

Transformation of Gadget Use as Adaptive Learning Media Based on Deep Learning at Junior High School

Hartini¹, Daviq Chairilisyah¹, Rita Kurnia¹, Cindy Febby Anjana¹, Izadri Nizami¹,
Noverman¹, Warni¹

¹ Program Studi Magister Administrasi Pendidikan, Universitas Riau, Pekanbaru, Indonesia

hartini4310@grad.unri.ac.id, daviq.chairilisyah@lecturer.unri.ac.id, rita.kurnia@lecturer.unri.ac.id,

cindy.febby4312@grad.unri.ac.id, izadri4659@grad.unri.ac.id, noverman4581@grad.unri.ac.id,

warni4315@grad.unri.ac.id

corresponding author: hartini4310@grad.unri.ac.id

ABSTRACT

The use of gadgets in the environment is increasing, no longer limited to urban communities, but has spread even to remote villages. This study aims to analyze how gadgets are used as a medium for adaptive learning based on deep learning for students, teachers, and the principal, as the policymakers, in the SMPN 1 Cerenti environment. Deep learning-based adaptive learning is a digital instructional system that uses artificial intelligence to analyze behavioral data, learning speed, and student learning preferences in real time. Through interviews, observations, and documentation of students, teachers, and the principal, this study reveals that the use of gadgets as a medium for adaptive learning has both positive and negative impacts on the learning process. The use of gadgets as a medium for adaptive learning allows teachers to access digital platforms flexibly, to create an active, interactive learning ecosystem, and ensure that all task progress is monitored and well-structured. The use of gadgets in learning platforms still faces obstacles, such as limited school infrastructure, signal instability due to power outages, numerous students lacking supporting devices, and low digital literacy among senior teachers in accessing and operating learning platforms. The research results are expected to make a meaningful contribution to the transformation of education. These findings not only highlight the effectiveness of technology in creating a structured learning ecosystem but also provide concrete recommendations to overcome technical and cultural obstacles faced by students and teachers in the field. This research provides an alternative concrete solution for the standardization of personal learning at the junior high school level by utilizing gadgets as an adaptive learning medium, which can automatically and accurately bridge the gap in students' understanding in real time. This contribution is becoming increasingly crucial for schools in rural areas, as technology can bridge the gap in educational quality between rural and urban areas without absolute dependence on global connectivity.

Keywords: *adaptive learning, digital transformation, gadgets, learning media*

Submitted	Accepted	Published
17 May 2026	13 June 2026	30 July 2026

Citation	:	Hartini., Chairilisyah, D., Kurnia, R., Anjana, C.F., Nizami, I., Noverman., & Warni. (2026). Transformation of Gadget Use As Adaptive Learning Media Based On Deep Learning at Junior High School. <i>Jurnal PAJAR (Pendidikan dan Pengajaran)</i> , 10(4), 604-620. DOI: http://dx.doi.org/10.33578/pjr.v10i4.1552 .
----------	---	--

INTRODUCTION

The development of digital technology and the demands of the 21st century require not only pedagogical innovation in learning but also adaptation to technological advances. The application and adaptation of technology in learning spaces has become a necessity to face the transformation in the era of globalization (Seminar et al. 2019). In the information and communication sector, technology has had a significant impact on education, especially in learning. A meaningful learning approach is needed to help students not only know facts but also understand concepts in depth and apply them. One of the approaches that is developing in the field of modern education is deep learning (Kovač et al. 2025).

Mendikdasmen has established the Deep Learning approach as a learning method to implement the *Kurikulum Merdeka* starting in 2025. Deep learning is implemented in all schools in both urban and rural areas. Deep Learning refers to a learning process that emphasizes a thorough understanding of concepts, students' active participation, and the ability to transfer and apply knowledge to new situations and everyday life (Haq and Prasetyo 2025). It emphasizes students' ability to understand, think critically, and apply knowledge contextually.

Deep learning is a transformation in learning culture that requires support from human resources, infrastructure, and management systems. The use of technology is one of the learning frameworks in deep learning. Digital technology is used to support meaningful and enjoyable learning. The use of information technology to improve the quality and effectiveness of the educational process includes information systems management, e-learning, learning platforms or media, and life skills education (Surjono, Muhtadi, and Wahyuningsih 2017).

The adoption of technology in the teaching and learning process is increasingly relevant. One of the technology devices is a gadget. Gadgets are the most widely used devices because of their portability and multifunctionality. Based on data from the Indonesian Internet Service Providers Association (APJII, 2026), 84.31% of users access the internet via gadgets. This indicates that the use of gadgets has the potential to create opportunities for adaptive transformation of learning media in the development of digitalization. Memet Casmat (2022) conveys that mobile learning, as a subset of e-learning, has numerous advantages in facilitating the learning process without the limits of time, space, and place.

Several studies discuss deep learning as an effective means of transforming learning. Ira Fatmawati (2025) states that integrating deep learning into history learning, using strategies and methods aligned with information technology, makes history material more contextual and brings the role to life. Syifa'u R (2025) confirms that deep learning is an effective strategy for achieving meaningful and humanistic learning, fostering lifelong learners who are capable of adapting to global challenges in the 21st century. Hendra Purwanto et al. (2026) state that continuous teacher training, equitable distribution of infrastructure, and supportive educational policies are needed for the implementation of the deep learning approach to take place optimally and sustainably.

Other studies discuss technology in education. Al-Juhra (2025) asserts that digital transformation has great potential to revolutionize the education system if supported by adaptive policies, improved teacher competencies, and equitable access to technology, thereby ensuring effective and sustainable implementation. Veiz Elok Faiqoh Meila et al. (2025) argue that multi-party collaboration is needed to build an educational ecosystem ready to adopt technology wisely and in line with the characteristics of early childhood. David Darwim (2025) states that integrating this technology can support more inclusive and sustainable education, with essential roles for education policies, teacher training, and increased digital literacy among students.

