Analysis Of Ict Media Development In The Learning Process At Mi Nurul Islam Plangkapan Towards The Transformation Of Indonesia's Golden Education 2045

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ABSTRACT

This study aims to describe the development and implementation of Information and Communication Technology (ICT) media in learning at MI Nurul Islam Plangkapan as part of the transformation toward Golden Indonesia 2045. This research employed a qualitative field approach with data collected through interviews, observations, and documentation. The results indicate that teachers, the headmaster, and students showed positive responses toward the use of ICT in the learning process. Teachers utilized digital media such as PowerPoint, Canva, and Quizizz to create more engaging and interactive learning experiences. Although challenges such as limited facilities and unstable internet connections remain, ICT integration has enhanced students' motivation, participation, and 21st-century learning competencies. It is concluded that ICT implementation in elementary madrasahs contributes to improving learning quality and supports the national vision of Digital Madrasah toward Golden Indonesia 2045.

Keywords: *ICT media, interactive learning, digital madrasah, Golden Indonesia 2045*

Introduction

The development of information and communication technology (ICT) has brought fundamental changes to the global education system, including in Indonesia. Technology is now

not just a learning aid, but also a strategic means of realizing educational transformation towards Indonesia's golden generation in 2045. The idea of Indonesia Emas 2045 places education as the main pillar in producing superior, adaptive, and highly competitive human resources in the digital era (Djunaedi et al., 2024; K.P. Suharyono S. Hadiningrat & Verry Albert Jekson Mardame Silalahi, 2024; Nur Abdul Latif Al Waroi et al., 2025).

This vision emphasizes the importance of integrating technology into the learning process at all levels of education, including elementary and madrasah ibtidaiyah (MI). In this context, digital literacy is a key prerequisite for producing a generation capable of critical, creative, collaborative, and communicative thinking (Nur Abdul Latif Al Waroi et al., 2025; Syahrir et al., 2024). Thus, the use of ICT in education not only supports learning effectiveness but also shapes the character and 21st-century skills needed to face the era of globalization.

According to Hidayah et al. (2020), the use of ICT-based media in elementary schools can improve learning interactions and expand students' access to various learning resources. Bahri et al. (2021), similarly stated that technology-based learning allows students to construct meaning through active and contextual learning experiences. Research by Yusuf et al. (2021) confirms that ICT-based learning media plays an important role in developing learning independence, as it provides flexibility in choosing the time, place, and relevant learning resources.

Furthermore, the application of ICT in learning contributes significantly to increasing student motivation and learning outcomes (Rohana et al., 2024; Zen et al., 2022). Pembelajaran berbasis teknologi menjadikan siswa lebih aktif, antusias, dan kreatif, karena mereka Technology-based learning makes students more active, enthusiastic, and creative, as they can explore the material independently. In addition, the use of digital media also allows teachers to tailor teaching methods to students' diverse learning styles (Ni'matussyahara et al., 2023).

However, on the other hand, the implementation of ICT in basic education, especially in madrasahs, still faces various challenges. A study by Mertasari (2022) shows that most madrasahs in rural areas experience limitations in infrastructure, teacher digital literacy, and learning resources. This condition hinders the optimal use of technology in the teaching and learning process. This is in line with the findings of Sulistianingtyas et al. (2022) which explain that training in ICT media creation for teachers has not been implemented effectively and sustainably, even though it has been proven to improve pedagogical competence.

To address these challenges, various ICT-based learning media development models continue to be studied. Setuju et al. (2020) developed ICT-based media for independent learning that has been proven effective in increasing student independence. also developed GeoGebra-based Schoology media that can improve students' ICT literacy in mathematics learning. Meanwhile, Asiya et al. (2024) successfully demonstrated that innovative game-based media, such as domino cards, can significantly increase the motivation and learning outcomes of elementary school students in mathematics.

A similar approach was proposed by Prihantini et al. (2024), who assessed that the use of ICT as a source and medium for modern 21st-century learning has been proven to make it easier for teachers to deliver material and improve the effectiveness of learning in elementary schools. This is also supported by Sandi & Fernandy (2022), who found that the effectiveness of mathematics learning increases when using ICT-based media compared to conventional methods.

In addition to technical aspects, ICT integration also has character and moral value dimensions. Benny et al. (2025) emphasize the importance of web-based learning media for building student character through interfaith and intercultural values learning. This opinion is in line with Indah Septiani et al. (2020), who developed Bandura's observational model-based interactive multimedia to strengthen student character through the integration of national historical values. Thus, ICT is not only a means of increasing knowledge, but also a medium for shaping the personality and character of the nation.

