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TRANSFORMATION OF LEARNING MEDIA TECHNOLOGY IN THE DIGITAL ERA: A COMPREHENSIVE ANALYSIS OF IMPACT, CHALLENGES, AND IMPLEMENTATION IN INDONESIA

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ABSTRACT

Education plays a vital role in transferring religious, academic, and social knowledge. Technological advances have transformed learning media from inscription-based methods to the digital era. Various electronic media, such as projectors, OHPs, LCDs, and Interactive Digital Boards (IDBs), have enhanced the teaching and learning process. Through a literature review and observation of learning media development, the study found that technological innovations improve the speed, ease, and accuracy of content delivery. Image-based media helps create uniform understanding among students, text-based media reduces teachers' writing time, and modern digital tools such as IDBs and touchscreens provide intuitive interfaces that facilitate learning. Overall, digital learning media are more effective and efficient than conventional media and are therefore recommended for broader implementation in modern schools.

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INTRODUCTION

The world of education plays a vital role in human life . Education is a platform for transferring religious , worldly , and social knowledge . Simply put , education can be defined as a human endeavor to cultivate one 's personality in accordance with the values of society and culture . Therefore , no matter how simple a society's civilization , the educational process continues . This demonstrates that education has existed throughout human civilization as an effort to preserve life . The development of digital technology has fundamentally changed the educational landscape . As explained by Mahendra, Rapar, & Kilis (2025), information and communication technology (ICT) has become an inseparable part of education in the digital era, requiring educators to adapt technology to create more interactive , flexible , and appropriate learning experiences for today 's students . The book "Media and Learning Technology " by Yaudi (2018) emphasizes that the integration of ICT in learning encompasses various aspects , from its definition , characteristics , urgency , to models . development of learning media and technology .

Educational methods have undergone many stages of change : from stone inscriptions , leaves, tree trunks , paper , to the limitless digital era . The use of media has shifted from handwriting, typing- based computers , to now only touch (touchscreen). One of the media facilities in schools that is still used today is the blackboard . Within a period of several centuries to decades, the development of learning media technology continues to increase rapidly . The development of electronic media enjoyed by the millennial generation in the early 1980s began with Slide Projectors & Opaque Projectors, then OHP (Overhead Projectors), then LCDs which are still used today , and the most recent is PID (Digital Interaction Board). Some modern schools have now provided touch screens for classroom learning as a replacement for blackboards . Its advantages include ease , speed , accuracy when entering data, as well as an intuitive user interface , the ability to understand something without thinking , based on movement and habits.

Although various studies have examined the development of learning media technology, there is still a gap in the literature regarding a comprehensive analysis of the positive and negative impacts of the simultaneous implementation of the latest technology , especially from the perspective of educators in Indonesia . A study by Nurdini et al . (2025) showed that 87.8 % of teachers were accustomed to using digital technology in learning , but still found significant obstacles in the form of limited access to devices (67.7%), unstable internet connections (60.7 %), and lack of training (56.6%). Meanwhile , research by Haryanti et al . (2025) identified that teachers experience obstacles in delivering material effectively to students with different abilities and learning styles , and that the available learning media have not been able to optimally stimulate students' creative thinking abilities . However , there is not much research that has integratedly discussed three aspects at once : the positive impacts , negative impacts , and difficulties of educators in the context of media development from the analog to the current digital era in Indonesia. A systematic study by Adam et al . (2025) confirmed that Key challenges include low teacher digital literacy , lack of pedagogical technology integration , student unpreparedness for independent learning , and limited digital access and inclusivity . This gap is the primary focus of this article .

This article uses a literature review method and observation of the development of learning media from the inscription period to the digital era, with a focus on electronic media from the early 1980s to the present . Based on data from Nurdini et al . (2025) involving 1,622 teachers in 38 provinces of Indonesia, this study integrates findings based on a national -scale survey . This review also refers to the results of a meta- analysis that includes 324 studies from the Scopus and Web of Science databases for the period 2017-2023 (ScienceDirect, 2025). The formulation of the problems discussed are : first , the positive impact of learning with the latest technology ; second , the negative impact of learning with the latest technology ; and third , the difficulties of educators with the latest technology .