Based on initial observations, the principal of SMPN 1 Cerenti informed them that the school has implemented deep learning. The school has prepared supporting infrastructure, both human resources and infrastructure. The school provides a Wi-Fi network to support technology-based learning. Cerenti is a sub-district located in a palm oil plantation area. Internet access in this area is often disrupted during power outages.

In early March, 2026, the researcher interviewed one of the Grade 8 teachers at SMPN 1 Cerenti. Not all Grade 8 students have gadgets. The Grade 8A study group has the majority of students with gadgets. The teacher confirmed that almost all students use gadgets to join WhatsApp groups, access social media, watch videos, and play games. Gadgets are not yet utilized for learning. Data on all Grade 8 students who have gadgets are shown in Table 1.

Table 1. List of distribution of student gadget users

8th Grade Study Groups	Number of Students	Students with Gadgets	Percentages	Descriptions
Grade 8A	32	24	29%	majority
Grade 8B	26	12	14%	minority
Grade 8C	28	12	14%	minority
Grade 8D	26	10	12%	minority

Grade 8E	27	14	17%	minority
Grade 8F	26	11	13%	minority
Total	165	83	100 %	

Based on the data in Table 1, which presents the distribution of student gadget users among Grade 8A students, out of 32 students, only 8 do not have gadgets due to financial reasons. In terms of gadget ownership percentage, 29% of grade 8 students in grade 8A own gadgets, while a small percentage own gadgets. This indicates that gadget ownership among grade 8A students at SMPN 1 Cerenti meets the expected criteria.

Most previous research uses a Systematic Literature Review (SLR) or a desk study approach to understand the concepts of mobile learning and deep learning. There is still a lack of empirical case studies that specifically observe the transformation of device use in the field. Current research has not explored how devices can be transformed into adaptive media. Furthermore, research on how devices can continue to perform deep adaptive learning functions under limited connectivity or through innovative blended learning models remains very rare in the current literature. This phenomenon underscores the urgency of shifting technology's role from merely a leisure tool to a cognitive tool formally integrated into the learning process.

Therefore, this research is crucial, although the use of devices as a learning medium has become widespread in Indonesia, obstacles to digital infrastructure and uneven internet connectivity persist. There are a few adaptive learning models that simultaneously address teachers' digital literacy barriers and infrastructure limitations in non-urban areas. Furthermore, it is vital to demonstrate empirically that the use of adaptive devices not only increases engagement in learning but also triggers deep collaboration between humans and machines, encouraging students to acquire strong conceptual understanding and creative problem-solving skills. This phenomenon underscores the urgency of shifting technology's role from merely a leisure tool to a cognitive tool formally integrated into the learning process.

LITERATURE REVIEW

Learning Media

The changes in education during the digital era require fundamental transformations in the knowledge-transferring process in classrooms. Achieving learning goals successfully depends on the quality of the content, the teachers' skills, and the appropriateness of communication methods. Media is a tool or means used to help the learning process; thus, it can increase the effectiveness and efficiency of the teacher for the students (Zubaidi et al. 2023). Learning media are matters that are used to transfer information or messages and stimulate attention, interest, thoughts, and feelings, leading to the achievement of specific learning objectives (Kurnia et al. 2022). Learning media play a crucial role in helping teachers deliver material more clearly and systematically. Buckingham (2007) mentions that media education can provide an essential critical dimension to the use of technology in education, moving beyond a merely instrumental approach, and that it can help bridge the 'new digital divide' between students' experiences of technology outside school and their experiences in the classroom (Buckingham 2007).

The main function of learning media is to assist the learning process and improve student learning outcomes. Media is a strategic instrument in determining the success of the teaching and learning process in the world of education (JW Kusum 2023). Meanwhile, the additional function of media is to help create a more interesting, effective, and varied learning environment so that students will be more motivated in the learning process and achieve better learning outcomes (Haq and Prasetyo 2025). For media to function effectively and efficiently, it must be adapted to the objectives and functions of the learning media. The use of digital platforms is replacing non-digital tools to simplify and streamline existing processes. Common practices included facilitating communication, setting up online traditional types of homework (e.g., quizzes), automating marking and feedback, and supporting online-mediated learning and revision (Gouseti and Shaw 2026),

Media can be used for learning purposes, both in a classical and individual capacity. The use of learning media in the teaching and learning process arouses new desires and interests, motivates and stimulates learning activities, and has a psychological influence on students (Bau et al. 2025). Learning media can include visual, audio, or multimedia tools used to facilitate learning in the classroom (Fathurrahman et al. 2024). Research reveal that integrating technology, such as gadgets, into learning media can increase student participation and encourage independent learning exploration.

Gadgets

A gadget is a term for a device or instrument that has a practical purpose and function that is specifically designed to be more sophisticated than previously created technology (Wikipedia 2024). Gadgets have distinct characteristics from other electronic devices. The difference lies in the innovation they contain. This means that gadgets continually offer the latest technology that makes life easier. Gadgets are considered special electronic devices that differ from other electronic devices. What makes gadgets special is their ability to introduce new technology that is considered helpful to their users. This unique feature makes users feel satisfied and interested in owning and using gadgets.

Various tools have been created to support and lighten the burden of human work, one of which is a gadget. Gadgets are portable electronic devices with various digital applications and can be used to quickly access information via the internet. Gadgets are small technological objects that serve as innovations, one of which is a learning medium (Julianingsih et al., 2021). Gadget is a small, interesting mechanical device or tool that can bring much joy to its users, even though it may be inefficient in use (Ayunda, Ruslan, and Ridayani 2025).

In general, gadgets are considered electronic devices with a specific function. Gadgets no longer function as communication tools, but also as entertainment media through voice, text, images, and video (Ayunda et al. 2025). Gadget refers to a wide variety of technological devices that are constantly evolving and designed with specific functions. The use of gadgets in learning enables students to quickly obtain information and expand learning resources beyond textbooks. Gadgets have become a source of learning for students, with almost all learning materials now available on them, making the learning process easier. The use of gadgets in schools is implemented to assist teachers in delivering material in a more varied and engaging manner. The use of gadgets in education has transformed from just a communication tool into an essential learning instrument for both teachers and students.

