a reference in the teaching process and delivery of material to students. For students, the curriculum serves as a learning guide to help them understand the material and prepare for exams, while simultaneously creating equitable educational standards throughout Indonesia. For the community, especially parents, the curriculum serves as a basis for monitoring and supporting their children's learning process, as well as helping to determine appropriate educational patterns.

Since 2004, the Indonesian curriculum system has undergone various changes. These changes began with the Competency-Based Curriculum (KBK), which emphasized students as the center of learning and teachers as facilitators. This was followed by the 2006 School-Level Curriculum (KTSP), which provided schools with the freedom to develop their own curricula under government guidance. The 2013 Curriculum was then introduced, focusing on developing 21st-century competencies and replacing the National Examination with a Computer-Based National Assessment (ANBK) to measure student literacy and numeracy. Currently, the Merdeka Curriculum is being implemented with the support of the Merdeka Mengajar platform and various supporting programs, including "leader teachers" and "leader schools" (Hidayat *et al*., 2025).

Curriculum implementation at the elementary school level should be designed flexibly to accommodate the diversity of student characteristics, the school environment, and local social and cultural needs. A flexible curriculum is an approach that provides flexibility in selecting learning content according to the interests, needs, and characteristics of students (Wibowo & Sirai, 2025). Furthermore, in the book "Primary School Curriculum: Philosophical Perspectives, Innovation, and Implementation" by Rochendi et al., it is stated that curriculum implementation in elementary schools should not only rely on conventional methods such as lectures and memorization, but also use approaches that provide meaningful learning experiences, such as experiential learning, which allows students to understand concepts through direct interaction with their surroundings. This strategy can be implemented through observation, simple experiments, and contextual projects that foster critical thinking skills. Furthermore, a playful approach is an important method in supporting a flexible curriculum. Play is a natural way for children to learn and develop cognitively, socially, and motorically. This method can be implemented through simulations, role-play, and contextual educational games. Project-based learning is also effective in improving conceptual understanding, critical thinking skills, communication skills, and a sense of responsibility (Rajagukguk, 2023). Meanwhile, the environmental exploration learning method can also provide contextual learning opportunities and build social and ecological awareness. Through activities such as field trips or environmental projects, students gain a deeper and more relevant understanding. By implementing a flexible approach, students are encouraged to become active, creative, and independent learners.

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The Role of Information and Communication Technology (ICT) in Elementary Education

Information and communication technology (ICT) is a catalyst for change in education, including at the elementary level. The integration of ICT into learning provides an opportunity for a transformation from conventional learning to more active, collaborative, and technology-based learning. In the book "Information and Communication Technology in Educational Management" by Mustari, five key shifts in learning transformation are outlined: 1) from a training-based approach to a performance-oriented approach; 2) from classroom-based learning to flexible, ubiquitous learning; 3) from the use of print media to digital platforms; 4) from reliance on physical facilities to the use of collaborative networks; and 5) from a cyclical time system to real-time learning.

ICT also supports learning activities and overall education management. First, ICT functions as a skill and competency tool that needs to be proportionally accessed by all levels of society according to their individual needs. Second, ICT serves as a learning infrastructure that enables students to learn at any time and from anywhere through digital materials and internet connections. Third, ICT serves as a source of learning materials, offering quick access to the latest information, continuously updated teaching materials, and facilitating global collaboration. Fourth, ICT serves as a learning aid that enriches the learning process with real-world contexts, material visualization, and independent exploration. Fifth, ICT supports learning management by increasing administrative efficiency, interaction between stakeholders, and providing ongoing learning support. Ultimately, ICT serves as a decision support system that enables teachers to understand students' potential, enhance their competencies, and provide critical data for the formulation of government education policies.

