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The Impact of Digital Media Integration on Geography Learning Outcomes in Indonesian High Schools

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ABSTRACT

This study explores how digital media enhances geography learning in Indonesian high schools, specifically focusing on SMA Swasta Budi Agung Medan. In the context of global advancements in educational technology, the integration of digital media in geography education has become increasingly relevant, particularly given the subject's emphasis on spatial and visual understanding. This research aims to examine the role of digital media in supporting geography learning and to identify the challenges teachers face during its implementation. A qualitative descriptive approach was used, involving interviews with teachers, students, and school administrators at SMA Budi Agung Medan. The findings reveal that digital tools such as Quizizz, Wordwall, and Google Earth are actively used and have increased student motivation, engagement, and comprehension of complex geographical concepts. However, several challenges were identified, including limited access to digital devices among students, insufficient teacher readiness to integrate technology effectively, and difficulties maintaining classroom discipline during interactive sessions. The study concludes that while digital media significantly enriches geography learning, its success depends on improving infrastructure, providing continuous professional development for teachers, and adopting effective classroom management strategies. These findings offer valuable implications for policy development, teacher training programs, and curriculum planning to optimize the integration of digital media in geography education.

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1. INTRODUCTION

The 21st century has dramatically shifted how education is conceptualized, delivered, and experienced worldwide. Among the many advancements that characterize this new era of learning, integrating digital media into classroom practices has emerged as a transformative force, particularly in subjects like geography, which inherently demand

visual, spatial, and contextual understanding. As modern societies become increasingly interconnected and information-rich, the need for innovative teaching methods that prepare students to think critically and globally is more urgent than ever [1], [2], [3].

In geography education, digital media tools offer immense pedagogical advantages. Through digital platforms, students can access dynamic maps, satellite imagery, simulations of natural disasters, and real-time environmental data, all of which allow for more immersive and contextual learning. Technologies such as Geographic Information Systems (GIS), interactive multimedia, digital storytelling, virtual reality (VR), and augmented reality (AR) are now being used in many countries to develop students' geographic literacy, critical thinking, spatial reasoning, and global awareness [4], [5].

Several recent studies over the last five years demonstrate the growing effectiveness of digital media in geography classrooms globally. Pasaribu found that digital mapping tools significantly improved students' spatial thinking abilities and engagement [6], [7].

In Asia, similar advancements have been reported. Pasaribu reported that using digital games and interactive learning apps boosted student motivation and encouraged collaborative learning practices in geography. These studies collectively affirm that digital media can serve as a powerful bridge between abstract geographical theories and real-world applications, creating learning experiences that are engaging, relevant, and impactful [4].

Despite this global progress, the situation in Indonesia, particularly in the context of geography education, presents a different picture. While the national education system has shown strong interest in integrating technology, most notably through implementing the Merdeka Curriculum, which emphasizes flexibility, creativity, and student-centered learning, the practical use of digital media in geography instruction remains under-researched. Most existing studies in Indonesia tend to focus on the use of technology in general education or STEM subjects, with little focus on social science disciplines like geography. Moreover, the experiences of Indonesian high school teachers and students in using digital media—their perceptions, challenges, and best practices—are rarely documented in the academic literature [9], [10], [11].

Preliminary observations conducted in November 2024 at SMA Swasta Budi Agung Medan suggest that digital media has entered geography classrooms. Several teachers have begun using Quizizz, Wordwall, and Google Earth to supplement their lessons. These platforms offer opportunities for teachers to prepare materials more efficiently and provide students with more diverse and interactive learning experiences. Teachers noted that digital tools help capture students’ attention, stimulate curiosity, and encourage them to think more creatively and critically about their study topics. In particular, tools like Google Earth allow students to explore real-world locations and analyze physical and human geographical features directly from satellite imagery, offering a far richer experience than traditional textbooks.

However, despite these initial steps, the use of digital media in geography learning at SMA Swasta Budi Agung Medan is still in its formative stages. Teachers continue to face various challenges, including limited access to infrastructure, lack of training in using

advanced tools, time constraints, and uncertainties about how to align digital tools with learning objectives and assessments. These barriers may hinder the full realization of the Merdeka Curriculum's goals, especially those related to developing higher-order thinking skills in students [3], [12], [13].