The study found a number of positive impacts . First , increased learning effectiveness : 87.8% of teachers have become accustomed to using digital technology , with an increase in learning completeness from 31 % to 94% in the Google Slides media study . Second , in the study of Rahmadhani et al. (2025) showed that increased critical thinking skills : E- maginative media contributed 24.3% to the improvement of critical thinking skills and 25.0% to students' personal learning journey . Third , pedagogical transformation : shifting from content - centered instruction to technology- mediated learner - centered pedagogy . Meanwhile , the identified negative impacts include the digital divide due to limited access in remote areas , infrastructure instability where 60.7% of teachers reported unstable internet connections , and inadequate digital literacy because 56.6% of teachers reported a lack of training . The difficulties faced by

educators include limited ongoing professional training , pedagogical challenges in delivering material to students with different abilities , and limited time and resources including adaptation . material for low bandwidth conditions .

This study offers several novel contributions . First , the simultaneous integration of three aspects . Unlike previous studies that tend to focus on one aspect (e.g. , only positive impacts or only challenges), this study holistically integrates the analysis of positive impacts , negative impacts , and difficulties faced by educators within a comprehensive framework . Second , a historical -transformative perspective . This study offers a complete narrative of the evolution of learning media from the inscription era to the Digital Interaction Board (PID), providing a contextual understanding of how each phase of development brings its own challenges and opportunities that are still relevant to current conditions . Third , the latest empirical data on a national scale . By integrating survey data from 1,622 teachers in 38 Indonesian provinces (2025) as well as findings from various studies from 2023-2025, this study presents representative empirical evidence on the real conditions of learning technology implementation in Indonesia. Fourth , an applicable problem formulation . All three problem formulations are designed to provide direct practical implications for policy makers and education practitioners in formulating more effective and equitable technology implementation strategies .

In closing , the development of learning media technology from the ancient to the digital era has brought about significant transformations in the world of education . Modern digital media offers advantages in convenience , speed , accuracy , and intuitiveness . However , its implementation faces serious challenges in the form of a digital divide , limited infrastructure , and a lack of teacher training . The success of digital education transformation depends not only on the availability of infrastructure , but also on the pedagogical capacity of teachers in utilizing digital media in a contextual , exploratory , and scientific manner . Policies that support continuous teacher professional development and the provision of equitable infrastructure are needed to realize inclusive and quality digital learning .

LITERATURE REVIEW

Instructional Media

The teaching and learning process is inseparable from learning media , which acts as a tool for the teaching and learning process that facilitates learning and also as a tool for educators to convey knowledge and material . The word media has the meaning of intermediary , so learning media can be interpreted as an intermediary used **in** the learning process . According to Sapriyah , the word media comes from Latin and is the plural form of the word medium , which literally means intermediary or messenger . According to the Association of Education and Communication Technology (AECT) in America , media is limited to all forms and channels used by people to convey messages or information . As technology advances and becomes more sophisticated , the use of technology is essentially aimed at facilitating human work in everyday life . Digital technology is one concrete example of how we as humans today cannot be separated from its grip . Learning media that is appropriate to the needs of activities Learning will create effective and efficient learning activities so that the material delivered by the teacher to students can be absorbed optimally .

The development of media was initially only considered as a teaching aid for teachers, namely as a visual aid such as pictures, models , objects , and other tools that can provide concrete

experiences , motivate learning and increase students' absorption and retention of learning (Sapriyah, 2019). However , unfortunately , because of focusing too much on the visual aids used, so that less attention was paid to the design, development of learning (instruction) , production and evaluation aspects . For audio itself , it entered technology around the 20th century , visual tools to concretize the learning process were equipped with audio tools so that we know the existence of audio visual tools or audio visual aids (AVA).

Development of Learning Media Technology

Technology has become an integral part of human life in this modern era . In education, technology is not only an aid , but also a paradigm shift in the way of learning and teaching . This shift shows that in the digital era , learning is no longer teacher-centered but rather focuses on the student experience in more flexible and collaborative learning (Frontiers in Education, 2026). Furthermore, through various innovations that continue to develop , technology has a significant impact on improving the quality of learning , both for students , teachers, and educational institutions . One of the main advantages of technology is its ability to provide unlimited access to information . With the help of the internet, students can access various learning resources , such as articles , e-books, educational videos , and scientific journals from around the world. This allows students to dig deeper into knowledge and broaden their horizons beyond the material taught in class .