In the digital era, the role of ICT is becoming increasingly crucial in equipping students with digital literacy as part of 21st-century competencies (Solih & Julianto, 2025). ICT integration offers various benefits, including the potential to enhance knowledge through exploration, problem-solving skills, critical thinking skills, self-evaluation, and reflection (Miftah, 2022). However, the integration of ICT in learning still faces various obstacles, particularly at the primary and secondary levels of education. Some schools have not been able to optimize the use of ICT due to limited internet access and a lack of supporting facilities, particularly in remote areas (Yunita & Sholeh, 2021). Furthermore, the lack of ICT training for teachers is a significant obstacle, as teachers struggle to keep pace with technological developments without adequate training, which hinders their ability to support the teaching and learning process effectively.

Therefore, strong government support is crucial to ensuring the equitable distribution of ICT-based education. The government needs not only to establish curriculum policies that support ICT integration but also to play an active role in providing adequate infrastructure, strengthening regulations that facilitate technology access across all regions, and implementing ongoing training programs for teachers to enable them to optimize the use of ICT in the learning process (Asfiana, 2024).

ICT Teacher Competencies

Teachers are professional educators who play a role in educating, teaching, guiding, training, and evaluating students at the early childhood, elementary, and secondary levels within the formal education system (Indrawati *et al*., 2022). As educators, teachers must continually stay up-to-date with and adapt to current developments in order to innovate. In digital learning, teacher competencies encompass not only technical skills but also pedagogical understanding to apply technology appropriately. In various situations, teachers must possess the ability to use technology even before becoming teachers themselves (Hadiapurwa *et al*., 2021).

As part of the transformation of roles in the 21st century, the role of teachers needs to be enhanced to continually update teaching methods, integrate technology, and develop 21st-century skills in students (Fauziyah, 2024). The main characteristics of teachers in this century include six key aspects. First, teachers need to think globally, understand cross-border issues, and guide students in developing an

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awareness of global interconnections and cultural diversity. Second, teachers must be proficient in technology to support digital learning, design project-based instruction, and instill digital skills in students. Third, teachers need to be sensitive to cultural diversity, create an inclusive learning environment, and respect the diverse backgrounds of students. Fourth, teachers are encouraged to build partnerships with external parties such as parents, communities, and professionals to enrich learning and expand student support. Fifth, the teacher's role also includes being a facilitator, motivator, and inspirator, encouraging active learning, empowering students, and inspiring them to grow. Ultimately, teachers are expected to be creative and innovative in their instructional approaches, incorporating technology and interactive methods that foster creativity and critical thinking. These characteristics are essential for developing educators who can guide students in facing the complex and dynamic challenges of the modern world.

The ICT competency framework for teachers, developed by UNESCO in 2018, supports educational transformation by enabling teachers to integrate technology effectively into their teaching practices. This framework divides competencies into three levels: knowledge acquisition, knowledge deepening, and knowledge creation. At the first level, teachers utilize ICT to support traditional learning and manage managerial tasks digitally. At the second level, teachers begin to apply ICT more deeply to enhance student understanding through collaborative and project-based learning. At the third level, learning becomes transformative, where teachers and students create new knowledge and develop 21st-century skills such as critical thinking, innovation, and problem-solving. Each competency level encompasses six main aspects: ICT policy in education, curriculum and assessment, pedagogy, digital skills, organization and administration, and teacher professional development. Teachers do not always occupy a single level but possess competencies spread across various aspects and levels. Therefore, regular assessments are necessary to identify teachers' strengths and weaknesses in ICT utilization, providing a basis for planning ongoing training to make learning more adaptive and meaningful.

School Support for ICT Learning

Compared to teachers' ICT skills, school leaders' perceptions can have a significant influence on the integration of ICT in schools. As leaders, principals play a crucial role in encouraging the adoption of technology in schools to create a positive learning environment (Wiyana *et al*., 2024). Through inspirational and visionary leadership, principals can inspire teachers to adopt innovative teaching methods and create a collaborative environment that supports digital transformation and overcomes resistance to change (Mawaddah *et al*., 2024).