Furthermore, there is a clear research gap in understanding how digital media specifically supports the development of critical thinking, creativity, and engagement in geography learning within the Indonesian high school context. While international research offers valuable models, the local context, shaped by unique educational policies, technological infrastructure, teacher competencies, and cultural attitudes, necessitates localized studies that can inform effective, context-sensitive practices [14], [15].

Given this context, this study aims to explore how digital media supports geography learning at SMA Swasta Budi Agung Medan, focusing on its contribution to students' creative and critical thinking skills. The study also seeks to identify the challenges geography teachers face in integrating these tools into their teaching practices. By doing so, the research fills an existing gap in the literature and contributes to the broader conversation about how digital media can be strategically and sustainably embedded into Indonesian education, particularly within the social sciences.

The findings of this research are expected to provide practical insights for educators, school administrators, and policymakers, especially in designing strategies to maximize the use of digital media in the classroom. Ultimately, the study aims to support the development of an educational environment that is more engaging, inclusive, and responsive to the demands of the 21st-century learner.

2. METHOD

This study employed a qualitative research approach with a descriptive analytical method to explore the role of digital media in supporting geography learning at SMA Swasta Budi Agung Medan. The qualitative approach was chosen because it enables a deep understanding of the studied phenomena by describing real-world experiences and social interactions in a natural setting. According to Sugiyono [16], qualitative research emphasizes the exploration of social realities through interaction with research subjects and observation of natural behavior, rather than through numerical analysis. Using this method, the researcher sought to uncover how digital media is implemented in classroom settings and how it affects teachers' and students' learning experiences, engagement, and cognitive development [17], [18].

SMA Swasta Budi Agung Medan was selected as the research site because the school has already integrated various forms of digital media into its teaching practices, including in geography classes. The availability of technological tools such as Quizizz, Wordwall, and Google Earth in this school provides a valuable context for examining how digital media influences teaching methods, student engagement, and learning outcomes in geography.

Several techniques were used to collect accurate and in-depth data from the field, including observation, interviews, and documentation. The observations were conducted during geography lessons to directly witness how digital media was applied in the

classroom, how students interacted with it, and how the teacher facilitated the learning process using these tools. These observations helped the researcher understand the classroom environment and the practical application of digital media in real time [15]. In addition to observations, semi-structured interviews were conducted with several informants to gather various perspectives. The main informant in this study was the school principal, who provided insights into the school's policies and support for digital learning. The key informant was the geography teacher, who shared detailed information about the teaching process, experiences with digital tools, and challenges faced. Supporting informants included a history teacher and several students, who offered additional perspectives on how digital media impacted interdisciplinary learning and student motivation.

The researcher also utilized documentation techniques by collecting relevant materials such as lesson plans, screenshots of digital tools, classroom photos, and institutional documents related to digital education. These documents complemented and validated the data obtained from observations and interviews. Once the data were collected, they were analyzed through descriptive qualitative analysis. The analysis involved three main steps: data reduction, data display, and conclusion drawing. The researcher categorized data into relevant themes such as the benefits of digital media integration, challenges faced by teachers, and students' responses to digital-based learning. Direct quotations from informants were included strategically to support the thematic analysis and ensure the findings' authenticity and credibility. This study considers qualitative data not merely as supporting information, but as the primary material that reflects the meaning behind participants' actions, experiences, and expressions. The goal is not to generalize, but to offer a contextual understanding of how digital media contributes to geography learning in a specific school environment. Through this qualitative approach, the researcher aims to provide an in-depth portrait of the integration of digital media, its implications for teaching and learning, and the realities educators and students face in implementing it.