In addition , technology allows the development of more interactive learning methods , namely the use of educational software , learning applications , and e-learning platforms make the learning process more interesting . For example , with animated videos or simulations , students can understand difficult concepts more easily , or the use of virtual reality (VR) and augmented reality (AR) technology that allows for immersive student learning experiences , such as exploring the solar system virtually or studying human anatomy in detail .

Technology also enables personalization in the learning process . With the help of artificial intelligence (AI), learning systems can be tailored to the needs and abilities of each student . For example , online learning platforms can provide material recommendations based on the student's level of understanding , so that the learning process becomes more effective and efficient (Ditmawa, 2025) . Technology also improves collaboration and communication capabilities between students , teachers, and parents . With applications such as Google Classroom , Microsoft Teams, or Zoom, students can work together on group projects even though they are in different locations . Teachers can also provide direct feedback and monitor student progress more easily .
Thus , the benefits of technology in education are enormous , because this technology makes various information accessible to anyone and anywhere . Distance learning programs or e - learning provide opportunities for students living in remote areas to continue receiving a quality education . This technology also provides flexibility for those who have limited time to study according to their schedule . The use of technology in education also helps increase efficiency and productivity . For example , learning management applications allow teachers to organize schedules , organize materials , and evaluate student learning outcomes automatically . This reduces the administrative burden and allows teachers to focus on teaching .

The Development of Whiteboard Technology

The development of learning media technology has undergone a significant revolution over the past few decades . The whiteboard is an integral part of education and business . From classrooms to meeting rooms , we often encounter whiteboards . Whiteboards serve as a medium for conveying ideas, explaining concepts , and also serving as a forum for discussion .

The following is the development of blackboards during the 19th century to the 20th century :

1. In the 19th and 20th centuries **, chalkboards** became the standard in schools worldwide , the advantage being their low cost . Chalk and blackboards were easy to produce, affordable , durable **,** and required little maintenance . Not only that , teachers could write and draw quickly , but the downside was that the resulting images sometimes did not match the original visuals , were time-consuming in the drawing or writing process , and were also very dangerous for people with respiratory disorders .
2. In the 1960s , **whiteboards** were introduced , using erasable markers . Their advantages were dust - free and easy to clean , but the resulting images were still not as accurate as the original . Similar to chalkboards , when teachers wrote or drew , learning time was wasted .
3. In the 1990s , **digital interactive whiteboards** emerged . Interactive **whiteboards** (IWBs), also known as electronic or digital whiteboards, are large touchscreen displays connected to a computer and projector . To operate the IWB, the user controls it directly from the screen in the same way a mouse is used to control a computer . IWBs also have many multimedia functions , such as internet access , images , sounds , and video files.
4. The interactive whiteboard was originally conceived by David Martin and Nancy Knowlton in 1987. Shortly thereafter , they founded the company SMART Technologies and introduced the world's first SMART Board in 1991. Although the initial concept was to create a device that functioned as a whiteboard and a computer , by the time it was marketed , touch- sensitive applications had also been added . The goal of this main feature was to include the ability to control the whiteboard with a touch of a finger , allowing users to write on top of Microsoft Windows applications displayed on the screen (Shannon Coffey.2010-2012).
5. the 2020s, the Digital **Interactive Board (PID) or Interactive Flat Panel (IFP)** is a large touchscreen device that integrates the functions of a computer , whiteboard , and projector , allowing teachers and students to write , draw , access online content (such as YouTube channels), and share screens in real-time for more dynamic and interactive learning , supporting the digitalization of education , including for students with special needs . Touchscreens are not only PIDs or Smartboards , but Android cellphone screens and touchscreen laptops are also part of the development of learning media using touchscreens .