From a theoretical perspective, the development of ICT in learning can be explained through the Technological Pedagogical and Content Knowledge (TPACK) framework, which emphasizes a balance between mastery of technology, pedagogy, and teaching materials (Azhar et al., 2025; Mukhlis et al., 2025). Teachers who have TPACK competencies are able to integrate technology effectively and contextually into learning. On the other hand Kustyarini et al. (2020) constructivist approach asserts that the use of ICT supports active learning in which students construct meaning through digital exploration and collaboration.

However, the implementation of ICT is not without social and legal challenges arising from digital transformation. Octaviani Suryanto & Mulyana (2024) remind us of the implications for social behavior change and the need for legal regulations that are adaptive to technological advances. On a macro scale, Nur Abdul Latif Al Waroi et al. (2025) and Djunaedi et al. (2024) emphasize that the development of digital infrastructure, such as electricity and internet networks, is a strategic prerequisite for achieving an inclusive and equitable Golden Indonesia 2045.

From an educational policy perspective, the Merdeka Belajar curriculum provides teachers with greater scope for innovation through the use of learning technology. Syahrir et al. (2024) assess that this curriculum is capable of strengthening the adaptive and creative profile of Pancasila students with the support of ICT. In addition, Zaqiah et al. (2024) show that the teacher professional training program (PPG) contributes significantly to improving teacher competence, particularly in the use of learning technology.

The relationship between technology and learning quality is also reinforced by the findings of Yusuf et al. (2021) and Bahri et al. (2021), who state that ICT development strategies in education must consider flexibility, infrastructure availability, and ongoing teacher training. The application of ICT also needs to take into account the characteristics of students in order to create an inclusive and meaningful learning environment (Hidayati et al., 2024; Meryansumayeka et al., 2022).

Thus, the development of ICT-based learning media is not only relevant to the context of educational modernization, but also a strategic step in building a creative, collaborative, and future-oriented learning ecosystem. Research at MI Nurul Islam Plangkapan, Tambak District, Banyumas Regency, was directed at examining how the process of developing and implementing ICT media was applied by teachers in thematic learning.

This research is important because it provides an empirical description of the strategies used by madrasah teachers in utilizing technology amid limited resources. In addition, this study also aims to identify the supporting and inhibiting factors for ICT development in elementary madrasahs and assess its contribution to student motivation and learning outcomes (Pranoto et al., 2025). With a qualitative field approach, this study is expected to strengthen the literature on ICT for Education (ICT4E) and provide practical recommendations for madrasahs in

accelerating digital transformation towards Indonesia Emas 2045..

Methods

This study uses a qualitative approach with a field study design that aims to gain an in-depth understanding of the process of developing ICT media in learning at MI Nurul Islam Plangkapan, Tambak District, Banyumas Regency. This approach was chosen because it allows researchers to explore the meanings, experiences, and social dynamics behind the application of ICT in the elementary madrasah environment. The data sources in this study consisted of primary and secondary sources. Primary sources were obtained directly from in-depth interviews with the madrasah principal, classroom teachers, and several students who were actively involved in ICT-based learning (Pranoto et al., 2025). In addition, participatory observation was conducted to observe teaching and learning activit ies, the use of digital devices, and interactions between teachers and students in the classroom. Documentation in the form of activity photos, teacher training notes, and madrasah archives were also used to reinforce the data from observations and interviews.

The data obtained were analyzed using the interactive model developed Miles et al. (2014), which consists of three main stages, namely data reduction, data presentation, and conclusion drawing. Data reduction was carried out by sorting information relevant to the research focus, while data presentation was carried out through the preparation of descriptive narratives and thematic categorization based on findings in the field. The process of drawing conclusions was carried out inductively by linking empirical findings with relevant theories, such as the TPACK (Technological Pedagogical and Content Knowledge) framework and constructivism theory, which emphasizes the active role of students in constructing knowledge through digital media. Data validity was maintained through source and method triangulation techniques, namely comparing the results of interviews, observations, and documentation to ensure the validity of the findings. With this approach, the study is expected to provide a comprehensive picture of the reality of ICT media development in elementary madrasahs and its contribution to the transformation of education towards Indonesia Emas 2045.
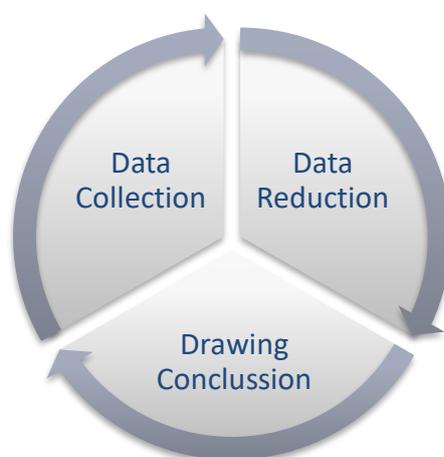
Gambar. 1 *Data presentation model with triangulation*

