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THE ROLE OF LEARNING MEDIA IN LEARNING MATHEMATICS: *A SYSTEMATIC LITERATURE REVIEW*

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Abstrak: Media pembelajaran merupakan sarana yang dapat digunakan untuk membantu proses transfer pengetahuan dari guru ke siswa agar pembelajaran lebih efektif. Studi literatur ini memberikan kajian yang komprehensif mengenai manfaat dan peran media pembelajaran dalam pembelajaran matematika. Sistematika literatur ini menggunakan Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) sebagai pendekatan penelitian, tahap PRISMA meliputi: identifikasi, screening, eligibility, dan include. Perolehan artikel sejumlah 113 yang bersumber dari database Scopus, ERIC, dan Proquest yang diambil pada rentang satu decade terakhir. Melalui PRISMA, didapat 12 artikel tinjauan yang menjadi data untuk menjawab pertanyaan penelitian. Hasil penelitian menunjukkan Indonesia merupakan negara dengan wilayah penelitian terbanyak, yaitu 9 dari 12 penelitian. Jenjang SMA memiliki penerapan media pembelajaran terbanyak dari penelitian yang dikumpulkan. Terdapat berbagai jenis media yang digunakan, jenis media yang beragam ini menghasilkan pengembangan materi matematika yang bervariasi melalui media pembelajaran. Beberapa materi yang dikembangkan meliputi geometri (dalam tujuh penelitian), trigonometri (dalam dua penelitian), serta materi fungsi, aljabar, dan persamaan kuadrat (masing-masing dalam satu penelitian). Media pembelajaran juga dapat mengembangkan kemampuan kognitif matematis, antara lain: pemecahan masalah matematis, pemahaman matematis, komunikasi matematis, berpikir kritis matematis, representasi matematis, penalaran matematis, dan kemampuan spasial. Selain itu, kemampuan afektif juga dapat dikembangkan, seperti kemandirian belajar (dalam dua penelitian), kepercayaan diri, kreasi, dan konsentrasi belajar.
Kata kunci : *Media Pembelajaran*, *Pembelajaran Matematika*, *Pendidikan Matematika*, *Sistematika Literature Review*

Abstract: Learning media is a tool that can assist the process of transferring knowledge from teacher to student so that learning is more effective. This literature study provides a comprehensive study of the benefits and role of instructional media in learning mathematics. This literature systematics uses Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) as a research approach. The PRISMA stages include: identification, screening, eligibility, and include. Acquisition of 113 articles sourced from Scopus, ERIC, and Proquest databases taken in the last decade. Through PRISMA, 12 review articles were obtained, which became data to answer research questions. The results showed that Indonesia has the most research areas, 9 out of 12 studies. SMA level has the most application of instructional media from the research collected. Various types of media are used, and these various types of media result in the development of various mathematical materials through learning media. Some of the material developed includes geometry (in seven studies), trigonometry (in two studies), as well as material on functions, algebra, and quadratic equations (each in one study). Learning media

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can also develop mathematical cognitive abilities, including mathematical problem-solving, mathematical understanding, mathematical communication, critical mathematical thinking, mathematical representation, mathematical reasoning, and spatial abilities. In addition, affective abilities can also be developed, such as learning independence (in two studies), self-confidence, creativity, and learning concentration.
Keywords: *Learning Media, Mathematics Learning, Mathematics Education, Systematic Literature Review*

INTRODUCTION

Mathematics is essential in various aspects of life (Tinungki, 2015). By studying mathematics, a person is used to thinking systematically, scientifically, logically, and critically, and it can increase his creativity (Kadir et al., 2017). Its usefulness can help a person solve various problems in everyday life (Ojose, 2011) so that in the global education curriculum, mathematics is given space to be included in the scope of education (Kemendikbud, 2022). However, several challenges are often encountered in learning mathematics, including difficulties in understanding abstract mathematical concepts and students' need for more motivation in learning mathematics (Muhaimin et al., 2023). Therefore, to achieve optimal mathematics learning goals, effective and efficient strategies are needed in learning, one of which is to use appropriate learning media (Babiker, 2015; Kapi Kahbi et al., 2017; Muhaimin & Dasari, 2022).