One of the priority programs of the Ministry of Primary and Secondary Education (Kemendikdasmen) in 2026 is the digitalization of learning through the distribution of Interactive Digital Boards (PID). This program continues the 2025 program which was appreciated by stakeholders so that Kemendikdasmen obtained a very good category based on the stakeholder satisfaction index or Stakeholder Satisfaction Survey (SSS). A total of more than 173 thousand schools have received and utilized Digital Interactive Panels as learning media (Yanuar, 2025). This number of schools is part of the target of the learning digitalization program , namely 288,865. The application is very easy , still using a laptop but can be without cables , namely with a wireless USB .

The recent provision of digital interactive boards (PID) to schools aims to support the digitalization of learning , increase student interaction and engagement , facilitate more interesting and meaningful learning , and support inclusive education for students with special needs (ABK).

Table 1. Timeline of the Development of the Blackboard (19th Century – 2020s)

Period	Types of Whiteboards	Technology / Materials	Excess	Lack
Century 19–20	Chalkboard	Chalk and slate	Low cost , durable , easy to manufacture	The image does not match the original visual , dusty (respiratory hazard), time consuming to write
1960s	Whiteboard	Erasable marker pen	Dust -free , easy to clean	Visuals do not match the original , writing time is still wasted
1990s	Interactive Whiteboard (IWB)	Touch screen + computer + projector (SMART Board, 1991)	Multimedia (internet, images , sound , video), touch control	Expensive , requires special training
2020s	Digital Interaction Board (DIB) / Interactive Flat Panel (IFP)	Large touch screen + integrated computer + wireless USB	No projector , online content access (YouTube), real-time screen sharing , support for children with special needs	

Development of Projector Technology

The development of learning media technology in recent decades has experienced a significant revolution . The desire to display original visuals , original audio and moving images is one of the triggers for the continued development of technology in the world of education . When viewed visually , a whiteboard only looks like a two- dimensional image , besides that the visuals presented sometimes do not match the actual object . Then came the media projector , which was initially only used to project films but was seen in the world of education and business to provide an understanding of concepts and display objects in their original form . This projector has also experienced development from just images to being able to be colored and have audio. Today 's projectors are considered to represent learning that includes visuals, audio and even movement . The following are the stages of revolution of the projector :

1. 1800s magic lantern (oil lamp and picture) , Early projectors that used oil lamps or candles to display images on a wall .
2. Early 1900s Film projector (cinema celluloid tape), Used in old-school cinemas to play films from reels of celluloid tape in black and white . The distinctive sound of the rotating machine often adds a nostalgic feel .

3. 1950-1970s Slide and Opaque Projectors (photo and education) , Slide Projectors display images from 35mm slide films. Very popular for family photo presentations or educational purposes . Opaque Projectors allow users to display images from physical objects or books without having to create transparencies . Slide Projectors themselves are optical devices for projecting enlarged photographic slide images onto a screen . Many projectors have a mechanical arrangement for displaying a series of slides loaded into a special tray in sequence . Opaque Projectors themselves are different from slide projectors, this tool is able to project original objects that are not transparent .
4. 1980-1990s OHP (School and Office Transparency). Usually used in schools or meeting rooms in the 80-90s. This projector displays images from transparent sheets (acetate) that can be drawn by yourself and even colored with color maker markers with the help of light and mirrors and then displays or projects text or images to be large onto a screen or wall so that they are clearly visible from various corners of the room. In addition, OHP can be used to enlarge photos , complex images that are traced directly using your hands and color maker markers . (RE.Hertanto . 2021)
5. In the 2000s, LCD and DLP projectors began to appear , offering sharper image quality and a more compact size . Images were generated via a VGA or HDMI cable connection from a laptop . Slides were presented more perfectly because they used computerized slide creation , making them more engaging and facilitating learning .
6. In the 2010s , mini and portable smart projectors, featuring LED technology , Android, and wireless connectivity , have become increasingly practical and multifunctional . There are even modern devices like Bluetooth mobile phone projectors that can connect directly to smartphones without the hassle of cables .