Result and Discussion

This study was conducted at Nurul Islam Plangkapan Madrasah Ibtidaiyah (MI), Tambak Subdistrict, Banyumas Regency. The focus of the study was on efforts to develop Information and Communication Technology (ICT)-based learning media and its implementation in the learning process towards the transformation of Indonesia's Golden Education 2045. Data was obtained through in-depth interviews with the principal, three teachers, and four students, and was supported by classroom observations and documentation of madrasah activities.

The results showed that the madrasah had begun to apply ICT in learning activities, although it was still in the early stages of development. All teachers responded positively to the use of ICT-based media because it was considered to increase learning motivation, make learning more interesting, and make it easier for students to understand abstract concepts. Teachers used various digital media such as PowerPoint, learning videos, Canva, Quizizz, and Wordwall to help students understand the subject matter, especially in Natural Sciences (IPA) and Islamic Religious Education (PAI) subjects.

From interviews with teachers (G1–G3), it was found that the use of ICT has had a positive impact on the learning environment. Young teachers (G3) have been able to create interactive media using Canva for Education and Quizizz, while senior teachers (G2) are still in the adaptation stage but show a high willingness to learn. Teacher (G1) stated that learning using videos and interactive presentations makes students more focused and less prone to boredom. The main obstacles faced by teachers are limited devices, unstable internet connections, and uneven technical skills among teachers.

Table 1 Results of Interviews With Teachers

Teacher Code	Utilization of ICT Media	Student Responses	Obstacles	Hope
G1	PowerPoint, instructional videos, Wordwall	Students are enthusiastic and focused	The internet is unstable	ICT facilities improved
G2	Digital videos and quizzes	Active and enthusiastic students	Limitations of tools and skills	Advanced ICT training
G3	*Canva, Quizizz, Google Classroom*	Collaborative and creative students	Slow connection and limited time	Digital laboratories are strengthened

Interviews with the Madrasah Principal (KM) revealed that the madrasah has a clear vision for developing technology-based learning. The principal explained that MI Nurul Islam Plangkapan has launched an internal program called Madrasah Berbasis Digital (Digital-Based Madrasah), which aims to improve the quality of learning by utilizing information technology. Strategic efforts that have been made include the provision of ICT facilities such as laptops, projectors, and Wi-Fi networks; teacher training on digital literacy; and the formation of a small

team of digital learning media developers (Ulum et al., 2024). However, budget and network limitations remain major challenges in implementing the program.

Meanwhile, interviews with students (grades 1–4) show that the majority of students respond positively to ICT-based learning. Students feel more motivated and find it easier to understand the material through the visual and audio displays of the learning videos. They consider learning activities to be more interesting and enjoyable. Some students who are more tech-savvy (such as S3) even play a role in helping teachers prepare the tools, while students who are not yet familiar with technology (such as S4) still show hesitation but have a desire to learn to use digital devices.

Table 2 Student Interview Results

Student Code	Views on ICT Learning	Perceived Obstacles	Harapan ke Depan
S1	Happy and motivated	Slow internet	More computers
S2	Initially confused, now interested	The video is too fast	Basic computer training
S3	Active and helpful to teachers	Unstable network	The computer lab is more spacious
S4	Still unsure but eager to learn	Not yet proficient with computers	Additional computer lessons

Field observations show that ICT-based learning has been well integrated into learning activities in grades V and VI. Teachers use PowerPoint and educational videos as the main tools for delivering material. When teachers show videos about the solar system, students appear enthusiastic and actively engaged (Azami et al., 2025). The classroom atmosphere was lively and communicative; students asked many questions and worked together to answer digital quizzes using Quizizz. Teachers were able to overcome internet connection problems by providing additional explanations verbally.