Overcoming various barriers to the use of ICT in the learning process requires strong support from various parties, including the government, school institutions, and teachers. This collaboration is crucial for optimal ICT integration, as joint support and participation are essential for practical efforts (Yunita & Sholeh, 2021). Furthermore, providing ICT support facilities is essential as a first step in developing, implementing, and integrating ICT into school activities (Lasea *et al*., 2022). Schools can provide computer laboratories and internet facilities for teachers and students to utilize.

Schools also need to improve teacher competency through empowerment programs. One step that can be taken is to hold ICT training for teachers. This activity aims to enhance teachers' mastery and understanding of technology utilization, thereby making the learning process more effective, interactive, and creative (Riani *et al*., 2025). Furthermore, schools can hold workshops by inviting competent speakers in their fields (Persada *et al*., 2025). These steps not only improve teachers' technical skills but also encourage innovation in student-centered learning strategies. By improving teachers' competency in ICT, they will be better equipped to face the challenges of education in the digital age and integrate various digital learning resources optimally.

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METHODS

This research employs a qualitative approach, utilizing a case study, to provide an in-depth description of the implementation of Information and Communication Technology (ICT) as a local content subject at Budiluhur Elementary School in Cimahi. This approach was chosen because it provides a comprehensive understanding and is consistent with real-world conditions. Data collection was conducted through two methods: interviews and observations. Interviews were conducted directly with two informants: the vice principal for curriculum and the ICT subject teacher. The interviews focused on aspects of ICT implementation, including local content, learning strategies, school support, and the challenges and opportunities encountered during its implementation. Meanwhile, observations were conducted of the Lesson Implementation Plan (RPP), syllabus, and teaching materials used in the ICT learning process.

The data obtained were analyzed using thematic analysis to facilitate conclusion drawing. The analysis process began with data coding. The results of the interviews and observations were categorized based on the primary research themes: 1) implementation of ICT in the elementary school curriculum; 2) learning strategies and the role of teachers in ICT teaching; 3) development of digital competency and its impact on students; 4) supporting facilities and infrastructure for ICT learning. 5) teacher professionalism and educator competency development; and 6) evaluation and reflection on the implementation of ICT learning. To ensure the validity and reliability of the research findings, data triangulation was conducted by comparing the results of interviews, observations, and learning documents. Furthermore, the research findings were compared with relevant previous research to generate new findings.

RESULTS AND DISCUSSION

Implementation of ICT in the Elementary School Curriculum

In the 2024/2025 academic year, Budiluhur Elementary School in Cimahi implemented two curricula simultaneously: the 2013 Curriculum and the Merdeka Curriculum. The 2013 Curriculum was explicitly implemented for sixth-grade students, the last cohort to use it. Meanwhile, the Merdeka Curriculum began implementation in 2021 and is currently being used in most classes. However, in the upcoming academic year, Budiluhur Elementary School will develop learning using the Merdeka Curriculum with an adapted deep-learning approach. In addition to developing an in-depth understanding, this approach also enhances students' critical thinking skills (Sumarto & Harahap, 2025).

In the implementation of the 2013 Curriculum, Information and Communication Technology (ICT) was no longer a compulsory subject and was only offered as an elective for schools with adequate human resources and facilities (Tan *et al*., 2023). This situation led many schools, particularly public schools, to forgo instruction in ICT. However, after the implementation of the Merdeka Curriculum, ICT was strengthened with the addition of Informatics. However, its implementation only began at the junior high school level and has not yet been fully implemented at the elementary school level (Nurjanah *et al*., 2025).

Budiluhur Elementary School integrates ICT as local content, although it is not yet a nationally compulsory subject at the elementary school level. ICT is allocated learning time, like other subjects, with one meeting per week, lasting two 35-minute sessions, from third to sixth grade. ICT learning outcomes are formally included in student report cards, demonstrating the school's recognition of the importance of developing digital competencies from an early age.