Table 2. Timeline of Projector Development (1800s – Present)

Period	Projector Types	Technology	Main Function	Characteristics
1800s	Magic Lantern	Oil lamp / candle	Displaying pictures on the wall	The earliest projectors , static images
early 1900s	Film Projector	Celluloid tape (black and white)	Playing cinema films	The distinctive sound of the engine turning , a nostalgic feel
1950s–1970s	Slide Projector & Opaque Projector	35mm slides / opaque physical objects	Family photo presentation , educational purposes	Slide projector (images from slides), opaque projector (from books / real objects)
1980s–1990s	OHP (Overhead Projector)	Transparent sheet (acetate) + colored markers	Schools and offices (transparency presentations)	Can draw manually, enlarge photos / complex images
2000s	LCD & DLP Projectors	Digital (VGA/HDMI from laptop)	Business & education presentations	Sharp , compact , computerized images
2010–present	Smart Projector (Mini, Portable, LED, Android, Wireless)	LED, Android, wireless connection (Bluetooth, WiFi)	Flexible learning , home entertainment	

Based on the explanation of the stages of the projector revolution above , as well as the dynamics of the transition from conventional whiteboards to various generations of projectors , the following is a summary of previous research that empirically examines the effectiveness , development , and comparison between learning media starting from the use of whiteboards to the digital projector era . This table is expected to provide a comparative overview of how each phase of media development has been studied and contributed to the world of education .

Table 3. Research Summary : Development of Learning Media (Whiteboard to Projector Revolution)

NO	RESEARCHERS (YEAR)	MEDIA RESEARCHED	RESEARCH METHODS	KEY FINDINGS
1	Sri Wartini (2017)	Whiteboard, LCD Projector , Language Laboratory	Field research with a qualitative approach (observational study) at SMP Negeri 1 Jetis, Bantul.	Teachers' use of learning media (whiteboards , LCD projectors , language laboratories) does not fully align with the principles of good media use . Improved teacher knowledge , creativity , and training are needed .
2	Rukmini (2000)	OHP (Overhead Projector)	Classroom Action Research (CAR) at State Junior High School 1 Tapen , Bondowoso .	The use of OHP media has been proven to improve students' learning outcomes and their attention during the learning process .
3	Multimedia Developer (2018)	Interactive Whiteboard (IWB) imitation	Research and development (R&D) with the Borg and Gall model at SMK Negeri 9 Malang.	IWB -based learning multimedia was declared valid and suitable for use . Validation results from media experts (92.71%), material experts (92.00%), and field trials (89.29 %) showed a very high level of suitability .
4	Porman CE Aritonang (2021)	Remote Digital Whiteboard	Internet of Things (IoT) based hardware research and development (R&D) using Raspberry Pi, Android, and Projector .	A digital whiteboard prototype has been developed that allows teachers and students to write , draw , and erase like a conventional whiteboard , but over a long distance .
5	Maya Rahmawati (2009)	Infocus vs OHP	Experimental study at State Senior High	This study examines the differences in student learning outcomes between those using Infocus (LCD

			School 3 Pekanbaru .	Projector) and OHP media. (Specific result details are not available in the abstract , but this study serves as an early reference for comparison between projector generations).
6	Historical Review (2025)	Whiteboard, OHP, Interactive Whiteboard , Touch Panel / Smart Panel	Literature study and historical review of the development of educational display technology .	Media development has undergone significant evolution : from whiteboards (one -way , passive instructions), to OHPs (flexible , reduces dust), to interactive whiteboards (collaboration is starting to appear), and most recently touch / smart panels (interactive , wireless , real-time collaboration, supports hybrid learning) .

Benefits of Appropriate Technology as a Learning Medium

Today 's technology certainly has advantages and disadvantages , so we need to explain each one individually . According to Sapriyah (2019), the positive impacts of learning media are as follows :

a. The delivery of lessons becomes more standardized
b. Learning can be more interesting
c. Learning becomes more interactive
d. The length of learning time required can be shortened
e. The quality of learning outcomes can be improved
f. Learning can be provided when and where desired or needed.
g. Students' positive attitudes towards what they learn and towards the learning process can be improved .
h. h the teacher can change in a more positive direction , the teacher's burden of repeated explanations regarding the lesson content can be reduced or even eliminated so that he can focus on other important aspects in the teaching and learning process , for example as a consultant or student advisor .