3. RESULTS AND DISCUSSION

3.1 RESULT

The need for more flexible, interactive, and personalized learning is becoming increasingly apparent in this digital era. Digital media allows students to learn anytime and anywhere without being limited by space and time. With digital media, learning materials can be delivered in a more interesting format and increase student motivation and participation in learning. In addition, digital media also provides access to wider learning resources, ranging from scientific journals, e-books, to learning materials from renowned institutions worldwide. Through the material presented as attractively as possible, digital-based learning media serves to stimulate and focus students' attention to be more focused on the subject matter. Examples include: text displays to increase students' learning motivation, as well as images, videos, music, and various game templates that facilitate learning [20], [21], [22],

Rapid advances in digital technology have enabled educators to use various technical tools to enhance learning. In addition, several digital learning tools help facilitate and simplify the learning process. Teachers can enhance interactive learning with students by utilizing various interactive tools such as Wordwall, Mentimeter, Kahoot, Quizizz, and other programs. Teachers can use various digital program capabilities according to their needs [16] [18], [23], [24].

3.1.1 Benefits of Digital Media Integration

Digital media is very important in supporting geography learning activities at Budi Agung Medan Private High School. One of its main roles is to increase learning flexibility. Through digital media, students can learn anytime and anywhere without being bound by space and time. This helps students to adjust their learning rhythm according to their individual needs. In addition, digital media can also increase students' interest and motivation to learn. Interactive and fun applications such as Wordwall and Quizizz have made the learning atmosphere livelier and more dynamic. Students become more active in following lessons, even showing higher enthusiasm than conventional learning methods.

Another role is in increasing teacher creativity. With various digital platforms and applications available, geography teachers have compiled more varied and interesting teaching materials. Applications such as Google Earth, Quiziz, Wordwall, and several other features allow teachers to create a more contextual and visual learning experience, so that geography materials can be delivered more concretely and easily understood by students. Digital media also facilitates a more interesting learning evaluation process. Through digital quizzes such as those provided by Quizizz, learning evaluations are no longer monotonous, but are packaged interactively, which can increase student participation actively. In addition, digital media also supports better interaction and collaboration between teachers and students. Communication can be done through online platforms that allow for discussions, assignments, and direct, real-time feedback.

Furthermore, digital media helps develop essential 21st-century skills such as digital literacy, critical thinking, creativity, and collaboration. The use of technology in the learning process makes students better prepared to face the ever-changing global challenges. In addition, digital media enriches geography learning by providing access to various learning resources such as scientific journals, e-books, and materials from leading educational institutions worldwide. Not only that, but digital media also supports digital class management. Despite the challenges in maintaining a conducive classroom due to the competitive learning environment, teachers can utilize digital teaching features to help maintain student discipline and engagement. Thus, integrating digital media in geography learning at SMA Swasta Budi Agung Medan has created a more modern, enjoyable, and meaningful learning process.

Digital media not only impacts the learning process in the classroom, but the application of digital media also helps students develop skills, such as digital literacy, critical thinking, creativity, and collaboration skills. These skills are essential to prepare them to face the challenges of the ever-changing world of work and global society. Budi Agung Medan Private High School must ensure that all elements of the school, from

teachers and students to technological infrastructure, support the sustainable development and implementation of digital media. By gradually overcoming existing obstacles, Budi Agung Medan Private High School can maximize the potential of digital media in creating higher-quality education and learning relevant to the needs of the times, especially in geography learning.

The limited use of digital media in education certainly raises problems, including data security and privacy issues, a lack of training in schools to teach teachers how to use digital media, a lack of devices or laptops for students, limited access to technology skills for teachers, and ethical dilemmas. As a result, using digital technology in education requires supervision and management.