The use of media in learning has led to a high trend of research and development of learning media, ranging from traditional learning media to media starting to integrate Information and Communication Technology (ICT) in its development (Az-Zahroh et al., 2019; Kaufmann et al., 2000; Saputra et al. al., 2019). Learning media is divided into visual, audio, and audio-visual media (Widahyu, 2021). The various types of learning media can help students understand various mathematical concepts better and more effectively through visual, interactive, and multimedia representations (Firdaus et al., 2022). In addition, learning media can also increase students' motivation to learn mathematics by providing a more interactive and enjoyable learning experience, so using this learning media can increase students' learning achievement in mathematics, both individually and in groups (Rachmavita, 2020).

Dale's theory explains that the more concrete the learning experience is, the higher the students understand the information they get, and the more abstract the learning experience is, the less understanding is gained (Edgar, 1970). In this case, the learning media provides a concrete mathematical situation. Using this learning media can also facilitate enactive learning (learning while doing), providing concrete experiences that make it easier for students to understand abstract mathematical problems (Ambarini, 2018).

With the various benefits and trends of learning media research that has been described, it is necessary to have a literature review and discuss the role of instructional media in learning mathematics more deeply. SLR research on specific learning media has been carried out, starting from ICT-based and traditional media (Alpizar et al., 2020; Degner et al., 2022; Otchie & Pedaste, 2020; Sudarmo et al., 2021; Wijaya et al., 2021). However, we have not found any SLR research addressing instructional media in general. Therefore this article aims to provide a comprehensive study of the role of instructional media in mathematics education. Through this systematic review, the researcher provides literature based on the answers to the research questions (RQ) defined below.

1. How is the geographic distribution and time of the research conducted?
2. What educational levels are used in the application of instructional media?
3. What types of learning media are developed?
4. What learning media were developed to influence mathematical ability?
5. What mathematical material is used in the application of learning media?
6. What mathematical abilities are developed through the application of instructional media?
7. What is the affective effect of using instructional media in learning mathematics?

LITERATURE REVIEW

Learning media

Learning media are tools and materials used to convey messages, stimulate students' feelings, thoughts, wills, and attention, and encourage learning (Winarto et al., 2020). According to Puspitarini & Hanif (2019), learning media can be defined as physical and non-physical tools teachers use to convey material to students more effectively and efficiently. Thus learning media can be hardware or software used in delivering material by the teacher to students during the learning process. Using instructional media is expected to expedite learning and encourage students to learn more quickly and easily (Henderson et al., 2017). In line with this opinion, according to Handayani et al. (2021), the purpose of learning media is to create a more effective and efficient learning process in learning. According to Dale's Cone of experience theory, direct or concrete experience provides the highest learning outcomes, followed by artificial objects, dramatizations, field trips, television, live exhibition images, still images, visual symbols, and abstract symbols, which provide the tiniest portion of learning outcomes (Edgar, 1970). However, the learning process does not necessarily have to start with students' direct experience but can also use experiences appropriate to learning needs.

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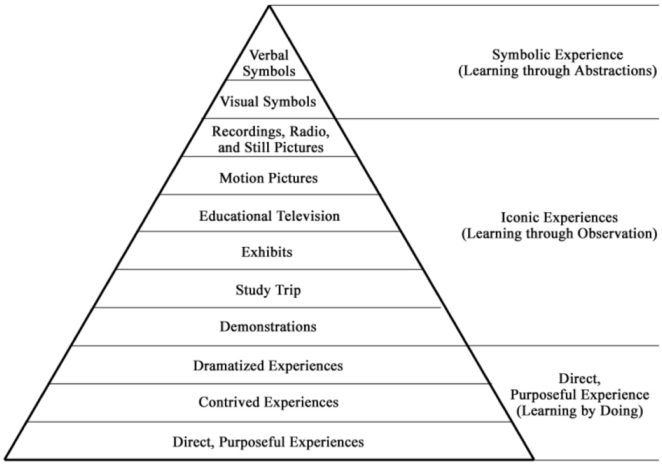

Figure 1. Dale's Cone of Experience

Technology-based multimedia can be used as learning media in class. Alpizar et al. (2020) state that multimedia, especially in presentation, has a significant and beneficial effect on improving student learning outcomes. Using multimedia in presentations aims to accommodate all the optimization of students' senses in audio, visual, or a combination of both. In addition, the Internet also influences the tendency to use media in class and learning outcomes. Puspitarini & Hanif (2019) stated that the Internet influences the choice of methods both inside and outside the classroom. The Internet provides independence, acceleration, feedback, accessibility, effectiveness, and productivity in learning.