The negative impacts of the increasing use of educational technology media are :

a. Students tend to type rather than write , so that students' writing is currently downgraded compared to students of the same age who are several years above them.
b. Lack of interest in reading books among students , because they always get information virtually .
c. It is easy for students to get information , making it easy for students to forget that information.
d. Reduced social interaction between friends
e. Students tend to be less patient , and are not used to waiting without their gadgets .

f. f Some students are aggressive because their gadgets are their main focus .

Ditmawa (2025) argues that despite its many benefits , the application of technology in education also faces challenges , such as gaps in access to technology , lack of training for teachers , and the risk of dependence on technology . To overcome this , support is needed from the government , educational institutions , and the community in providing adequate infrastructure , technology training for educators , and digital literacy for students . Technology has a very important role in improving the quality of learning . By utilizing technology optimally , the educational process can be more inclusive , efficient , and enjoyable . However , the successful implementation of technology in education requires collaboration from all parties to ensure that technology truly provides maximum benefits for all groups .

Real Implementation of Digital Learning

One example of a real implementation of a teacher who carries out digital classroom learning so that students feel the effort in learning is a mathematics teacher in a junior high school who once implemented a learning innovation using **the GeoGebra** application on **geometric transformation** material (translation , reflection , rotation , and dilation). This activity was carried out in grade IX as an effort to change the paradigm that mathematics is only dry and abstract . Technically , students create basic shapes such as triangles and squares in the Cartesian coordinate plane , then apply the four types of transformations repeatedly . After the pattern is arranged , they color the shapes to produce a design resembling a batik motif.

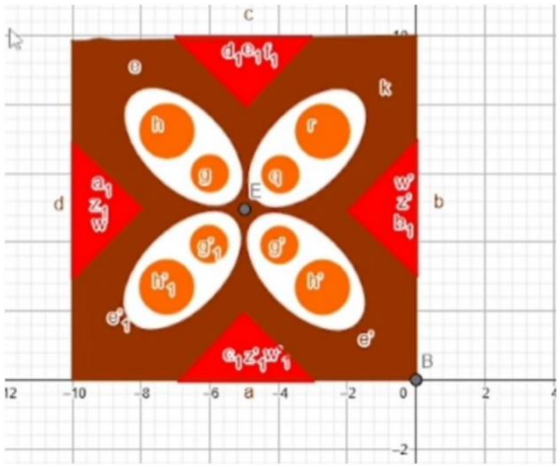


Figure 1. Collective work

This collective work was then named "Batik MBG" by the students . The name was inspired by the MBG (Free Nutritious Meal) menu that they are familiar with at school , namely fried eggs and tempeh . The round shape of fried eggs inspired the circle pattern on batik, while the square shape of tempeh inspired square and rectangular shapes , so that the resulting geometric motifs are not only derived from mathematical transformations , but also from the students' daily lives . As the culmination of the activity , one of the students who has screen recording skills uploaded the process of making and the final result of the digital batik design to his personal YouTube channel . The video became a collective documentation of the class and can be watched by the public , including parents and other teachers at the school . This publication not

only increased students ' self -confidence , but also made YouTube a digital portfolio that can be accessed at any time .

From this implementation , the teacher felt several significant impacts . Students' learning motivation increased drastically because they could see the movement of the shapes visually and dynamically . Students' conceptual understanding deepened because they were not only memorizing formulas , but actually carrying out geometric transformations themselves interactively . In addition , students ' creativity , collaboration , and digital literacy also grew through the process of discussion , coloring , screen recording , and uploading content to YouTube.

Based on this experience , there are several practical implications . GeoGebra has proven to be a bridge between abstract mathematics and the real world , while also realizing the STEAM (Science, Technology, Engineering, Arts, Mathematics) approach in a simple way . YouTube can also function as a student's digital portfolio , while differentiated learning becomes easier because students with visual learning styles are greatly assisted . Other teachers are also expected to not be afraid to innovate because GeoGebra is available for free and its interface is user- friendly .