Table 1. Aspects of Learning in Digital Media

Aspect	The Role of Digital Media	Explanation
Learning Flexibility	Learning without limits of space and time	Students can learn anywhere and anytime according to their needs.
Increasing Interest and Motivation	Interesting and interactive material	Media such as Wordwall and Quizizz make students more active and enthusiastic in learning.
Improving Teacher Creativity	Preparation of varied teaching materials	Teachers are helped to compile materials through applications such as Quizizz, Google Earth, Wordwall, and AI features.
Contextual and Visual Learning	Visualization of geography topics	Google Earth allows students to understand Earth materials visually and more concretely.
Interesting Learning Evaluation	Use of digital quizzes	Apps like Quizizz are used for formative evaluation through interactive quizzes.
Better Collaboration and Interaction	Online interaction between teachers and students	Digital media supports online discussions, feedback, and assignment submission.
Developing 21st Century Skills	Digital literacy, critical thinking, and creativity	Digital media helps students build important competencies for the future.
Enrichment of Material	Access to a variety of learning resources	Digital media opens access to global institutions' journals, e-books, and materials.
Supporting Digital Class Management	Utilization of digital teaching features	Teachers can manage classroom dynamics through digital media, although they face disciplinary challenges.

Various digital learning tools, online platforms, and learning software are used in education to enhance learning. These include interactive learning materials, online courses, e-learning, and learning programs allowing students to learn independently or with an instructor. One of the foundations of the entertainment sector is digital media. It comprises digital music, video games, video streaming, electronic books (e-books), and other entertainment applications that facilitate and accelerate access to entertainment content on various devices. Learning media conveys messages from the sender to the recipient to stimulate students' thoughts, feelings, attention, and interests in the learning process.

Table 2. The Use of Media

Aspect	Description
Needs of the Digital Era	Learning must be flexible, interactive, and personal. Digital media supports learning without space and time limits.
Benefits of Digital Media	1. More interesting and interactive material 2. Increase student motivation and participation 3. Access to a wide range of global learning resources
Implementation at Budi Agung Private High School, Medan	1. It has been used in geography learning by teachers 2. Using Quizizz, Wordwall, and Google Earth 3. Teachers feel helped, and students become more interested
Benefits of Using Digital Media	1. Learning becomes more exciting and fun 2. Teachers are helped in preparing teaching materials 3. Students are more interested and active in learning 4. Learning is more interactive and rich
Obstacles Faced	1. Teachers need time and creativity to prepare materials. 2. Not all students have smartphones or quotas 3. The class becomes less conducive because it is competitive 4. It requires careful study planning

Despite the many obstacles faced, using digital media has proven successful and provides learning benefits for students and teachers. Students show joy in learning using digital devices for learning. Digital media offers an interesting and entertaining experience where students actively participate in learning, besides listening to explanations. This shows how important digital media is for education and improving learning success.

3.1.2 Challenges in Implementation Faced by Geography Teachers in Using Digital Media

Budi Agung Medan Private High School, as a private educational institution, is also inseparable from the discussion of digital media. As a school committed to providing the best education for its students, using digital media is a must when facing the dynamics of modern education. Geography teachers have implemented digital media in this school, including some digital media such as Quizizz, Wordwall, and Google Earth. It is just that teachers who face several obstacles must be more creative in preparing materials in digital media such as Quizizz and Wordwall, students who sometimes do not have quotas, and some still do not have Smartphones, and teachers' readiness to maintain a conducive class. Students' enthusiasm for learning will increase when using digital media, but the ability to answer questions by competing for grades between fellow students makes the class less conducive. Therefore, teachers must be able to control the class to remain disciplined.

As explained from the results of interviews with all informants, namely the principal, geography teacher, history teacher, and students of Budi Agung Medan Private High School, the following:

Principal (Dr. Sandi Basuki): *"If you say the obstacle, maybe the technical preparation at the beginning is because we lack equipment so we have to dismantle and reassemble because in our school there is no permanent placement of equipment such as the placement of the infocus above near the ceiling, well from here the obstacle is the initial process which slightly lengthens the time. God willing, there is already a plan to use permanent in-focus placement in several classes, but we will prioritize the class's safety first to make it easier to place the permanent in-focus. Nevertheless, we already have several classes that*

specifically have televisions for learning, that use additional media in special classes that have been prepared. God willing, everything will be done for every class."