The Learning Implementation Plan (RPP) and syllabus for ICT subjects at Budiluhur Elementary School are independently developed by the teachers themselves, with reference to competency standards, basic competencies, and measurable competency achievements. Furthermore, the learning materials are designed to be relevant to students' needs in the face of technological developments. Although not based on a standardized national curriculum, the RPP still emphasizes the development of core digital skills,

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such as mastery of basic software, understanding computer hardware, and utilizing technology as a learning support medium.

Learning Strategies and the Teacher's Role in ICT Teaching

The implementation of appropriate learning methods is a crucial factor in improving student learning outcomes. In implementing ICT learning at Budiluhur Elementary School, teachers employ an interactive and engaging learning approach. The fun learning method is a learning strategy designed to create a fun learning atmosphere, making the material easier for students to understand and absorb (Annisa, 2023). ICT learning at Budiluhur Elementary School focuses not only on delivering material but also includes quizzes and educational games. This strategy aims to maintain student motivation and reduce boredom, especially in lower grades. The learning resources used include books compiled by the ICT teachers of Budiluhur Elementary School and relevant websites.

As part of its learning strategy, Budiluhur Elementary School designs ICT teaching materials tailored to the grade level and the competencies to be achieved. This is reflected in the lesson plans (RPP) and syllabus documents prepared by the teachers. In grade 3, students are introduced to the basic concepts of information and communication technology, including an introduction to traditional and modern communication tools, as well as the simple use of ICT devices. This material serves as the foundation for students' initial understanding of the role of technology in everyday life.

In grade 4, the learning focus shifts to skills in using word processing software such as Microsoft Word. Students are taught to open, save, print, and close documents, as well as to use basic icons in Microsoft Word. This aligns with strengthening students' cognitive and psychomotor skills according to their developmental stage.

In grade 5, learning materials focus on presentation software, Microsoft PowerPoint. Students not only learn about basic icons, menus, and features, but are also encouraged to create simple presentation slides with image elements, text, and transition effects. They are also introduced to graphic design software, such as Canva, which helps develop creativity and digital communication skills.

In grade 6, students explore spreadsheet software, Microsoft Excel. The material provided includes an introduction to the workspace, covering basic menu usage and simple data input. The objective of this learning is to equip students with digital numeracy skills relevant to the next level of education. In addition, students are introduced to video editing applications such as CapCut, as an effort to expand their digital production skills.

Assessment in ICT learning at Budiluhur Elementary School is conducted through a combination of methods, including written exams (mid-semester and final assessments), practical assignments, attitude observations (moral values), individual projects, and collaborative projects. Individual projects typically take the form of digital works such as holiday greeting card designs or t-shirt designs for school activities. These works are exhibited at a school exhibition as a token of appreciation for their creativity. Collaborative projects, meanwhile, take the form of short films, worked on in groups. Typically, a group of ten students collaborates on the design and production of the film. However, this school year, each sixth-grade class is producing a short film as a class project. The film is planned to be screened at the school's farewell event as a reflection of the ICT learning they have undergone.

Digital Competency Development and the Impact of ICT on Students

ICT learning at Budiluhur Elementary School has enabled students to master basic digital skills. In addition to understanding how computer devices and applications work, students are also encouraged to think

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creatively and innovatively in their approach to problem-solving. Projects such as creating presentation slides, short videos, and graphic design encourage students to apply digital skills in real-life contexts. These activities provide a platform for students to express their ideas and thoughts visually and interactively, allowing them to experience technology as a tool for communication and creativity. For example, in a project to create a class farewell video, students were not only required to master video editing applications like CapCut, but also to collaborate on a script, assign roles, and complete the production within a specific timeframe. This is a form of project-based learning that requires students to be active, independent, and think critically.

Students at Budiluhur Elementary School also exhibit a high level of enthusiasm for ICT learning. Based on interviews with ICT teachers, students often arrive early to the computer lab and demonstrate a strong interest in learning, even outside of class hours. The learning environment, complemented by a fun learning approach, incorporates quizzes and educational games, making learning a pleasurable experience for students. One fifth-grade student, for example, actively requested additional assignments to deepen their mastery of Excel. This phenomenon not only demonstrates that ICT learning can foster curiosity and a strong spirit of independent learning but also illustrates that students have adopted technology as an integral part of their exploration and self-development process.