One of the functions of learning media is to deliver material in the learning process (Fahrurozi et al., 2017). Apart from being a means of delivering material in the learning process, other functions, according to Asyhar (2011), include: (a) Learning media is a source for learning; (b) The semantic function, namely concretizing something abstract in mathematics; (c) The manipulative function, which provides the visualization to the user to manipulate mathematical objects; (d) The fixative function is the ability to capture, store and reproduce objects or events that have occurred for a long time; (e) The distributive function includes the use of large or unlimited learning media so that many students can access it; (f) The psychological function of learning media involves a role in attracting attention, influencing emotions, increasing cognitive understanding, stimulating imagination, and motivating students; and (g) sociocultural function. Namely, the use of media in learning can overcome sociocultural barriers between students with different customs, habits, environments, and experiences between students.

While the principles of using media in the learning process, according to Musfiqon (2012), can be divided into three main principles: (a) The principle of effectiveness and efficiency. Effectiveness in the

learning concept is the achievement of learning objectives in a learning process, while efficiency is the achievement of learning objectives by using time, costs, facilities, and other resources to a minimum; (b) The principle of relevance, the teacher's accuracy in using learning media that is by the learning objectives; and (c) the principle of productivity, practice in the learning process is the goal of optimal goals by the utilization of available natural resources and human resources.

Mathematical abilities

Mathematical ability is an individual's ability to acquire, process, and store mathematical information known as mathematical ability (Annett & Kilshaw, 1982). Identifying the substructures that underlie mathematical abilities is similar to efforts to identify the substructures of spatial abilities using factor analysis (Xie et al., 2020). Mathematical ability is considered a factor of intelligence within the framework of CHC theory, but solving mathematical problems also requires other abilities, such as spatial, reasoning, and verbal abilities (Reinhold et al., 2020).

Different theoretical frameworks propose various classifications for mathematical ability. According to Campbell (2005), mathematical abilities can be divided into numerical abilities and mathematical problem-solving. Numerical abilities encompass fundamental operations with numbers, counting, and basic arithmetic, while mathematical problem-solving involves abstract representation of mathematical relationships and generating solutions. In contrast, Lin et al. (2011) argue that mathematical ability comprises arithmetic abilities, logical reasoning, and spatial imaginative abilities. Arithmetic skills encompass operations with integers, decimals, fractions, and percentages, as well as concepts like limits, calculus, and algebra. Logical reasoning involves the capacity for comparing, generalizing, inducting, deducing, analyzing, and synthesizing mathematical phenomena, rules, and quantitative relationships. Spatial imaginative abilities refer to understanding motion, transformations, the connection between plane positions and shapes, and geometric interpretations of mathematical and algebraic formulas..

Gaber & Schlimm (2015) proposed numerical and geometric abilities as basic mathematical abilities from an evolutionary perspective. Numerical capabilities are developed to estimate threats and opportunities, while geometric capabilities are developed to estimate landmarks and marine environments. An interconnected system of brain quantities and geometries was developed to process numerical and geometric information. Previous studies have observed differences in brain activation to process magnitudes and geometries, with specific brain regions involved in processing geometric or numerical information. There is a difference of opinion regarding the relationship between numerical and arithmetic abilities, with some seeing numerical ability as including arithmetic ability and others

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seeing numerical ability as an essential component of arithmetic ability (Ye et al., 2016). However, most studies have investigated numerical and arithmetic abilities separately (Mutaf-Yıldız et al., 2020; Toll et al., 2011). In this study, the authors suggest that mathematical ability consists of four primary abilities: numerical, arithmetic, geometric, and logical reasoning.