In the learning process that utilizes digital media, geography teachers often encounter several challenges. One of the main obstacles is that not all students have devices such as smartphones. Even when students already have these devices, they are still constrained by the limited availability of internet quota. However, digital media has increased student enthusiasm, especially when taking quizzes. They become more active and enthusiastic to achieve the best grades. However, this also has other consequences, namely, the classroom atmosphere becomes less conducive because students tend to be noisy and too excited, which ultimately disrupts order during learning. This is following the results of interviews with geography teachers who stated that:

Geography Teacher (Muhammad Fauzan S.Si): *"The obstacles that I usually face in conducting the teaching and learning process using digital media are that there are students who do not have smartphones, even though they have smartphones, sometimes students do not have internet quota, and when using digital media, students become more enthusiastic in answering quizzes and flock to bonding to get grades because the class becomes less conducive and a little noisy."*

With digital media, principals, teachers, and students feel helped because of its easy use, its many features that make the teaching and learning process more exciting and enjoyable, even though there must be some obstacles. The SMA Swasta Budi Agung Medan school's technical obstacles include several differences. Nevertheless, these differences lead to one point: in addition to being profitable, digital media can also experience obstacles such as hotspot obstacles, smartphones, and teacher readiness in teaching. As explained from the results of interviews conducted by researchers with all informants, namely principals, geography teachers, history teachers, and students of SMA Swasta Budi Agung Medan, the following:

Principal (Dr. Sandi Basuki): *"Alhamdulillah, SMA Swasta Budi Agung Medan has implemented digital-based media, often called digital media. Moreover, the Merdeka curriculum is now where teachers must learn to use technology more deeply and apply digital media. Digital media can influence student learning because there are many features available in digital media, for example, the digital media that is widely used here is a learning quiz application. "Well, in the learning quiz application, there are several interesting, unique, and funny features so that students can focus on their views and will also be more focused on learning using digital media."*

The use of digital media in learning history and geography subjects has a very positive impact, especially for the current generation who are growing up amidst technological developments. In history learning, digital media can bring the material presented to life. Through historical documentaries or animated videos, students can more easily understand and imagine important events in the past, such as World Wars or other historical events. On the other hand, in geography learning, technology such as Google

Earth provides a more interesting and interactive learning experience. Students can explore various world regions virtually, observe climate change, and learn about natural phenomena such as volcanic eruptions or earthquakes through in-depth and easy-to-understand simulations.

History Teacher (Haris Wibowo, SS): *"The use of digital media in history and geography learning is very helpful, especially for the current generation who are more familiar with technology. In history, digital media makes lessons more alive. For example, with historical documentaries or animated videos, students can more easily imagine important events, such as world wars or other major events. Meanwhile, technology such as Google Earth makes learning geography more interesting. Students can virtually explore different parts of the world, see climate change, or understand natural phenomena such as volcanoes and earthquakes with interactive simulations."*

Budi Agung Medan Private High School, starting from the principal, teachers, and students, agreed to properly implement digital media in schools, one of which is in geography learning, where digital media is more directed at the Google Earth quiz application and discussions about the Earth. The advantage of learning using digital media is that it makes the teaching and learning process more exciting, teachers also feel helped, so preparing teaching materials is easier. Digital media also brings many changes to students' learning interests, where the responses given by students when learning using digital media are more active and enjoyable.

In learning activities, geography teachers often utilize various application-based digital media to support teaching. One that is often used is Google Earth. This application is beneficial, especially in explaining materials related to the Earth. With various features available, students can explore geographic information visually and interactively, deepening their understanding of the topic. In addition, geography teachers also utilize Quizizz, an interactive quiz platform that can be customized to the subject matter's needs. Its features allow you to change the format and content of questions to suit the discussed topic. No less important, geography teachers also use Wordwall, a learning application that offers a variety of quizzes and educational games. Wordwall makes it easy for me to create engaging and fun student learning activities.

One of the primary forms of implementation of digital media in geography learning is its ability to make the learning process more interesting, interactive, and easy for students to understand. Through technological support, students can virtually explore various parts of the world without leaving the classroom. For example, by utilizing Google Earth, students can observe natural conditions in various regions, while digital simulations allow them to understand the dynamics of climate change and natural disasters more concretely. In addition, collaboration between geography teachers and other subjects, such as history, opens up opportunities to develop more creative teaching approaches. For example, using interactive maps can help explain the relationship between the development of civilization and the geographical conditions of a region. Not only that, real-time data can also be used to analyze actual phenomena such as urbanization and environmental change, so that students can see the relationship between theory and ongoing reality.