However, despite these positive impacts, Budiluhur Elementary School faces challenges, particularly related to free access to technology outside the school environment. Some students are known to access age-inappropriate content at home, primarily due to a lack of supervision from busy working parents. This situation raises concerns that, without adequate guidance, technology can become a gateway to inappropriate information and foster unhealthy digital habits.

To address this, the school collaborates with parents through regular meetings and outreach programs on the importance of safe and responsible technology use. At the beginning of each school year, the school invites parents to discuss the school's work and teacher council meetings to align digital supervision strategies between home and school. This effort aims to build collective awareness of the importance of ethical and healthy digital literacy. Parents are encouraged to monitor and guide their children's use of technology at home. This ensures that ICT learning at school can synergize with positive digital habits within the family environment. Therefore, ICT education at Budiluhur Elementary School produces not only technically proficient students but also morally and socially responsible students in their use of technology.

Supporting ICT Learning Facilities and Infrastructure

Budiluhur Elementary School has provided an adequate computer laboratory to support ICT learning activities. This laboratory is equipped with enough computers to accommodate all students in one class and is supported by an internet connection that allows students to access various digital learning resources. Furthermore, the school has established a routine maintenance schedule to check the condition of both hardware and software. Damaged computers are immediately repaired, and if the damage cannot be repaired, the devices are replaced to maintain the quality of the learning environment. These steps demonstrate the school's commitment to providing students with optimal ICT facilities.

However, some technical challenges still occasionally arise. One major challenge is internet disruptions, particularly during heavy rain, which can cause unstable internet connections. Furthermore, during important activities such as the Computer-Based National Assessment (ANBK), some computers occasionally experience unexpected technical issues, including devices failing to turn on, screens not functioning, or software crashes. These situations certainly require technical preparedness and flexibility from the school and teachers.

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To overcome these obstacles, ICT teachers at Budiluhur Elementary School implement an adaptive and creative teaching approach. When the internet connection is disrupted, learning continues by replacing digital activities with non-digital ones that help hone students' skills and deepen their understanding of ICT concepts. For example, teachers hold technology-based educational games, manual quizzes that test knowledge about hardware and software functions, and group discussions on the ethics of technology use. In this way, students remain actively learning even when not directly using computers. This approach also fosters resilience and flexibility in facing technical challenges, which are essential components of digital literacy in the modern era.

Teacher Professionalism and Educator Competency Development

ICT teachers at Budiluhur Elementary School are actively engaged in professional development through various training programs and discussion forums that are relevant to developments in education and technology. Teachers regularly attend seminars, workshops, and training programs organized by educational institutions at the city, provincial, and national levels. The topics covered in these training programs are diverse, ranging from an introduction to the latest digital learning media, such as interactive applications and e-learning platforms, to technology-based classroom management techniques, to the integration of educational software that supports 21st-century skills, such as basic coding, multimedia design, and the use of Learning Management Systems (LMS).

In addition to formal training, ICT teachers also actively participate in educational communities such as the Teacher Working Group (KKG) and the Teacher Activity Center (PKG). These forums serve as a platform for discussion and collaboration among teachers, where they share field experiences, design solutions to learning challenges, and evaluate the effectiveness of strategies implemented in the classroom. In KKG sessions, for example, teachers demonstrate the use of learning applications they have tried, share modules they have developed themselves, and discuss how technology can be used to support cross-subject learning.

The results of this training and collaboration were then implemented in real-world classroom learning. ICT teachers at Budiluhur Elementary School applied the training and collaboration with fellow teachers through a fun learning approach tailored to students' needs. Innovation was demonstrated through the use of applications like Canva and Capcut, as well as the implementation of creative projects, including short videos and graphic design. Furthermore, teachers actively adapted learning methods to students' needs and emerging technical challenges, for example, by switching from digital learning to non-digital activities when network connectivity was problematic. This demonstrated the teachers' ability to adapt learning flexibly and contextually.

