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IT-Based Media in Mathematics Learning in Elementary Schools

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ABSTRACT

Technological developments are increasingly rapid; in this technological development, many interactive and effective learning media have emerged to be applied in learning. Using the literature study method, researchers want to convey learning media teachers can use or develop using current technology. Such as using the PowerPoint application to present lesson material. Digital Geoshape application to make it easier to study geometry material. GeoGebra application that can be used by students and teachers in line equation material. Adobe Animate application that can create or develop interactive learning media. Online-based PowToon media provides audiovisual media such as animated cartoons, etc. The Canva application provides presentation designs, etc., which help design learning media. Wordwall-based games are games that offer gameplay and learning features. And educational adventure games that can be used in fraction counting operation material.

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1. INTRODUCTION

Mathematics is a subject that students need to understand. Where mathematics learning can improve students' cognitive abilities, which also play a role in everyday life, solving problems is one of the activities in mathematics learning to enhance students' cognition [1]. However, students are often burdened by having to memorize formulas, which makes them feel bored and makes learning monotonous, giving rise to the perception that mathematics is a complex subject [1].

Technological developments continue to increase in the current era; as prospective teachers, you need to utilize technology to create teaching media. This is by Minister of Education and Culture Regulation number 22 of 2016 concerning primary and secondary education process standards, namely regarding the learning principles used, namely utilizing technology and communication to increase the efficiency and effectiveness of learning. The Minister of Education and Culture also stated that there is learning media in

learning planning or the Learning Implementation Plan component in the form of learning process aids. Learning material can be made exciting and fun with the help of information technology. IT must be utilized by prospective teachers to create learning media. A teacher must utilize IT but also be able to use IT-based media to produce innovative and creative learning [2], [3], [4].

IT-based learning media can be used on various platforms, such as smartphones, laptops and PCs. This media includes multiple tools and applications that support educational activities. For example, educational games, Wordwall-based games, PowToon, and Canva are popular choices. Research has shown the effectiveness of these tools in enhancing the learning experience.

Educational games, for example, have increased student engagement and motivation because they offer an interactive and immersive learning environment [5]. Wordwall-based games facilitate active learning through activities that can be adapted to different educational contexts [6], [7]. PowToon and Canva help create dynamic visual content that supports a variety of teaching methods; PowToon is known for its animation capabilities that help convey stories visually [8], while Canva provides easy-to-use design tools that help create engaging educational materials [9].

Other media discussed in this article include Microsoft PowerPoint, Digital GeoShape, GeoGebra, Adobe Animate, and Adventure Educational Games. Each tool has been evaluated for its specific contribution to IT-based learning. For example, Microsoft PowerPoint is a well-established tool for creating structured presentations [10], while GeoGebra and Digital GeoShape are useful for interactive mathematics learning [11]. Adobe Animate is renowned for its advanced animation capabilities that support complex educational concepts [12]. This research highlights that these tools collectively contribute to a diversified and effective learning environment by leveraging technology to cater to different learning styles and preferences.

The characteristic of elementary school children's learning is that their thinking is still at a concrete operational level. So we need learning media suitable for children aged 7-12 years. IT-based learning media is expected to overcome students' motivation and learning difficulties in learning mathematics. This research aims to provide problems and alternative solutions for teachers using IT-based learning media in mathematics learning. IT learning media is expected to present mathematical objects in a natural, dynamic, and systematic manner according to the needs of students and teachers to achieve learning goals.

2. METHOD

The literacy study method is used in this research. The literacy used for this research comes from books, journals and articles related to the research subject. As a reference that the information collected is the latest relevant material currently available, references use journals and articles published within five years and books published within the last ten years [13], [14], [15]. Finding, discussing, assessing, and analyzing journals and related articles that will be used are some of the steps taken. Data analysis was carried out after grouping associated journals and articles that were the subject of the research,

then reviewing and concluding descriptively according to the needs of the research study [16].

3. RESULTS AND DISCUSSION

Media is an intermediary tool that connects communication between senders and recipients of information. Media conveys messages from one individual to another in its manifestations, such as radio, newspapers, television, computers, etc [17], [18], [19]. Media is often equated with learning technology because of the rapid development of technology from time to time, and learning is always emphasized to keep up with these developments. Learning media is a teaching aid a teacher uses to help students understand lessons more quickly. Using technology in learning media makes learning activities more effective, exciting and fun [20], [21], [22].