Adaptive Learning

Adaptive learning is fundamentally a method that continuously adjusts the content, strategies, and pace of education to address the unique requirements of every learner. In today's digital era, this method is becoming more effective with the aid of technology, enabling the creation of more adaptable and data-informed educational resources. Adaptive learning is defined as a teaching method that utilizes technology to organize teaching and materials according to the needs or talents of students identified during the learning process (Yuda, Akbar, and Gusmaneli 2024). Learning process built by teachers to develop creative thinking that can improve students' thinking skills and ability to construct new knowledge (Wijaya 2025). Studying turns into a task aimed at enhancing a strong understanding of the content being learned.

In adaptive learning, technology is often used to help analyze students' learning needs. Li et al (2021) stated that adaptive learning is a teaching system that adjusts the teaching content to meet the changing learning needs of students. Adaptive learning in a digital context is a teaching process that uses technology to adjust instruction and content based on students' abilities in the learning process. One of the main characteristics of adaptive learning is that learning is tailored to the abilities and needs of each individual and directs students to learning resources that suit their skill level (Uyun et al. 2024).

Adaptive learning systems enable teachers to monitor students' learning progress more effectively (Yuda et al. 2024). Digital technology plays a crucial role in the advancement of personalized learning. Digital

platforms that support adaptive learning include data-driven recommendation systems that analyze user information and provide content recommendations tailored to students' needs and preferences. This allows students to receive materials more tailored to their individual needs, compared to conventional learning methods that tend to be uniform.

The benefits of adaptive learning in the digital age include creating a more individualized learning experience. Every student learns differently and at a different pace, and adaptive learning allows instruction to be tailored to each student's preferences and abilities. Adaptive learning also increases student engagement. By providing materials tailored to their interests and ideal difficulty levels, students tend to feel more challenged and motivated to continue learning. Furthermore, adaptive learning provides faster and more accurate feedback. Through digital technology, students can receive immediate feedback after completing assignments or exams. This feedback helps them identify strengths and weaknesses, allowing them to focus more on areas for improvement.

Adaptive learning is an innovation based on advances in digital technology, providing a more personalized and interactive learning experience. With technologies such as artificial intelligence, machine learning, and online learning platforms, the learning process can be tailored to each student's unique needs, ultimately increasing effectiveness and engagement.

Deep Learning

Deep learning in education refers to a learning approach that emphasizes in-depth conceptual understanding. *Pemendikdasmen* No. 13 in 2025 states that Deep Learning is an approach that honors by emphasizing the creation of a learning atmosphere and a conscious, meaningful, and enjoyable learning process through holistic and integrated thought, feeling, and exercise (Mendikbud 2025). Deep learning refers to a learning process that focuses on in-depth understanding of concepts, active student involvement in the learning process, and the ability to transfer and apply knowledge to new situations and everyday life (Haq and Prasetyo 2025).

Furthermore, according to *Kemendikdasmen* RI, ineffective learning approaches have resulted in low reading and numeracy skills among Indonesian students, as reflected in the PISA results. Low literacy and numeracy are due to gaps in the effectiveness of learning in schools, which do not provide ample opportunities for teachers to develop students' creativity and critical thinking skills. The momentum of the 2035 Demographic Bonus and the vision of Golden Indonesia 2045 present both challenges and significant opportunities for the Indonesian education system. Education plays a crucial role in developing a generation that will achieve the vision of Golden Indonesia 2045. Primary and secondary education in Indonesia is striving quickly and effectively to accelerate the impact of education through various learning approaches, one of which is Deep Learning (Badan Standar, Kurikulum and Indonesia 2025).

Deep learning is based on the principles of mindful, meaningful, and joyful, which encourages student-centered learning while being relevant to real life. Students' learning experiences are achieved when they are aware of being active learners and are able to self-regulate. Students understand learning objectives, are intrinsically motivated to learn, and actively develop learning strategies to achieve these goals. Joyful learning is created in deep learning to encourage students to be active in the learning process. The positive, interactive, and collaborative learning environments are effective to reduce students' academic stress, and students' creativities increase well.

Deep Learning can be seen as a form of transformational learning that encourages intellectual, personal, and social development simultaneously (Kompensasi et al. 2020). Contextual learning that links subject matter to real-world situations is a vital element in deep learning strategies (Kovač et al. 2025). Educational technology can also be an essential supporting tool in deep learning (Kovač et al. 2025). Digital platforms such as simulations, interactive videos, online discussions, and digital formative assessments can be used to enrich the learning experience and expand students' access to various learning resources.

METHOD

The research was conducted using a qualitative approach with a case study method to delve deeper into social phenomena within a junior high school environment. This approach was selected to allow researchers to explore rich and comprehensive information regarding how the transformation of gadget use is implemented as an adaptive learning medium in the classroom.

This research was conducted for two months, from early March to April in the 2025-2026 academic year at SMP Negeri 1 Cerenti. This school was selected based on the consideration that SMP Negeri 1 Cerenti has great potential and is committed to implementing digital transformation through the adaptive use of devices. The sampling technique in this study used the Purposive Cluster Sampling method. To obtain accurate and relevant data for the research objectives, research subjects were determined using a purposive sampling technique. The selected subjects were elements directly involved in the learning ecosystem, including the principal as policymaker, teachers as facilitators, and students.

Table 2. The participants of the research

No	Participants	Codes	Amount
1	Principle	KS	1
2	Subject teachers	G-PAI	2
		G-PKN	2
		G-IND	2
		G-ING	2
		G-MTK	2
		G-IPA	2
		G-IPS	2
		G-OR	2
		G-SB	2
		G-BMR	2
3	Students	S-LK	14
		S-PR	10

As displayed above, the researcher selects a sample in the form of study groups, based on specific criteria that have been determined to answer the research focus. From the total of six grade 8 study groups, one class is selected as a sample with the criteria of having the largest number of students and at least 90% of the students in the study group owning gadgets. There are 20 subject teachers who participate in the research. They are teachers who taught in Grade 8A.