Evaluation and Reflection on ICT Learning Implementation

Evaluation of ICT learning implementation at Budiluhur Elementary School is conducted periodically as part of efforts to improve the quality of education. This evaluation encompasses various aspects, including the learning process, student competency achievement, the effectiveness of teaching methods, and the readiness of the supporting infrastructure. Evaluation activities are usually conducted after midterm and final exams, as well as in official forums such as teacher work meetings, curriculum team meetings, and school board meetings. In these forums, ICT teachers provide structured reports on student learning progress, covering learning outcomes, student participation levels, and successes and challenges encountered during the learning process.

The evaluation also includes observations of student engagement, creativity in project work, and teamwork skills. This provides a more comprehensive view of the impact of ICT learning on student skill development.

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The results of these evaluations serve not only as documentation but also as a basis for reflection and revision of lesson plans and syllabi. If a method is found to be ineffective, or if the material is deemed too complex and not yet suited to the students' abilities, teachers will revise it by adjusting the approach and simplifying the material without compromising the essence of the learning.

Furthermore, evaluations also cover technical aspects related to learning facilities and infrastructure. The school actively audits the condition of the computer lab, including hardware, software, and the network. Suppose problems such as unresponsive devices or unstable connections are discovered. In that case, the school will immediately follow up by repairing or replacing the units and strengthening the network with the support of available technicians. This technical evaluation is crucial to ensuring the smooth running of the learning process and minimizing disruptions that could hinder the achievement of ICT learning objectives.

Through a continuous process of evaluation and reflection, Budiluhur Elementary School demonstrates a strong commitment to learning, driven by ongoing improvement. Evaluation also serves as a key foundation in developing the school's annual work program. Evaluation results are used to identify strategic needs, including budget proposals for additional equipment, increased internet bandwidth, advanced training for teachers, and digital literacy programs for parents. These efforts aim to create a more effective learning ecosystem that is responsive to the challenges of the times. Thus, a comprehensive evaluation can create a generation of students who are not only technologically literate but also ready to face digital challenges wisely and responsibly.

Discussion

Budiluhur Elementary School has implemented ICT integration in a structured and strategic manner, not only as a stand-alone subject but also as a learning tool across subjects. This finding reflects the implementation of a flexible curriculum that emphasizes adapting learning strategies to the needs and characteristics of students (Cecep & Rohmanudin, 2024). This approach demonstrates the application of ICT to enrich learning experiences contextually and interactively, in accordance with the principles of meaningful learning (Huda & Djono, 2025). Thus, ICT learning at Budiluhur Elementary School serves as a step in preparing students to face the challenges of the digital era. Consistent implementation, appropriate allocation of learning time, and assessments reflected in student report cards indicate that the school prioritizes digital literacy as a crucial competency in basic education.

The active role of the principal and ICT teachers at Budiluhur Elementary School in encouraging technology-based learning innovations demonstrates that school leadership and culture contribute significantly to the success of ICT implementation. With their leadership, the principal can guide and organize the school environment holistically to achieve educational goals (Yunita & Sholeh, 2021). Therefore, awareness and understanding of ICT integration, including infrastructure, curriculum, and teacher skills development, are being pursued as a form of ICT integration at Budiluhur Elementary School. Internal policies and consistent teacher training influence the success of ICT implementation in elementary schools. This serves as a guideline for classroom teaching and learning activities (Kurniawati *et al*., 2022). Budiluhur Elementary School has demonstrated that planned training and consistent managerial support can accelerate teachers' adaptation to technology. This strategy supports the fulfillment of the ICT competency framework formulated by UNESCO in 2018, particularly at the knowledge deepening level, where teachers utilize ICT for collaborative and contextual project-based learning.