Documentation of activities supported the results of interviews and observations. The Lesson Plan (RPP) documents showed that teachers had included the use of ICT media in their lesson plans. In addition, there are photos of teacher training activities in March 2025 with the theme "Creating Interactive Learning Media Using Canva and Wordwall." Madrasah inventory data also records the availability of six laptops, four projectors, and one mini laboratory with eight computers that are used alternately between classes. The madrasah's 2025 work programme reaffirms MI Nurul Islam Plangkapan's commitment to supporting the digital transformation of education. The head of the madrasah encourages collaboration among teachers through the formation of an internal ICT team tasked with assisting other teachers in creating learning media. Photo documentation and teacher reflection journals show an increase in creativity and active participation in the application of digital media in the classroom.

In general, the results of this study indicate that the development of ICT media at MI Nurul Islam Plangkapan has been quite successful and has received support from all parties.

The principal acts as a policy facilitator, teachers as the main implementers of innovation, and students as active beneficiaries. Although limitations in equipment and network remain an obstacle, the spirit of adaptation and high willingness to learn from teachers, as well as the enthusiasm of students, indicate that this madrasah is on the right track towards creative and sustainable technology-based learning.

The application of ICT at MI Nurul Islam Plangkapan has not only improved the quality of learning but also changed the learning culture to be more collaborative and participatory. With the support of madrasah policies and the commitment of the entire school community, the implementation of ICT is expected to continue to develop until it becomes a model for other madrasahs in the Banyumas region in realizing the vision of Indonesia Emas 2045..

Discussion

The results of this study generally show that the application of ICT media at MI Nurul Islam Plangkapan has had a positive impact on the learning process and learning culture in the madrasah environment. These findings answer the research questions regarding how ICT media development is carried out by madrasah teachers and how the entire school community responds to these changes. Based on the results of interviews, observations, and documentation, it can be concluded that the use of ICT is not only a complement to the learning process, but has also become a pedagogical strategy that strengthens learning motivation, student engagement, and teacher innovation in classroom management.

The integration of ICT in learning at this madrasah is in line with the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra & Koehler (2006), di mana kompetensi guru dalam mengajar tidak hanya ditentukan oleh penguasaan materi dan pedagogi in which teacher competence in teaching is not only determined by mastery of subject matter and pedagogy, but also by the ability to effectively integrate technology. Teachers at MI Nurul Islam Plangkapan have demonstrated efforts to develop the TPACK dimension through the use of digital media such as PowerPoint, Canva, Wordwall, and Quizizz. Although not all teachers have achieved a high level of digital literacy, they have shown awareness of the importance of technology as an integral part of learning strategies.

Young teachers (G3) in this study showed a profile of educators who are adaptive to technological developments and capable of designing more engaging learning through digital media. This reflects their ability to master aspects of technological knowledge and pedagogical knowledge simultaneously, as described in the TPACK model. Meanwhile, senior teachers (G2) are still in the process of integrating ICT, but show enthusiasm for learning and collaborating with colleagues. This shows that digital transformation in madrasahs cannot be done instantly, but requires time, continuous training, and supportive leadership (Yusuf et al., 2021).

Field findings also reinforce the theory of teacher digital literacy (Ribble, 2015) which emphasizes the importance of educators' ability to use technology ethically, effectively, and creatively. Teachers at MI Nurul Islam Plangkapan have utilized ICT media not only as visual aids, but also as interactive tools to develop students' critical and collaborative thinking skills.

For example, digital quizzes using Quizizz encourage students to participate actively and think quickly, in line with the principles of student-centered learning (Muna et al., 2024). In this context, learning is no longer teacher-centered, but provides space for students to become active subjects in the learning process.

The results of interviews with madrasah principals (MPs) indicate the role of transformational leadership in supporting change. The madrasah principal acts as a motivator, facilitator, and policy director who fosters a culture of innovation in the madrasah. This type of leadership is in line with the views of Hidayah et al. (2020) who state that school/madrasah principals are a determining factor in the successful implementation of educational technology because they can create a learning ecosystem that is open to change. The Digital-Based Madrasah Initiative implemented at MI Nurul Islam Plangkapan is a concrete manifestation of visionary leadership, directing the entire school community to move towards technology-based learning without neglecting Islamic values.

Positive responses from students (S1–S4) also indicate that ICT-based learning has provided meaningful learning experiences. Students feel more interested, find it easier to understand the material, and are highly motivated to participate in lessons. These findings are in line with the results of studies by Bahri et al. (2021) and Mertasari (2022) which confirm that the use of digital media increases student engagement and conceptual understanding, especially at the elementary level. Students with better digital literacy are even able to assist teachers in technical aspects, as demonstrated by S3 who played an active role when the teacher used digital devices. This phenomenon shows that 21st-century learning requires two-way collaboration between teachers and students in utilizing technology as part of the learning process.