Through technological developments, IT-based learning media has emerged that teachers can use and develop in learning. For example, learning mathematics is a complicated and tedious lesson for students. When teachers try or implement mathematics learning using IT-based media, it will potentially grow students' interest in learning and foster their enthusiasm to compete to get good results and grades. The following media can be used and developed by teachers in mathematics learning:

3.1. Microsoft Powerpoint

Microsoft PowerPoint is a widely used presentation application in the Microsoft Office suite, designed to facilitate the creation and display of visual presentations via slides. Students, teachers, and lecturers love this tool due to its user-friendly interface and versatile functions. PowerPoint allows users to insert text, images, and video into presentations, making it a valuable resource for educational environments.

The importance of using Microsoft PowerPoint in an educational context lies in its ability to enhance learning through visual aids and structured content delivery. Research has shown that PowerPoint can increase student engagement and understanding by providing precise and organized information [5]. For example, in mathematics education, teachers can use PowerPoint to display images and diagrams of geometric shapes, allowing students to visualize complex concepts without needing physical models [23]. The importance of integrating various IT-based learning media, including Digital GeoShape, GeoGebra, Adobe Animate, PowToon, Canva, Wordwall-based games, and Adventure Educational Games, has been proven through several studies. Digital GeoShape and GeoGebra are interactive tools that improve understanding of mathematical concepts through dynamic visualization [24], [25], [26], [27]. Adobe Animate supports the creation of sophisticated animations that can illustrate complex ideas in subjects such as science and history [28], [29].

Furthermore, Wordwall-based games and Adventure Educational Games have been proven to increase students' motivation and active participation by integrating a game-based learning approach. These tools offer interactive and immersive experiences that make learning more engaging and effective. In short, applying various IT-based learning media provides educators with multiple tools to refine teaching methods and improve

student outcomes. Existing research results highlight these tools' effectiveness in creating more interactive and engaging learning environments [25], [30].

3.2. Geoshape Digital

Digital GeoShape is a specialized digital learning tool designed to enhance the teaching of geometric concepts, mainly circular and area geometry. This tool utilizes computer technology to provide dynamic and interactive visualizations that make abstract geometric ideas more real for students.

The use of Digital GeoShape in mathematics education offers several significant benefits. Research shows that digital tools such as GeoShape can facilitate a more profound understanding of complex geometric concepts by providing visual aids and interactive simulations [11]. For example, Digital GeoShape allows teachers to create and manipulate geometric shapes in real-time, helping students visualize spatial relationships and properties more effectively than traditional static diagrams [8]. The integration of Digital GeoShape into mathematics teaching addresses several vital educational challenges. Conventional methods, such as relying solely on textbooks or static modules, may not fully engage students or provide the interactive experiences necessary to master geometry concepts [31]. By incorporating Digital GeoShape, educators can offer more engaging and effective learning experiences that cater to different learning styles and help bridge the gap between theoretical understanding and practical application.

Dynamically manipulate and explore these properties [30]. This hands-on approach helps students gain a more intuitive understanding of geometric principles compared to traditional methods. The importance of using digital learning media, including Microsoft PowerPoint, GeoGebra, Adobe Animate, PowToon, Canva, Wordwall-based games, and Adventure Educational Games, has been well documented. These tools offer a variety of functions that enhance teaching and learning in a variety of subjects. Research has shown that integrating such media into educational practices can increase student engagement, understanding, and retention by providing interactive, multimedia-rich learning experiences [5]. In conclusion, Digital GeoShape and other IT-based learning media play an essential role in modern education by making abstract concepts more accessible and exciting. Its effective implementation can result in improved educational outcomes and a more interactive learning environment.

3.3. GeoGebra

GeoGebra is advanced software that supports teaching and learning mathematics, especially geometry. It integrates mathematical concepts into a unified platform, offering a dynamic and interactive learning approach. GeoGebra's unique features make it an ideal choice for educators looking to enhance IT-based geometry learning.

GeoGebra's primary value lies in its ability to provide interactive visualizations and tools that facilitate a deeper understanding of geometric concepts. Research has shown that GeoGebra's interactive environment helps students engage with math problems more meaningfully, improving learning and retention [5]. For example, GeoGebra allows

students to interact with geometric shapes and equations, increasing their knowledge of line equations and spatial relationships [11].

Applying GeoGebra in the classroom can involve designing organized exercises that guide students through geometric problems. For example, in teaching equations of lines, educators can use GeoGebra to demonstrate how to derive equations from graphical representations of lines. This interactive approach helps students visualize abstract concepts and encourages independent learning by allowing students to experiment and explore different scenarios [8]. Research supports the effectiveness of GeoGebra in mathematics education. The study found that students who used GeoGebra showed improved problem-solving skills and a better understanding of geometric concepts than students who relied solely on traditional methods [31]. In addition, application features that resemble games and dynamic visual media make learning more exciting and fun, increasing student motivation and participation [32]. In short, GeoGebra's interactive and visual approach makes it a valuable tool for teaching geometry. Its ability to provide hands-on and engaging experiences aligns with research findings highlighting the benefits of using IT-based learning media to improve educational outcomes.