RESEARCH METHOD

In this study, we conducted a systematic review to obtain a comprehensive literature review regarding the role of learning media on mathematical abilities in mathematics education. The systematic review, as defined by Moher et al. (2009), is a literature review of research questions formulated to collect and analyze studies or data obtained using a systematic method, which includes identifying, selecting, and assessing relevant studies. We apply the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) approach to our review process. We chose PRISMA because it provides a systematic step in the review process. According to Moher et al. (2009), this systematic review has four stages: article identification, article screening, reviewing eligibility, and inclusion results. We visualize our systematic review process with PRISMA in Figure 2.

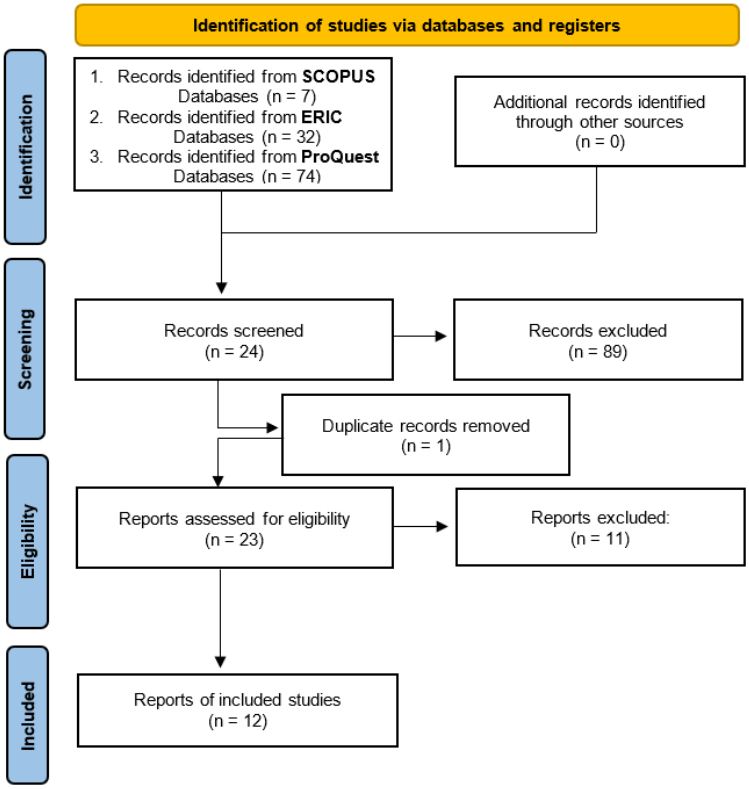

Figure 2. Prisma flowchart

Identification

We searched for review articles through the SCOPUS, ERIC, and ProQuest databases during this identification process. We use the help of keywords ("LEARNING MEDIA") AND ("MATHEMATICAL ABILITY") AND ("MATHEMATICS EDUCATION") OR ("MATHEMATICS"))) to make it easier for researchers to find the review article. A total of 113 articles were obtained, with specifications of 7 articles in the SCOPUS database, 32 in the ERIC database, and 74 in the ProQuest database.

Screening

After the identification stage, the articles found will be collected in a table based on the origin database for the screening process. At this stage, articles will be reviewed and selected based on specific criteria, namely: (1) they Must be published in scientific journals that have gone through a peer review process to ensure high-quality reviews; (2) They must be published within the last decade, namely between 2013 and 2023, so that publication trends can be studied; and (3) Must be written in English. Of the 113 articles identified, only 24 met the screening stage criteria, and as many as 89 other articles could not be considered.

Eligibility

This stage selects articles based on the following criteria, (1) relevant to variables and keywords, (2) relevant to the research question, and (3) relevant to the researcher's field of study. Of the 24 articles that passed the screening stage, only 13 articles met the criteria at this stage. Meanwhile, the researcher also searched for duplicate articles at this stage. The same article was detected, leaving 12 articles ready for review to answer research questions.

Includes

After successfully collecting 12 articles, we summarize and display these articles in Table 1 based on the topic or research question that is the focus of this research.