From the implementation side in the field, the results of observations show that the application of ICT media can create an interactive and collaborative classroom atmosphere. Learning using videos, interactive presentations, and digital quizzes builds student engagement in understanding concepts visually and auditorily. This supports the principles of 21st Century Learning, which emphasizes four main competencies: critical thinking, communication, collaboration, and creativity (4C). The use of ICT media allows these four competencies to develop simultaneously. Teachers not only deliver material, but also guide students to think critically, discuss, and solve problems through challenging digital activities.

However, limitations in devices and network infrastructure remain a significant obstacle. Some teachers complain about frequent internet disconnections and a lack of projectors in every classroom. These obstacles are in line with the findings of Zen et al. (2022) and Sulistianingtyas et al. (2022) who found that the successful implementation of ICT in educational institutions is highly dependent on the availability of adequate facilities and technical support. Nevertheless, the enthusiasm of teachers and the support of school principals show that a digital culture can flourish even in the face of limitations.

In addition, students' technological literacy is also an important factor that needs to be considered. Based on the interview results, some students (especially S4) still have difficulty operating computers independently. This condition indicates that digital literacy needs to be instilled from an early age through structured and continuous learning. According to Vygotsky's

social constructivism theory, learning experiences that involve social interaction and tools (in this case, ICT) will accelerate the development of students' thinking skills. Therefore, student involvement in ICT-based activities can be considered a process of digital scaffolding, in which teachers act as facilitators who help students achieve new competencies through technology.

From a policy perspective, the support for the Madrasah Digital program initiated by the Ministry of Religious Affairs provides a broad framework that underpins innovative practices at MI Nurul Islam Plangkapan. The implementation of this policy is reflected in the Madrasah Work Plan for 2025, which explicitly includes the strengthening of ICT in learning activities. The findings also show that there is ongoing internal training and reflection among teachers. This reflective practice reinforces the concept of a professional learning community (PLC), which is a community of teachers who support each other to improve their professional and pedagogical competencies.

Theoretically, the findings of this study reinforce the ICT integration model in basic education that emphasizes synergy between individual factors (teacher competence), institutional factors (madrasah policies), and cultural factors (digital learning culture). These three factors form an ecosystem that enables technology-based learning to develop sustainably. In the context of MI Nurul Islam Plangkapan, the combination of visionary leadership, teacher collaboration, and student enthusiasm became a strong social capital to overcome technical limitations.

Thus, the results of this study not only confirm the relevance of TPACK theory and teacher digital literacy in the context of madrasah education, but also broaden the understanding of how ICT-based learning can be adapted in Islamic primary education environments with limited resources. These findings contribute to the development of theory on the digital transformation of education in Indonesia, namely that the success of technology integration in learning is not solely determined by the sophistication of the devices, but by collaboration, leadership, and a learning culture that is open to innovation.

Conclusion

This study concludes that the development and application of Information and Communication Technology (ICT) media at MI Nurul Islam Plangkapan has been effective despite limitations in facilities and networks. Teachers have demonstrated readiness and creativity in integrating technologies such as PowerPoint, Canva, Quizizz, and educational videos to create a more engaging and interactive learning environment. The principal plays an active role in providing policy support and training, while students respond positively to ICT-based learning because it is considered to aid understanding and increase motivation to learn.

The application of ICT in this madrasah proves that digital transformation in education does not only depend on technological devices, but also on commitment, collaboration, and an innovative culture within the school environment. Through the Technological Pedagogical Content Knowledge (TPACK) approach, teachers are beginning to be able to integrate pedagogical, content, and technological aspects in an integrated manner. In addition to improving digital literacy, the use of ICT also strengthens students' critical thinking,

communication, collaboration, and creativity skills as key competencies for 21st-century learning.

Based on the findings of the study, it is recommended that teachers continue to improve their digital competencies through training and collaborative practices; madrasah principals expand ICT support and strengthen madrasah digital transformation policies; students actively and responsibly utilize technology as part of the learning process; and the government strengthens madrasah digitization programs through infrastructure assistance, training, and sustainable policies.

Overall, the development of ICT media at MI Nurul Islam Plangkapan reflects concrete steps towards the realization of a Digital Madrasah that is adaptive to the changing times and in line with the vision of Indonesia Emas 2045, namely to build a generation that is competitive, creative, and technologically literate.

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