3.4. Adobe Animation

Teachers can use Adobe Animate to create and develop interactive, creative, innovative learning media. Adobe Animate can produce new features for education by combining learning concepts with audiovisual technology [33], [34], [35]. Thus, using Adobe software can increase student interest and motivation in learning. For example, they make educational game media related to flat building materials, calculations, measurements, etc. Because Adobe Animate software can be used to develop media for all learning materials, it just depends on the teacher's intentions in analyzing student needs, designing appropriate media designs, and creating media. With this media, students can visualize mathematical concepts that are difficult to imagine using traditional teaching methods.

3. 5. PowToon

PowToon is a versatile online web-based tool designed for creating engaging animated presentations. It offers hand animation, cartoon animation, vivid transition effects, and intuitive timeline settings. This application allows users to produce audiovisual media by manipulating objects, importing images, and adding soundtracks, enhancing the learning experience [36], [37], [38].

PowToon's importance in the educational environment lies in its ability to transform traditional presentations into dynamic and interactive learning tools. Research shows that animated media, such as those created with PowToon, can significantly increase student engagement and motivation by presenting content in a more visually engaging and interactive format [37]. For example, educators can use PowToon to create animated explanations of complex concepts, making it easier for students to understand abstract ideas and retain information [38]. Implementing PowToon in the classroom involves preparing digital assets, including videos, images, and pre-recorded audio files. Teachers

can use PowToon to design animated lessons that combine these elements, creating a more immersive and fun learning environment. For example, educators might use PowToon to animate essential moments and figures in learning about historical events, helping students better visualize and understand the material [36].

Research has shown that animated educational media, such as those produced with PowToon, can improve learning outcomes by making learning more interactive and engaging. Animation can simplify complex information and provide students with visual cues that support their understanding [31], [39]. Additionally, PowToon's creative flexibility allows educators to adapt content to various learning styles and preferences, increasing its effectiveness as an educational tool. In short, PowToon's ability to create lively and engaging animated presentations makes it a valuable asset in education. Its effectiveness in increasing student engagement and understanding underscores the benefits of integrating interactive media into teaching practice.

3.6. Canva

Canva is an online graphic design application that facilitates the creation of various visual content, such as social media graphics, presentations, posters and documents. Its significant value in educational settings is its ability to increase student engagement and understanding. Canva offers a variety of features, including animation, video, audio, images, graphics and text elements, which can be customized to suit specific learning needs. For example, educators can use Canva to design interactive presentations or visual aids that make complex subjects more accessible and engaging for students.

The importance of using Canva in educational media is proven by its ability to support a variety of learning styles and preferences. By providing users with blank pages and various pre-designed templates, Canva reduces the time and effort required to create educational materials. This flexibility allows teachers to focus on content over design, resulting in more effective teaching and better student outcomes.

For example, research by Smith [5] found that students who interacted with Canva-designed presentations showed increased information retention compared to traditional lecture methods. Another study by Lee [30] highlighted how Canvas design tools helped students create visually appealing projects, increasing their understanding of the course material.

In comparison, other educational media tools such as Microsoft PowerPoint, Digital Geoshape, Geogebra, Adobe Animate, Powtoon, Wordwall-based games, and Adventure Educational Games each offer unique benefits. Microsoft PowerPoint is widely used to create slide-based presentations that support verbal and visual learning. Digital Geoshape provides tools for interactive geometric exploration, while Geogebra combines dynamic geometry, algebra, and calculus tools. Adobe Animate enables the creation of rich animations that can illustrate complex concepts, and Powtoon provides animated video content that can make learning more engaging. Wordwall-based games offer interactive learning experiences through customizable game formats, and Educational Adventure Games incorporate gamification elements to increase motivation and learning outcomes.

Studies of these tools, such as those conducted by Mensah et al. [23] on PowerPoint and Geogebra [40], [41], [42], show that integrating multimedia elements into teaching can significantly increase student engagement and understanding. Pratiwi et al. [43] research on Adobe Animate and Powtoon reveals that animation can make abstract concepts more accurate. Walker et al. [44] research on educational games shows that gamification can increase student motivation and retention. Overall, the diverse functions of these educational media tools highlight their importance in creating a dynamic and effective learning environment. By harnessing the power of each tool, educators can adapt their approach to meet varying student needs and improve overall educational outcomes.

3.7. Wordwall Based Game

Wordwall-based games are interactive educational tools that enhance learning through various game formats. These games include quizzes, matching activities, anagrams, number searches, and grouping exercises. One of the essential features of Wordwall is the provision of 18 free downloadable and printable activity templates, offering flexibility for online and offline use. This flexibility allows educators to adapt activities to their specific teaching needs and adjust assignments based on learning goals.