3.1.3 Analysis of the Relationship between Media Convergence Theory and the Role of Digital Media in Supporting Geography Learning Activities

The relationship and analysis between media convergence theory and the role of digital media in supporting geography learning activities at SMA Swasta Budi Agung Medan, namely, in geography learning, elements in convergence theory are very relevant and can be implemented in real terms. Regarding content, geography materials are delivered through various formats such as text, images, videos, interactive maps using Google Earth, and quiz games through platforms such as Quizizz and Wordwall. This cross-media approach enriches the learning experience and facilitates understanding of geographic concepts. From a technological perspective, using digital devices such as learning applications, projectors, and smartphones is an integral part of delivering material. This reflects the technological convergence that is occurring in the classroom.

Meanwhile, students no longer act as passive recipients of information. They actively participated through interactive quizzes and virtual exploration with Google Earth, and were involved in online discussions. This active role aligns with Henry Jenkins' view of the audience being directly involved in consuming and producing information. In addition, the involvement of the educational technology industry is also clearly visible through various applications such as Google Earth, Quizizz, and Wordwall. These applications result from global industry innovation that has now been integrated into the education system, especially in supporting more modern and effective geography learning.

3.1.4 The Direct Relevance of Convergence Theory to the Role of Digital Media

In geography learning, aspects of convergence have a very strong relevance. The concept of multiplatform learning allows teachers to deliver materials through various forms of digital media, such as visualization using Google Earth, video presentation as audio-visual media, reading texts, and interactive quizzes that encourage student involvement. This approach enriches the way of delivering materials and makes learning more dynamic. In addition, the diversity of student learning styles can be more easily accommodated. Both students who tend to be visual, auditory, or kinesthetic can still understand the material well, thanks to the flexibility of the media used. This aligns with Henry Jenkins' view that media convergence allows learning to occur more optimally, adapting to individual needs.

Digital media also opens up space for participatory and collaborative learning. Students can compete with each other in quiz games or work together to explore areas using digital map applications. These activities encourage active student involvement and build more meaningful interactions in the learning process. On the other hand, the role of teachers has also undergone significant changes. Teachers are no longer just tasked with delivering material, but also function as designers of digital-based learning experiences. They are required to be able to develop learning strategies by utilizing various types of media, creating an interesting and effective learning atmosphere. This transformation reflects the new role of educators in the era of digital convergence, where the ability to integrate technology is becoming an essential part of the teaching profession.

Henry Jenkins' Media Convergence Concept is relevant to implementing digital media in geography learning at Budi Agung Private High School, Medan. Learning is no longer linear or solely based on textbooks, but instead occurs in an interactive space where technology, content, and students intersect in a digital ecosystem. Digital media such as Quizizz, Wordwall, and Google Earth are concrete manifestations of this convergence, because:

a. Creating *a multimedia and interactive learning experience*,
b. Providing space for *active student participation*,
c. Responding to the need for *flexibility and differentiation of learning*,
d. Connecting schools with *the global education technology industry*.

Thus, media convergence theory provides a strong conceptual foundation in explaining how and why digital media can support geography learning more effectively and relevantly in today's digital era.

3.1.5 Digital Media in Geography Learning at Budi Agung Private High School, Medan

Geography teachers at SMA Swasta Budi Agung Medan often use digital media. One of the educational game applications that geography teachers use for learning is Wordwall. This program delivers learning content in an audio-visual format to attract students' interest and increase their learning motivation, especially in junior high and high schools. The steps used by geography teachers to use the Wordwall application are as follows: First, geography teachers must create or register an account on the Wordwall *website*, then complete the data listed therein. Then the geography teacher selects the *Create activity* and chooses one of the existing templates. After that, the geography teacher will write the title and description of the game and choose the desired content. Finally, the geography teacher will select *done* as the final step if they have finished making it.