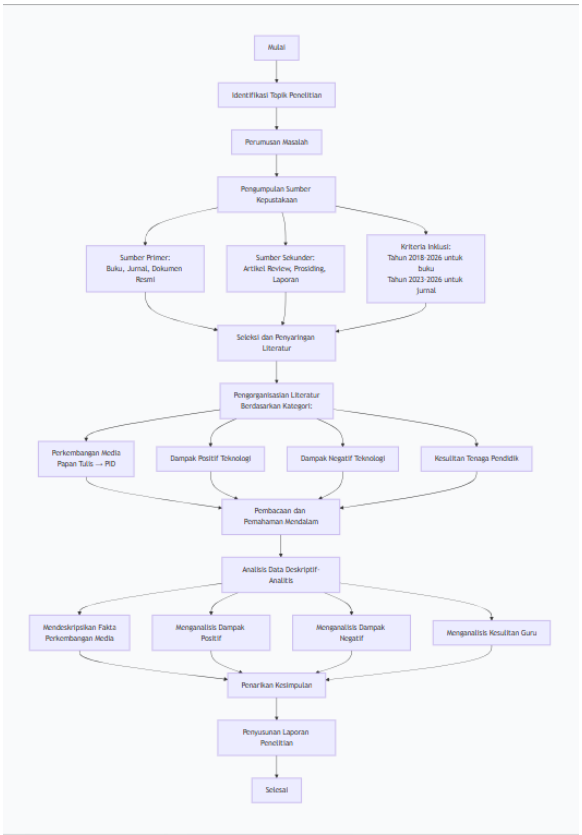
For experiences like this to be widely replicated , several policy recommendations need to be considered . Schools and education offices should provide equitable access to devices and the internet , integrate GeoGebra into the curriculum and lesson plans, and conduct ongoing teacher training . Furthermore , schools should encourage the publication of student work through official digital channels and reward teachers who successfully implement digital innovations . With these steps , digitalizing mathematics learning will not only replace chalk with projectors , but will truly make abstract concepts tangible and equip students with 21st- century skills .

RESEARCH METHODOLOGY

The type of research used is qualitative research in the form of library research . This research examines various literature , documents , and written sources relevant to the topic of transformation of learning media technology in education . Meanwhile, the research approach used is a descriptive-analytical approach , namely systematically describing the facts regarding the development of learning media technology (from chalkboards to PID / Digital Interaction Boards) and analyzing the positive impacts , negative impacts , and difficulties faced by educators .

Operationally , this research flow follows standard procedures for literature studies . The researcher begins by identifying the topic and formulating the problem , then collecting literature sources from reputable databases (books 2018–2026 and journals 2023–2026). After selecting , filtering , and organizing the literature into four categories (media development , positive impacts , negative impacts , teacher difficulties) , the researcher conducts in-depth reading and descriptive-analytical analysis that includes the presentation of facts as well as the interpretation of cause -and-effect relationships . The final stage is drawing conclusions and compiling a report as the research output . This entire flow is designed to ensure that the literature review runs systematically , avoids literature selection bias , and produces valid and scientifically accountable findings .

The following is the research flowchart in this journal:



CONCLUSION

This research confirms that learning media is a tool used to convey information , understand concepts , and display objects . Over time , the development of learning media technology has been very rapid . From chalkboards to touchscreen boards . However, the system for displaying objects and information is taken from a projector system . Early projectors used lenses that were then projected onto a screen or wall , but now they can project or display our computer displays onto a digital interactive board screen .

The positive and negative impacts of technological developments will always exist , here are some of the positive impacts : Lesson delivery becomes more standardized , Learning can be more interesting , Learning becomes more interactive , The length of learning time required can be shortened , The quality of learning outcomes can be improved , Learning can be given when and where desired or needed , Students' positive attitudes towards what they learn and towards the learning process can be increased , The role of teachers can change in a more positive direction , the burden on teachers for repeated explanations regarding lesson content can be reduced .

The negative impacts are less than the negative impacts , Students tend to type rather than write , so that students' writing is currently downgraded compared to students their age from several years above them . Lack of interest in reading books from students , because they always get information virtually . The ease of students getting information , makes students also easily forget the information . Reduced social interaction between friends . Students tend to be less patient , and are not used to waiting without their gadgets . Some students are aggressive because their gadgets are their main focus .

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