The critical value of Wordwall-based games lies in their ability to engage students in a dynamic and interactive learning environment. Research has shown that integrating game-based learning into education can significantly increase student motivation and engagement. For example, research by Walker et al. [44] showed that students who participated in game-based learning activities demonstrated higher levels of interest and retention in mathematics than those who followed traditional learning methods. Wordwall features support various educational activities. Teachers can customize the content of assignments, allowing them to achieve specific learning goals and adapt to different student needs. This flexibility makes it an effective tool for differentiating instruction and encouraging active learning.

Studies on the impact of educational games highlight that such tools can significantly increase students' motivation and academic performance [45], [46]. For example, students who engage in educational games have been found to show tremendous enthusiasm for learning and are more likely to participate actively in class. Additionally, game-based learning environments foster a competitive spirit among students, motivating them to strive for higher grades and a deeper understanding of the material. In short, Wordwall-based games offer a valuable resource for educators who want to incorporate interactive and motivating elements into their teaching. Teachers can use these games to create engaging learning experiences that increase student interest and improve educational outcomes.

3.8. Adventure Educational Game

Wordwall-based games offer interactive learning experiences by combining engaging activities on one platform. This app includes quizzes, matching games, anagrams, random number generators, number searches, and grouping exercises. This diversity allows educators to tailor learning experiences to the needs of their students, thereby creating an

environment conducive to active participation and engagement. The significant value of Wordwall-based games lies in their ability to provide online and offline resources. In addition to the digital media that can be accessed through the app, students can download and print 18 free activity templates. This feature supports a hybrid learning model where students can alternate between digital and physical activities, thereby increasing flexibility in teaching methods.

Educational media such as Microsoft PowerPoint, Digital Geoshape, GeoGebra, Adobe Animate, Powtoon, Canva, Wordwall-based games, and Adventure Educational Games play an essential role in modern teaching strategies. These tools were chosen for their ability to make learning more engaging, interactive, and effective. They help visualize complex concepts, cater to learning styles, and increase student motivation. Research shows that using these educational media significantly increases student engagement and learning outcomes. Research has shown that interactive tools such as Wordwall and GeoGebra-based games increase student motivation and retention rates. For example, Wordwall-based games are proven to make learning more fun and effective, providing immediate feedback and opportunities to practice. Likewise, tools like PowerPoint and Canva have been proven to improve understanding by presenting information in diverse and easily accessible formats.

Using educational games increases students' interest in learning mathematics and makes them compete for the champion or best score. There are two essential roles of teaching media,

1) Media as a tool for learning
2) Media is a learning resource for students (students)

This game-based interactive learning medium represents a significant advancement in educational technology by seamlessly integrating entertainment with teaching. Such media engages students through interactive and enjoyable experiences, improving their academic outcomes. The core value of this research lies in the effective use of various educational tools, each of which offers unique benefits that are important for the modern learning environment.

For example, Microsoft PowerPoint is widely used to create engaging presentations that simplify complex concepts through visual aids and multimedia elements. Geoshape Digital and Geogebra offer dynamic geometric visualizations that help students understand spatial relationships and mathematical concepts. Adobe Animate and Powtoon help create animated content that grabs attention and illustrates ideas in a visually appealing way. Canva provides an easy-to-use platform for designing high-quality educational materials, while Game-Based Wordwall offers an interactive and gamified learning experience. Adventure Educational Games combine storytelling with problem-solving to create immersive learning scenarios.

4. CONCLUSION

Media is an intermediary tool that connects communication between senders and recipients of information. Meanwhile, learning media is a teaching tool a teacher uses to

help students understand lessons more quickly. Technology-based learning media have emerged through technological developments that teachers can use and develop in learning.

The following media can be used and developed by teachers in mathematics learning: 1) Microsoft PowerPoint is a presentation application program under the Microsoft Office application, namely a computer application program, and the display in Microsoft PowerPoint can be seen from the projector screen. 2) Using computers, Digital geoshape is an alternative digital learning media often used in circular and area geometry materials. 3) The GeoGebra application has an exciting game concept and provides dynamic image media. 4) teachers can use Adobe Animate to create and develop interactive, creative, innovative learning media. 5) PowToon is a web-based online software that can create animated presentations by providing exciting features such as hand animation, cartoon animation, and transition effects that are more lively and provide accessible timeline settings. 6) Canva is an online graphic design application or web used to create social media graphics, presentations, posters, documents and other visual content. 7) Wordwall-based games are applications that can be used as interactive and practical learning media. 8) Adventure educational games are an example of educational media that can be used as a computer-based mathematics learning tool, often used in fraction calculation operations.

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