The research data were collected through three primary data collection techniques to obtain a comprehensive picture: observation, interviews, and documentation. Observations were conducted through direct observation of how device-based learning activities took place in the classroom. Interviews were used to in-depth explore the perceptions, experiences, and challenges faced by students, teachers, and the principal. Documentation was used to gather supporting evidence for learning programs, photos of activities, and school policies related to technology.

Table 3. The pre-research closed-ended questionnaire

No	Participants	Indicators
1	Students	The intensity of gadget use
2	Teachers	Types of digital activities of students and students' digital literacy.
3	Principles	School infrastructure readiness

Table 4. Research indicators on the transformation of gadgets as adaptive learning media in-depth learning-based learning for students, teachers, and school principals

No	Indicators		Aspects
1	Students	The Process of Implementing Gadget Transformation as an Adaptive Learning Medium in Deep Learning for Students	1. Orientation & Digital Readiness 2. Adaptive Independent Exploration Stage 3. Deep Knowledge construction 4. Collaboration and communicative elaboration 5. Self-Reflection and Evaluation
2	Teachers	The Teachers' Roles in Implementing Transformation of Gadgets as an Adaptive Learning Medium in Deep Learning	1. Adaptive Instructional Planning and Design 2. Diagnosis and Personalization of Learning 3. Facilitating Inquiry and Collaboration through Devices 4. Formative Evaluation, Reflection, and Feedback
3	Principles	The Principal's Role in Implementing Transformation of Gadgets As An Adaptive Learning Medium in Deep Learning	1. Strategic planning & policy formulation 2. Strengthening Digital Infrastructure and Ecosystems 3. Human Resource Transformation 4. Systematic Evaluation and Sustainability

The collected data was subsequently analyzed using the Miles and Huberman interactive model, which includes three main stages: data reduction, data presentation, and conclusion. The triangulation techniques were used to ensure the data obtained were valid and reliable. Data reduction involves sorting and simplifying the raw data obtained. Data presentation involves systematically organizing information for easy understanding. Conclusion drawing involves formulating meaning from field findings. Furthermore, to ensure that the data obtained is valid and reliable, the researcher applied triangulation techniques. This technique involves comparing and cross-checking information obtained from various data sources and different data collection methods.

In the data reduction stage, the data analysis process begins with data reduction, which is the stage where researchers sort, focus, and simplify raw data obtained from in-depth interviews, classroom observations, and field documentation studies. In this cycle, information is sorted appropriately to obtain relevant information regarding gadget transformation, adaptive learning, and deep learning from research

participants. The selected data is subsequently summarized based on research indicators to facilitate researchers in moving on to the next stage of analysis.

In the data presentation stage, after the data has been successfully simplified, researchers proceed to the data presentation stage, which involves organizing and systematically assembling information to make its relationship structure easier to understand. At this stage, qualitative data, which initially consisted of long, complex narrative texts, can be transformed into a more structured form, namely a representative table. Through this neat and orderly data presentation, researchers can easily see patterns of relationships between variables, understand phenomena occurring in the field, and plan further analytical actions objectively.

In conclusion drawing stage, the final stage of this interactive model is conclusion drawing and verification, the process of formulating the meaning and essence of all the field findings that have been presented. At the beginning of the analysis, the conclusions drawn by the researcher are still tentative, vague, and temporary, but as solid supporting evidence in the field increases, these conclusions can develop into more mature and valid conclusions. To ensure these conclusions are free from subjective bias, researchers conduct continuous verification throughout the research by reviewing field notes, discussing with colleagues, or re-examining the suitability of theories to accurately answer the problem formulation.

In the triangulation stage, to ensure that all data obtained is proven valid and reliable, the researcher applies triangulation techniques as the main instrument in testing the validity of qualitative data. This technique works by comparing and cross-checking information obtained through source triangulation, namely paralleling the perspectives of students, teachers, and the principal, while also being strengthened by method triangulation that confirms the alignment between the results of interviews, direct observations in the classroom, and supporting documents.

RESULTS AND DISCUSSION

This section presents the results of the gadgets used as adaptive learning media at SMP Negeri 1 Cirenti. The research results were collected through a combination of direct interviews with students, teachers, and principals regarding the integration of gadget use and the challenges and obstacles encountered in the learning process. The research results combine empirical experience and theory related to the transformation of gadget use as an adaptive learning medium in teaching.

Use of Gadgets at School

The instrument used in the pre-research phase was a closed-ended questionnaire in the form of statements distributed to 24 student respondents via Google Forms. This instrument was designed to measure three main indicators of initial conditions: (1) intensity of device use, (2) types of digital activities, and (3) school infrastructure readiness and students' digital literacy.

Table 5. The use of gadgets in school

No	Indicators	Descriptions
1	Intensity of Gadget Use	Based on the results of a pre-research questionnaire, the intensity of gadget use by eighth-grade students at SMPN 1 Digital is very high, with 85% of students admitting to accessing their devices daily during school hours. However, the majority of this usage is spent during breaks (averaging 45 minutes) or during breaks between subjects, rather than integrated into the classroom teaching and learning process.

- 2 Types of Digital Activities Gadget use in schools remains static and non-adaptive for content consumption. Students tend to use devices solely for non-adaptive activities, communication, and entertainment, such as reading PDFs, communicating in class WhatsApp groups, accessing social media, watching YouTube videos, and playing games during breaks, without any feedback from the device.
- 3 School Infrastructure Readiness The school has provided Wi-Fi in several areas, but the available capacity is insufficient for all students to access simultaneously, often causing lag when accessing video content. The school's charging system is inadequate, both inside and outside the classroom.