Furthermore, geography teachers at SMA Swasta Budi Agung Medan also often use the Quizizz application, an online application to produce interactive quizzes used in the classroom, for example, for formative evaluation. Geography teachers utilize Quizzz materials as an alternative teaching strategy. Quizizz is an application with a quiz library on its main page. It displays a collection of educational materials produced by educators who serve as administrators or designers, packaged in interactive questions that cover various topics at various levels, subjects, and other fields.

In addition to using platforms such as Wordwall and Quizizz, geography teachers at SMA Swasta Budi Agung Medan often use Google Earth as the main learning tool, especially for topics related to the Earth. This application is quite easy to use, so teachers and students have no difficulty operating it. To access Google Earth, geography teachers need to download it via the App Store or Google Play Store on their respective devices. Once the app opens, geography teachers will explore its features in simple steps. To search for a specific location, tap the search icon. If you want to see the surrounding area, the geography teacher can touch and slide the screen with one finger. To zoom in, pinch the screen with two fingers and spread them apart; conversely, to zoom out, pinch inward. Additionally, zooming in or out can be done by double-tapping the screen, holding it, and

then sliding your finger up or down. To return to the current location, the geography teacher presses the 'my location' icon at the screen's bottom right.

Student learning can be supported through the use of digital learning resources. The field of digital media has advanced significantly. A number of educational advances are made possible by digital media, where learning through digital media, which is considered more convenient, adaptable, and not limited by time or location, replaces traditional learning, which is inflexible and boring. Digital media provides a variety of useful learning resources, especially for children. For example, digital media can be used to keep children interested in learning activities by utilizing audio and video.

Due to the increase in digital media, especially among economic actors, technological progress has occurred rapidly in the modern era. In addition, the development of laptop and mobile phone technology is growing along with increasing market demand and diverse human needs. Digital media is another. Content that can be accessed from various sources is packaged in digital media. These digital media include websites, social media, digital photos and videos, digital audio, and others.

The optimal implementation of digital media at SMA Swasta Budi Agung Medan will improve the quality of learning at the school level and contribute to national efforts in creating a young generation that is intelligent, creative, and ready to compete in the era of globalization. In addition, teachers can also improve the effectiveness of teaching through the use of digital media to deliver materials more dynamically and adaptively. Using devices such as projectors, tablets, or digital whiteboards allows for delivering materials with better visualization, thus encouraging student involvement in the learning process. With digital media, communication between teachers and students becomes easier through online communication platforms, allowing discussions, assignment submissions, and direct feedback.

The right solution for researchers to overcome several obstacles in digital media learning is that teacher creativity can be improved through regular training in creating interactive learning media, such as animated videos, infographics, and online quizzes using Canva, Google Earth, Quiziz, or Wordwall. To overcome the constraints of students' internet quotas, schools can collaborate with telecommunications providers to provide more affordable learning packages. Another alternative is to provide free Wi-Fi facilities in the school environment to support hybrid learning.

3.2 DISCUSSION

The lack of innovation in geography learning media remains a critical issue in secondary education. Geography, as a subject closely related to spatial phenomena, the environment, and everyday life, demands a learning approach that is contextual, engaging, and technologically relevant. However, the reality in many classrooms still reflects the dominance of conventional teaching methods that are less interactive and insufficiently aligned with students’ digital habits. In the current digital era, where Android-based smartphones are widely used among adolescents, integrating this technology into learning provides a strategic opportunity to modernize instructional methods. In this context, the

study conducted by Yudith Tia Lasfika, Herry Widyastono, and Sri Yamtinah emphasizes the urgency of digital-based innovation in geography education [25].

The present study aims to develop an interactive digital learning medium based on the Android platform for high school geography instruction. Employing a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), the product underwent validation by media experts, content experts, and classroom teachers. The validation results showed that the Android-based interactive media was categorized as "feasible without revision," with an average score of 96% from media experts and teachers, and 85.8% from content experts and teachers. This media offers an engaging and interactive approach to learning and integrates environmental awareness into its instructional content.