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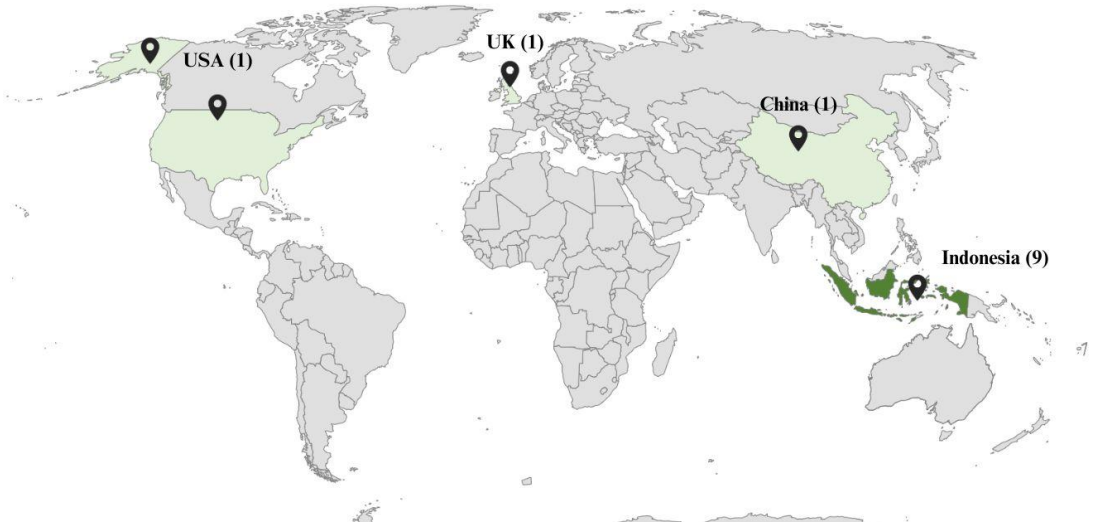
Table 1. includes review articles

No	Author	Year	Country	Level	Media Type	Media Name	Material	Mathematical Ability	Affective
1	(Hermita et al., 2021)	2021	Indonesia	ES	ICT	hungry ant video	Polyhedron	Spatial	Concentration, motivation
2	(Wijaya et al., 2020)	2020	China	SHS	ICT	Hawgent Dynamic Mathematics	Trigonometry	Concept understanding	Learning motivation and enthusiasm for learning
3	(Mahpudin et al., 2020)	2020	Indonesia	SHS	ICT	Android-based Mathematics	Mathematical equations	Mathematical representation ability	Motivation and effectiveness
4	(Nurjanah et al., 2020)	2021	Indonesia	JHS	ICT	Computer based learning	Geometry	Understanding and reasoning	Motivation
5	(Bernard & Senjayawati, 2019)	2019	Indonesia	JHS	ICT	Visual Basic Application for Excel	Geometry	Mathematical understanding	Confidence
6	(Rahayu & Kuswanto, 2021)	2021	Indonesia	SHS	ICT	Android-based carom games comic	Geometry	Critical thinking and representation	Motivation
7	(Hidayat et al., 2019)	2019	Indonesia	SHS	ICT	Rubu 'Al-Mujayyab	Trigonometry	Problem-solving	Eeffectiveness
8	(Setiyani et al., 2020)	2020	Indonesia	SHS	ICT	Digital module	Function	Mathematical communication	Learning independence
9	(Walters et al., 2016)	2014	United Kingdom	College	ICT	Math-eo	Algebra	Problem-solving	Enthusiasm and motivation
10	(Mahoney & Hall, 2017)	2017	USA	Disabilities	ICT	Padlet	Geometry	Mathematical communication	Creation
11	(Hasibuan et al., 2018)	2019	Indonesia	JHS	ICT	RME	Geometry	Problem-solving	Learning independence
12	(Negara et al., 2022)	2022	Indonesia	SHS	ICT	Geo Gebra	Geometry	mathematical reasoning	Effectiveness

Description: Elementary School (ES), Junior High School (JHS), Senior High School (SHS)

RESULTS AND DISCUSSION

Geographic research



Note: UK (United Kingdom), USA (United States of America)

Figure 3. Distribution of Research Places

Based on the results of the review, these articles came from four countries, namely Indonesia, China, the United Kingdom (UK), and the United States of America (USA) (Figure 3). Of the four countries, Indonesia is the country with the most research, with nine articles (Bernard & Senjayawati, 2019; Hasibuan et al., 2018; Hermita et al., 2021; Hidayat et al., 2019; Mahpudin et al., 2020; Negara et al., 2022; Nurjanah et al., 2020; Rahayu & Kuswanto, 2021; Setiyani et al., 2020) and the remaining one article each for China (Wijaya et al., 2020), UK (Walters et al., 2016), and USA (Mahoney & Hall, 2017).