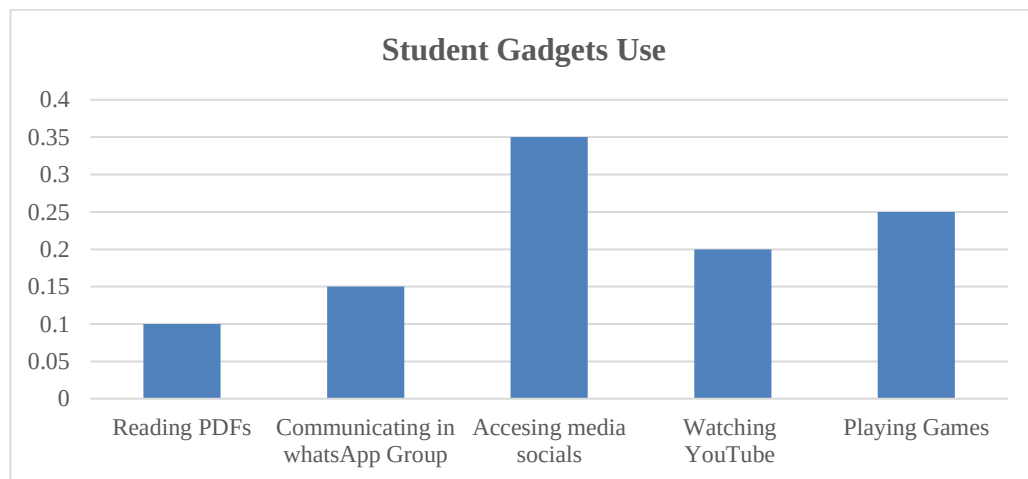


Figure 1. Percentage of student gadget use

The graph illustrates that of the total 24 minutes students spend interacting with gadgets at school each day, the largest portion is spent on social media (35%) and gaming (25%). This indicates that the function of gadgets as adaptive learning media that stimulate high-level thinking processes (deep learning) remains largely underexplored.

Transformation of Gadgets as Adaptive Learning Media in Deep Learning

The implementation of device transformation for students focuses on active student engagement in self-directed learning, where digital devices no longer function merely as passive information consumption media but as adaptive cognitive aids. Students are able to independently construct in-depth understanding, control their learning rhythm at their own cognitive pace, and develop broader cognitive skills.

Table 6. The process of implementing gadget transformation as an adaptive learning medium in deep learning for Students

No	Indicators	Descriptions
1	Orientation & Digital Readiness	Students set up their gadgets by downloading necessary applications, ensuring internet access, or adjusting accessibility settings. Students understand commitments regarding when gadgets can be used, what applications can be opened, and how to communicate digitally ethically in learning.
2	Adaptive Independent Exploration stage	Students interact with digital media or platforms (Google Classroom) or educational AI applications (Canva for Education). Faster learners can explore enrichment materials, while those who need more time can repeat video tutorials or simulations on their devices. Students can choose the digital learning resources that best help them understand concepts, whether through text, audio, or interactive videos provided by the teacher.
3	Deep Knowledge Construction	Students use gadgets as mini-research tools. They search for data and analyze phenomena to solve complex problems posed by teachers. Gadgets help students to select relevant information, compare multiple sources, and integrate this information into a better understanding.
4	Collaboration and Communicative Elaboration	Students use gadgets to work together on collaborative documents and discuss in digital forums. Gadgets are also used as a means of coordination in projects, such as video presentations and infographics.
5	Self-Reflection and Evaluation	Students receive direct feedback from adaptive applications, for example, recommendations on material to be corrected if they answer incorrectly or digital input from teachers or peers (peer feedback).

Teachers are experiencing a transformation with gadgets as their role shifts from conveying information to facilitating and architecting technology-based learning. By creating reflective, collaborative, and meaningful digital activities, teachers can leverage the adaptive capabilities of devices to implement differentiated learning strategies, monitor formative development in real time, and enhance higher-order thinking skills.

Table 7. The teachers' roles in implementing the transformation of gadgets as an adaptive learning medium in deep learning

No	Indicators	Descriptions
1	Adaptive Instructional Planning and Design	Teachers determine essential material. Teachers select and modify interactive digital worksheets and modules in GCR with differentiation features, providing different learning paths for fast and slow learners.

2	Diagnosis and Personalization of Learning	Teachers instruct students to do diagnostic assessments on their gadgets through an interactive application, such as Kahoot. In addition, teachers share different digital learning links through gadgets. The teachers provide enrichment access for high-achieving students and links to explanatory videos or concrete simulations for students who are slower to understand the material.
3	Facilitating Inquiry and Collaboration Through Devices	Teachers direct students to use gadgets as mini-research tools in search of data, and analyze phenomena to solve complex problems posed. Teachers also guide students to select relevant information and compare multiple sources by using gadgets.
4	Formative Evaluation, Reflection, and Feedback	Teachers monitor students' digital activities asynchronously to ensure students use gadgets according to digital ethics and assist students who experience difficulties understanding. Teachers also guide students in discussing their findings in the GCR using their gadgets.

Managerial implementation positions the principal as an instructional leader and transformative agent responsible for building a supportive and sustainable digital ecosystem. This role is realized through legitimizing school macro policies, strengthening digital infrastructure, and facilitating teacher professional development.

Table 8. The principal's role in implementing the transformation of gadgets as an adaptive learning medium in deep learning

No	Indicators	Descriptions
1	Strategic Planning & Policy Formulation	Issuing a written Standard Operating Procedure (SOP) that regulates the rights, obligations, and ethics of device use by students and teachers. SOP covers screen time restrictions, device responsibilities, and regulations regarding website access. The principal also holds meetings with the school committee and parents to understand that gadgets as a learning medium that can be adapted and supported from home.
2	Strengthening Digital Infrastructure and Ecosystems	Ensuring the availability of adequate physical and digital facilities so that the adaptive learning process does not experience technical obstacles. The school provides spare gadget units (school tablets) to be loaned to students who do not have gadgets.
3	Human Resource Transformation	Mobilizing the Internal School Learning Community (Kombel) as a forum for teachers to share best practices, discuss application obstacles, and evaluate adaptive digital modules together.
4	Systematic Evaluation and Sustainability	Holding a coordination meeting to analyze student learning outcomes and see the correlation between gadget transformation and the depth of student understanding, and identifying challenges that arise during implementation.