The overall ICT learning structure at Budiluhur Elementary School demonstrates a planned approach oriented toward developing 21st-century competencies. With a tiered material structure, varied learning approaches, and diverse assessment methods, ICT learning at Budiluhur Elementary School not only prepares students to face technological developments but also builds a foundation for critical and creative

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thinking skills from an early age. Furthermore, ICT learning at Budiluhur Elementary School is designed to develop students' cognitive, affective, and psychomotor domains in a balanced manner.

The use of ICT by teachers at Budiluhur Elementary School has also resulted in increased student motivation and active engagement in the classroom. Teachers not only serve as facilitators in technology-based learning but also fulfill the role of innovators. Furthermore, the application of ICT not only improves students' cognitive competence and practical skills but also develops soft skills such as critical thinking, creativity, collaboration, discipline, responsibility, and self-confidence (Asrizal *et al*., 2022). Through group activities and collaborative projects, students at Budiluhur Elementary School learn to communicate effectively, share ideas, and appreciate the roles and contributions of their peers in achieving shared goals.

However, field findings also indicate challenges in implementing ICT, particularly related to limited internet connectivity and the need to improve non-ICT teacher competencies. This situation aligns with research findings that identified a lack of teacher skills, limited creativity, and inadequate training as key obstacles to implementing ICT-based learning media (Zulfa *et al*., 2023). Although Budiluhur Elementary School has conducted various training programs, these challenges persist, particularly among senior teachers who are less familiar with technology, highlighting the need for a more personalized and sustainable training approach (Riani *et al*., 2025).

These competency development activities have significantly impacted the quality of teaching. As a result, teachers not only gain technical mastery of the subject matter but also demonstrate improvements in their pedagogical skills. Teachers must be able to deliver material using a differentiated approach, develop digital-based assessments, and build more dynamic interactions with students through online platforms (Efendi *et al*., 2024). Amidst the rapid changes in information technology, this training and collaboration also help teachers remain relevant, creative, and responsive to the needs of the times.

urthermore, this ongoing professional development process also shapes ICT teachers as agents of change in schools. Armed with continually updated knowledge and skills, teachers can act as innovative and inspiring learning facilitators, not only teaching digital skills but also instilling digital literacy values , such as cybersecurity, digital ethics, and responsible media use (Wohlfart & Wagner, 2023). This provides a crucial foundation for developing a generation of students who are not only technologically proficient but also wise in their use of technology.

A key finding in this study is the presence of an internal ICT development team at the school, which systematically designs, monitors, and evaluates ICT integration programs within the school. The existence of this team indicates that Budiluhur Elementary School has reached the knowledge creation stage within the ICT competency framework for teachers and school management, who act as creators and developers of educational innovation. This has not been widely reported in previous research, making Budiluhur Elementary School a model for other elementary schools in developing sustainable and contextually relevant policies and practices.

CONCLUSION

Budiluhur Elementary School has successfully developed a strategic, sustainable, and adaptive ICT integration model. This success is demonstrated through internal policies that support the use of ICT, consistent teacher training, and the formation of a school ICT development team that actively designs, monitors, and evaluates the implementation of technology in learning activities. These findings address the research objectives by confirming that effective ICT integration at the elementary education level is highly dependent on visionary leadership, infrastructure readiness, and collaboration among stakeholders within the school environment. Although obstacles such as limited connectivity and varying teacher competencies persist, the school has successfully created a digital learning ecosystem that is both

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productive and relevant to students' needs. Based on these findings, it is recommended that other schools adopt Budiluhur Elementary School's approach, tailoring it to their own circumstances and resources. Furthermore, policymakers are expected to provide ongoing regulatory and budgetary support, particularly in areas such as infrastructure procurement and teacher training. For future development, further research can focus on long-term evaluations of the impact of ICT integration on student learning outcomes, as well as designing ICT integration models appropriate for schools with limited facilities.

AUTHOR'S NOTE

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