The high quantity of learning media research must be distinct from the country's low education quality (Susilo & Sofiarini, 2021). One of the reasons for this low quality of education is the low mathematical ability of students (Aber et al., 2017). Based on the review results, Indonesia has the most research on learning media (Figure 3). They revealed that the low mathematical ability of Indonesian students became the basis for their research (Bernard & Senjayawati, 2019; Hasibuan et al., 2018; Hermita et al., 2021; Hidayat et al., 2019; Mahoney & Hall, 2017; Mahpudin et al., 2020; Negara et al., 2022; Nurjanah et al., 2020; Rahayu & Kuswanto, 2021; Setiyani et al., 2020; Walters et al., 2016; Wijaya et al., 2020). Other empirical evidence is shown by data from the Organization for Economic Co-operation and Development (OECD), PISA in 2018 states that Indonesia is ranked 71 out of 77

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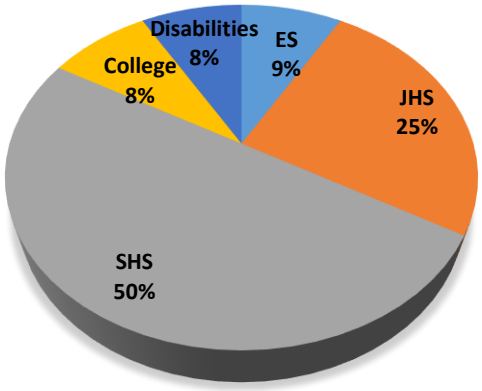
countries participating in this program with a math ability score of 379. In contrast to Chinese countries, the UK and the USA rank in the top 10 in the 2018 PISA results (OECD, 2019). Based on these data, this represents that many Indonesian students have difficulty understanding mathematical material, coupled with the abstractness of this mathematical material. This condition is in line with the high enthusiasm of researchers in Indonesia to provide solutions to this gap through research, one of which is by developing mathematics learning media.

Educational level



Note: ES (Elementary School), JHS (Junior High School), SHS (Senior High School)

Figure 4. Distribution of Education Levels

Research on learning media is spread across all levels of education, from elementary to tertiary level, even with schools with disabilities complementing research trends in this field. Based on Figure 4, the SMA level is the most common in six studies (Hidayat et al., 2019; Mahpudin et al., 2020; Negara et al., 2022; Rahayu & Kuswanto, 2021; Setiyani et al., 2020; Wijaya et al ., 2020), then junior high school level with three studies conducted (Bernard & Senjayawati, 2019; Hasibuan et al., 2018; Nurjanah et al., 2020), and one study each for elementary school level (Hermita et al., 2021), college (Walters et al., 2016), and disability (Mahoney & Hall, 2017).

High school and junior high school levels are the most dominant. On the other hand, learning mathematics among these students has begun to require students' abstract thinking (Widodo & Wahyudin, 2018). Many still have concrete thoughts about understanding mathematics (Afthina et al., 2017; Nurjanah et al., 2020). This is a severe gap, so there is a need for media or tools that can connect students' concrete thinking with abstract mathematical material. According to Widodo & Wahyudin (2018), learning media has a role in helping students in bridging concrete student thinking to abstract thinking, namely mathematics. Sometimes learning media does not only function for this; according to Puspitarini & Hanif (2019), learning media is used to motivate students in learning, this is the reason

why learning media also needs to be developed at the elementary level, seeing as students at this level usually like learning interestingly (Ani Widosari et al., 2017), this can be realized by learning that involves learning media. With learning media, elementary students can interact directly with the material to form meaningful learning (Rachmadtullah et al., 2018).