Challenges and Obstacles of Implementation

The implementation of the transformation of gadgets as adaptive learning media has encountered several challenges and obstacles. These challenges come from digital infrastructure, human resource

competence, and the curriculum system integrated with technology. Meanwhile, the obstacles encountered are socioeconomic, cognitive behavior, legal, technology, and financial.

Table 9. The challenges and obstacles in implementing the transformation of gadgets as an adaptive learning medium in deep learning

No	Variables	Dimensions	Indicators
1	Challenges	Digital Infrastructure	The availability of gadgets and servers with specifications that support adaptive learning based on artificial intelligence.
		Technical Readiness	The stability and latency speed of the internet network in processing content delivery personally to each student's device.
		Pedagogical-Technological Competence	The teacher's ability to design a curriculum that is flexible and responsive to analytical data generated by student devices.
		System and Curriculum Integration	Alignment of the device's operating system, Learning Management System (LMS), and learning outcomes targeted in the curriculum
2	Obstacles	Socio-Economic	Disparity in ownership of adaptive standard devices among students due to parents' economic level
		Network Barriers	Unstable telecommunications networks and electricity supply
		Psychological Barriers	Teachers' resistance to conventional pedagogical methods is shifting to digital-based methods
		Cognitive Behavior	Students' abilities to use learning platforms
		Systematic Evaluation	There are limitations to the institutional budget in financing digital devices and long-term adaptive learning systems.

DISCUSSION

Use of Gadgets At School

Pre-research data findings on the transformation of gadget use at SMPN 1 Cerenti digitally reveal a mismatch between the quantity of technology access and the quality of its use in an academic context. The fact that 85% of eighth-grade students access gadgets daily during school hours confirms that digital devices have become an integral part of students' daily ecosystem. The dominant use occurs during breaks, indicating that gadgets are still positioned as instruments for recreation and personal communication, rather than being used as instructional media in the classroom.

The use of static, non-adaptive devices, focused on passive content consumption, such as reading static PDF documents, interacting with WhatsApp, social media, and watching videos without any system feedback. It indicates the lack of internalization of deep learning principles and places students at a surface level of learning. Devices do not yet act as adaptive agents capable of providing precise content personalization for students. The availability of hardware connectivity in schools does not necessarily correlate linearly with digital pedagogical transformation.

Acceleration towards adaptive learning at SMPN 1 Cerenti is increasingly hampered by infrastructure limitations in terms of Wi-Fi bandwidth capacity. The occurrence of network latency (lag) when students access video-based content simultaneously is not only a secondary technical issue but also disrupts the continuity of students' focus and cognitive engagement. The transformation of gadgets to adaptive learning medium based on deep learning requires a holistic reconstruction that demands synchronization between strengthening the school's technical infrastructure, redesigning the digital curriculum, and shifting the culture of device use from passive consumption to interactive knowledge production. According to Masfufah (2024),

transformation must be balanced with a learning culture that is open, fair, and values diversity. The formulation of recommendations includes strengthening infrastructure, developing national standards, increasing digital literacy, and empowering school communities.

Integration of Gadgets as an Adaptive Learning Medium in Deep Learning

The successful implementation of digital device transformation in this study demonstrates a substantive paradigm shift in the three main pillars of education: students, educators, and instructional leadership. At the student level, findings demonstrating the transformation of gadgets from passive consumption instruments to adaptive cognitive tools imply that students' learning agency has been optimally developed. The primary benefit of this condition is the facilitation of the principle of self-regulated learning, where students are no longer forced to follow a uniform classical learning rhythm, but are instead able to control the tempo of information acquisition based on their individual cognitive capacity. According to Jusman (2025), the integration of technology in education not only increases student engagement but also enables a more personalized and innovative learning approach.

Within the framework of deep learning, this independence triggers deep cognitive engagement that enables students to construct knowledge holistically, rather than simply memorizing facts, allowing higher-order thinking skills (HOTS) to develop naturally. According to Syifa'u Rohmah (2025), deep learning plays a crucial role in developing higher-order thinking skills such as critical, creative, collaborative, and communicative skills. The findings reveal that deep learning plays a crucial role in developing higher-order thinking skills such as critical, creative, collaborative, and communicative skills. Hendra Purwanto (2026) conveys that deep learning can increase student engagement, conceptual mastery, and critical and reflective reasoning skills.

The transformation experienced by teachers provides theoretical significance; the adoption of mature technology successfully reconstructs their pedagogical identity, from a transmitter of knowledge to a facilitator and architect of learning experiences. By utilizing the device's adaptive features, teachers gain practical benefits in the form of the ability to execute differentiated instruction precisely. According to Norpin (2025), online learning platforms, educative application, and interactive software provide opportunities to serve the content dynamically and support varied learning styles.

Real-time recording of students' formative development data provides immediate feedback loops that enable teachers to implement pedagogical interventions quickly and accurately. The significance of this shift in educator behavior is that technology does not eliminate the role of teachers, but rather amplifies their capacity to design reflective and collaborative digital activities, which in turn stimulate students' in-depth thinking. According to Paul F. Burke (2025), results from a Structural Equation Model (SEM) demonstrate that when teachers adopt innovative pedagogical tasks into their teaching with digital technologies, they perceive an improvement in student learning experiences.

From an institutional perspective, the success of this transformation does not stand alone but is supported by the effectiveness of school leadership and managerial governance. The research findings emphasize the strategic importance of school principals, who no longer merely perform bureaucratic administrative functions but instead act as visionary instructional leaders and transformative agents. Legitimizing school macro policies, strengthening resilient digital infrastructure, and providing space for continuous teacher professional development are essential prerequisites for creating a healthy digital ecosystem. According to Rina Nurhidayati (2025), improving digital literacy is not only the responsibility of individual teachers but also the result of relationships between policies, support facilities, and structured managerial programs.