This research contributes to more applied and solution-oriented innovation than previous studies. The study by Yudith Tia Lasfika, Herry Widyastono, and Sri Yamtinah focused on identifying the availability of information technology (IT) infrastructure, teacher characteristics, the need for digital learning media, and student learning styles in geography instruction. Conducted in teacher associations and two top-performing schools in Surakarta City and Karanganyar Regency, their study revealed that a majority of geography teachers—64.71% in Surakarta and 81.25% in Karanganyar—had never created or implemented IT-based media in their classrooms. In contrast, a vast majority of students (94.12% in Surakarta and 100% in Karanganyar) expressed strong interest in learning geography through interactive web-based media. This study highlights a significant gap between teacher readiness and student expectations, underscoring the relevance of this current research that directly addresses that gap.

Similarly, the study by Dannis Ni'matussyahara, Sugiyanto, and Sarwono reinforces the urgent need for digital media in geography learning. Their findings indicate that most students have a visual learning style and are enthusiastic about multimedia-based learning. However, limited digital competence among teachers is identified as a major barrier. They recommend developing integrative multimedia platforms like interactive websites to meet students' learning preferences. In this regard, the Android-based interactive media developed in this study offers a concrete response to the challenges identified in their research by creating a digital solution aligned with student needs and technological trends [26].

Another relevant study by Diana Novianti Sofyan, Herpratiwi, Rangga Firdaus, and Muhammad Nurwahidin focuses on implementing Higher Order Thinking Skills (HOTS)-based e-modules in geography instruction at SMA Negeri 1 Terbanggi Besar, Central Lampung. Utilizing a mixed-method approach, their study found that using e-modules significantly improved students' learning outcomes, with 29 out of 30 respondents reaching a high gain category in N-gain measurements. Despite facing some challenges in applying HOTS-based models, the study confirms that digital media can effectively enhance students' critical and creative thinking abilities. While their research emphasizes the importance of integrating HOTS into learning, it does not produce a new media product like this current study [27].

In summary, this research offers a unique contribution by going beyond identifying needs or evaluating existing media, as seen in the previous studies. It develops a fully validated and classroom-ready Android-based learning product that is pedagogically sound and technologically relevant. This distinguishes the study from the more descriptive and evaluative approaches taken by the studies of Yudith Tia Lasfika et al., Dannis Ni'matussyahara et al., and Diana Novianti Sofyan et al.

Therefore, it can be concluded that this research not only reinforces the findings of the previous studies but also extends their implications by offering a practical, ready-to-use digital media solution. The Android-based interactive media developed here addresses pedagogical and technological challenges while simultaneously promoting environmental awareness, an essential aspect of geography education. This study exemplifies how technology can be leveraged to foster meaningful and engaging learning experiences that prepare students for the demands of 21st-century education.

4. CONCLUSIONS

The use of digital media in geography learning at SMA Swasta Budi Agung Medan has demonstrated a significant positive impact. It enhances the learning process's flexibility, interactivity, and personalization while promoting active student engagement. Through digital platforms such as Wordwall, Quizizz, and Google Earth, teachers can deliver content in various engaging formats—including text, images, videos, and educational games—enriching the learning experience and making abstract geographical concepts more accessible. Despite these benefits, several challenges remain, including limited access to devices, inadequate internet data (quota), and varying levels of teacher readiness in managing digital learning environments. These findings suggest the need for targeted teacher training on classroom management strategies during digital learning and the development of stronger technological infrastructure. Schools should consider providing free Wi-Fi access and establishing partnerships with telecommunications providers to support students' connectivity and digital learning needs. This study is limited in scope as it focuses on a single school and employs a qualitative approach, which may limit the generalizability of the findings to broader educational contexts. Therefore, future research is recommended to adopt quantitative methods to measure the effectiveness of digital media on student learning outcomes in geography across multiple schools and diverse educational settings. Such studies could provide more robust data to guide policy decisions and instructional design in digital-based geography education.

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