Overall, the philosophical significance of this research suggests that the transformation of a gadget to adaptive learning medium based on deep learning will only achieve substantive success when there is a harmonious symphony between student learning agency, teacher pedagogical innovation, and adaptive structural-managerial support from institutional leaders.

Challenges and Obstacles in Implementation

The implementation of device transformation as an adaptive learning medium relies on a configuration of interrelated structural and cultural factors. Challenges stemming from digital infrastructure, human resource competency, and curriculum integration indicate that the transition to immersive learning demands a high level of technological pedagogical competence. The need for artificial intelligence-enabled server devices and minimal network latency demonstrates the absolute dependence of adaptive learning on responsive technological infrastructure.

Socio-economic barriers, cognitive behavior, techno-legal aspects, and financial limitations emphasize the gap between technological idealism and empirical reality on the ground. The gap in standard device ownership due to parental economic stratification emphasizes the digital divide phenomenon, which risks creating academic exclusion for students from economically well-off families.

Cognitive and culturally, resistance from conventional to digital methods, low platforming skills, and distractions from non-academic features (games and social media) indicate that students' mental readiness and self-regulated learning are not yet fully mature enough to manage digital freedom.

This condition is further influenced by unstable operational costs and long-term licensing. Non-academic distractions provide a strong basis for schools to design device lockout regulations or tighten cyber security measures to maintain student focus during class hours. Financial constraints encourage institutions to manage effective budgeting that ensures the long-term sustainability of adaptive systems.

Practically, these findings offer significant pragmatic benefits for policymakers, who should avoid rushing into hardware procurement before standardizing Wi-Fi bandwidth capacity and providing digital literacy training for educators. According to Yuda Al Fadillah (2024), improving technological infrastructure and training for educators is crucial to maximizing the potential of adaptive learning.

CONCLUSIONS AND RECOMMENDATION

Based on research findings regarding the transformation of the use of gadgets as adaptive learning media based on deep learning at SMP Negeri 1 Cerenti, three main scientific conclusions can be drawn.

1. Successful technology integration within the junior high school ecosystem requires adequate hardware ownership and digital literacy skills (software/mindware) from teachers and students. The shift in gadget functionality from entertainment to interactive educational media has been proven to create a more engaging and effective learning environment and stimulate active student engagement.
2. The technology adaptation process has reached a stage of comprehensive procedural and conceptual understanding. Both teachers and students have been able to internalize the use of gadgets across the entire learning process—from the pre-learning stage (planning), during learning (critical exploration and collaboration), to post-learning (evaluation and in-depth reflection).
3. The implementation of digital innovation still faces systemic, multisectoral challenges. These challenges encompass individual aspects (digital performance gaps among students), professional aspects (varying levels of teacher readiness and technical pedagogical competency), and institutional aspects (limited school financial governance in ensuring infrastructure sustainability, device maintenance, and internet access funding).

This research makes a significant contribution to developments in the field of Educational Technology and Curriculum Management, including:

1. This research adds to the literature on the implementation of differentiated and adaptive learning models at the secondary school level. These findings empirically demonstrate that gadgets are not merely instrumental tools but rather catalytic media capable of facilitating deep learning (meaningful learning and higher-order thinking/HOTS) when supported by the digital literacy readiness of key actors.
2. The research results produce a field framework addressing the real challenges of digital reconstruction in a remote/regional school (SMP Negeri 1 Cerenti). The identified barriers can serve as a reference model for school principals and policymakers in designing innovation mitigation strategies.

3. Practically, this research provides an argumentative basis for education policymakers (the Department of Education and School Committees) regarding the importance of reorienting the use of School Operational Assistance (BOS) funds, or internal budgets. Budget management should no longer focus solely on physical procurement (output), but should instead be allocated sustainably for operational costs, maintenance, and regular teacher upskilling training to ensure the sustainability of the digital transformation.

Based on research findings regarding the transformation of gadgets into adaptive learning media based on deep learning at SMP Negeri 1 Cerenti, several structured strategic recommendations are proposed for the sustainability of this innovation.

First, to address the gap in device ownership among underprivileged students, the school management and the school committee need to establish an inclusive financial partnership scheme involving wealthy parents to facilitate the procurement of affordable, quality gadgets or provide a soft installment program in collaboration with local technology stores.

Second, to address the challenge of educator competency, the school is advised to hold regular IT training focused on deep learning pedagogy, which is further followed up with a reverse mentoring program or ongoing mentoring where junior teachers who are more technologically literate accompany their senior colleagues in integrating digital media in the classroom.

Third, to overcome the limitations of the school's operational budget in providing stable internet access, the school needs to conduct strategic communication and establish partnerships with palm oil companies in the surrounding area to optimize the use of Corporate Social Responsibility (CSR) funds in the form of procuring Wi-Fi signal booster infrastructure in the school environment.

Finally, for the development of scientific knowledge, further researchers are recommended to conduct replication research or relevant comparative studies in remote, isolated, and less developed areas (rural areas) to test the effectiveness and resilience of this deep learning-based adaptive learning model in the characteristics of areas with more extreme infrastructure limitations.

Credit authorship contribution statement

The first, fourth, fifth, sixth, and seventh authors contributed to the formulation of the research concept, methodological design, data collection and processing, data analysis, and the writing of the initial draft of the manuscript. The second author was responsible for assisting in the development and implementation of the research methodology, contributing to the research's critical review, reinforcement of data analysis, and refinement of the final manuscript. All authors participated in the review process and approved the final version of the manuscript.

Declaration of competing interest

The authors declare that there are no competing interests, either financial or personal relationships, that could have influenced the research process or the results reported in this article.

Ethical Declaration

All participants provided informed consent prior to their involvement in the study. They were informed about the study's purpose, procedures, and their right to withdraw at any time without consequence.

REFERENCES

- Ayunda, Khairani, Ruslan Ruslan, and Ridayani Ridayani. 2025. "Pengaruh Penggunaan Gadget Terhadap Minat Belajar Peserta Didik Pada Mata Pelajaran PPKn d SMP Negeri 1 Karang Baru Kabupaten Aceh Tamiang." *Jurnal Pancasila Dan Kewarganegaraan* 10(1):77–86.

- Badan Standar, Kurikulum, dan Asesmen Pendidikan, and Kementerian Pendidikan Dasar dan Menengah Republik Indonesia. 2025. *Naskah Akademik: PEMBELAJARAN MENDALAM Menuju Pendidikan Bermutu Untuk Semua*. Indonesia.
- Bau, Mario Ferdinan, Maria Natalia Meo, Grasella Ferina Nai Modok, Novalianti Nitti, Fadil Mas' ud, and Rahyudi Dwiputa. 2025. "Pengaruh Penggunaan Gadget Dan Media Digital Terhadap Motivasi Belajar Siswa SD." *Pendas: Jurnal Ilmiah Pendidikan Dasar* 10(04):280–91.
- Buckingham, David. 2007. "Media Education Goes Digital: An Introduction." *Learning, Media and Technology* 32(2):111–19. doi:10.1080/17439880701343006.
- Fathurrahman, Muhammad, Putri Dini Retno Pratiwi, Marice Awairaro, Nazmi Al-lahmadi, Salima Silayar, and Ismail Djakaria. 2024. "Integrasi Teknologi Dalam Pendidikan Matematika: Wawasan Dari Tinjauan Literatur Sistematis: Technology Integration In Mathematics Education: Insights From A Systematic Literature Review." *KAMBIK: Journal of Mathematics Education* 2(1):66–79.
- Gouseti, Anastasia, and Patricia Shaw. 2026. "When Platformisation Meets Schooling: Exploring Teachers, Students and Parents' Experiences of Digital Platform Use." *Learning, Media and Technology* 9884:1–20. doi:10.1080/17439884.2026.2653746.
- Haq, Muh Dliya, and Nova Tri Prasetyo. 2025. "Deep Learning Sebagai Pendekatan Transformatif dalam Pendidikan: Sebuah Tinjauan Literatur." *Jurnal Studi Guru Dan Pembelajaran* 8(3):1826–42.
- JW Kusum, MR Akbar. 2023. *No Title Dimensi Media Pembelajaran (Teori Dan Penerapan Media Pembelajaran Pada Era Revolusi Industri 4.0 Menuju Era Society 5.0)*. Jambi: PT. Sonpedia Publishing Indonesia.
- Kompensasi, Pengaruh, Yeni Ariesa, Jakson Kamal, Alexandrio Emmanuel, Rita Hayati, Yasir Arafat, Artanti Puspita Sari, Syarwani Ahmad, Ade Silvia Utari, Yenny Puspita, M. Imansyah, Yasir Arafat, Dessy Wardiah, Endang Yulianti, Yasir Arafat, and Dessy Wardiah. 2020. "(Jurnal Manajemen, Kepemimpinan, Dan Supervisi Pendidikan) P-ISSN: 2548-7094 E-ISSN 2614-8021." 5(2).
- Kovač, V. B., D. Nome, A. R. Jensen, and L. Lj Skreland. 2025. "The Why, What and How of Deep Learning: Critical Analysis and Additional Concerns." *Education Inquiry* 16(2):237–53. doi:10.1080/20004508.2023.2194502.
- Kurnia, Rita, Universitas Riau, M. Arli Rusandi, and Piki Setri Pernantah. 2022. "Pelatihan Media Pembelajaran Berbasis Teknologi Mekatronik Untuk Meningkatkan Kompetensi Guru PAUD Di Kabupaten Kampar, Riau Yeni Solfiah." *Jurnal Pengabdian Dan Penerapan IPTEK* 6(1):9–16. doi:10.31284/j.jpp-ipetek.2022.v6i1.2179.
- Mendikbud. 2025. *Permendikdasmen Nomor 13 Tahun 2025*. Indonesia.
- Seminar, Prosiding, Nasional Pendidikan, Program Pascasarjana, and Universitas PGRI. 2019. "Yang Merupakan Gabungan Keunggulan Pembelajaran Yang Dilakukan Secara Tatap-Muka Dan Secara Virtual. Kata Kunci — Teknologi, SPADA,." 125–29.
- Surjono, Herman Dwi, Ali Muhtadi, and Dian Wahyuningsih. 2017. "The Implementation of Blended Learning in Multimedia Courses for Undergraduate Students in Indonesia." *International Journal of Information and Education Technology* 7(10):783–86. doi:10.18178/ijiet.2017.7.10.972.
- Uyun, Khurotul, Romi Dewi Astuti, Tri Widya Ningsih, and Karfica Nofridayana. 2024. "720-Article Text-2924-2-10-20240508." 2(3).
- Wijaya, Mulyadi. 2025. "Kurikulum Deep Learning Di Indonesia; Sebuah Harapan Baru." *Jurnal Ilmiah Pendidikan Scholastic* 9(1):10–15. doi:10.36057/jips.v9i1.713.
- Yuda, Al Fadillah, Alifa Rafli Akbar, and Gusmaneli. 2024. "Strategi Desain Pembelajaran Adaptif Untuk Meningkatkan Pengalaman Belajar Di Era Digital." *Jurnal Pendidikan Sains Dan Teknologi Terapan* 01(4):354–62.
- Zubaidi, Ariyan, Andy Hidayat Jatmika, Wirarama Wedashwara, Ahmad Zafrullah Mardiansyah, Ramaditia Dwiyanaputra, and Raphael Bianco Huwae. 2023. "Pelatihan Pemanfaatan Media Digital Untuk



Jurnal PAJAR (Pendidikan dan Pengajaran)

Volume 10 Nomor 4 July 2026 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337

DOI : <http://dx.doi.org/10.33578/pjr.v10i4.1552>

Berwirausaha Di Masa Pandemi Covid-19 Bagi Ibu-Ibu PKK Dan Karang Taruna Desa Aikmel Utara.” *Jurnal Begawe Teknologi Informasi (JBegaTI)* 4(1).