The effectiveness of the other in the application of this learning media can be seen in its application at the tertiary level. At this level, learning media is developed to support students in achieving their goals effectively (Imran, 2014). For example, in geometry lecture material, GeoGebra learning media is usually used; this helps students speed up their work in making graphs without manually doing it manually using pen and paper (Murtafiah et al., 2019); this condition makes learning more effective. Interesting discussion on the level of disability, students at this level have their privileges compared to other standard students; it is noted that students with disabilities think that they are three to four years late compared to standard students (Ehri, 1989). This condition makes understanding of mathematics not as good as standard students, so learning media is needed to help students with disabilities understand math material so that it can be understood easily.

Media type

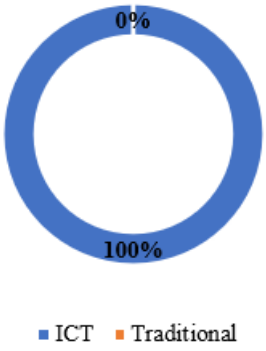


Figure 5. Media Type Distribution

It is pretty surprising that in the last decade, only ICT-based media have been found in learning media (Bernard & Senjayawati, 2019; Hasibuan et al., 2018; Hermita et al., 2021; Hidayat et al., 2019; Mahoney & Hall, 2017; Mahpudin et al., 2020; Negara et al., 2022; Nurjanah et al., 2020; Rahayu & Kuswanto, 2021; Setiyani et al., 2020; Walters et al., 2016; Wijaya et al., 2020). Based on Figure 5, there is no discussion of traditional media. The rapid development of the times is the reason behind the rapid development of technology. Effectiveness and a more attractive appearance are also the things that integrated ICT a lot to do to develop learning media in the last decade. Integrating ICT into learning media is considered to have more advantages than non-ICT media, making research and academics dominate the use of ICT learning media compared to traditional learning media (Habibi et al., 2022; Sabanci & Ozyildirim, 2014).

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Various studies regarding the advantages of ICT-based mathematics learning media are as follows: (1) attracting students' attention, ICT learning media such as videos, animations, and games can attract students' attention and make them more enthusiastic about learning mathematics (Puspitarini & Hanif, 2019); (2) increasing student involvement, the use of ICT learning media can also increase student involvement in learning mathematics. This makes learning more interactive; ICT learning media such as simulations, games, and interactive videos can provide more interactive and exciting learning resources for students (Puspitarini & Hanif, 2019); (3) expanding learning accessibility, ICT learning media can increase the accessibility of learning mathematics for students who have physical or geographical limitations (Marini et al., 2022); (4) improve the effectiveness of learning, the use of ICT learning media in learning mathematics can increase the effectiveness of learning because it can provide faster and more accurate feedback and evaluation. In addition, students can access learning materials anytime and anywhere, so they can learn mathematics more flexibly (Dwijayani, 2019).

Mathematics learning media

Table 2. Distribution of Learning Media

Learning Media	Amount (n_i)
Hungry Ant Video	1
Hawgent Dynamic Mathematics	1
Android-based mathematics learning media	1
Computer based learning	1
Visual Basic Application for Excel	1
Android-based carom games comic	1
Rubu 'Al-Mujayyab	1
Digital module	1
Math-eo	1
Padlet	1
Geo Gebra	1

Previously it was discussed that there was complete domination of ICT-based learning media. We describe what types of learning media are used to support learning mathematics (Table 2). Of the various types of learning media, there are media that you can develop yourself, including hungry ant videos (Hermita et al., 2021), agent dynamic mathematics (Wijaya et al., 2020), android-based mathematics learning media (Mahpudin et al. ., 2020), android-based carom games comic (Rahayu & Kuswanto, 2021), rubu 'al-mujayyab (Hidayat et al., 2019), digital module (Setiyani et al., 2020), math-eo (Walters et al. al., 2016), and padlet (Mahoney & Hall, 2017). Then media develop from existing ones, such as GeoGebra (Negara et al., 2022) and Excel (Bernard & Senjayawati, 2019).

In the world of research, researchers tend to develop learning media from scratch, meaning they prefer to design their learning media based on needs during the initial analysis (Syahidi et al., 2019). This is based on developing existing media, such as GeoGebra; it tends to take more work to provide the facilities required during the needs analysis. But all of that in development research is the same, the most important thing is that the media being developed can provide benefits and solutions to the problems found.

Mathematical material

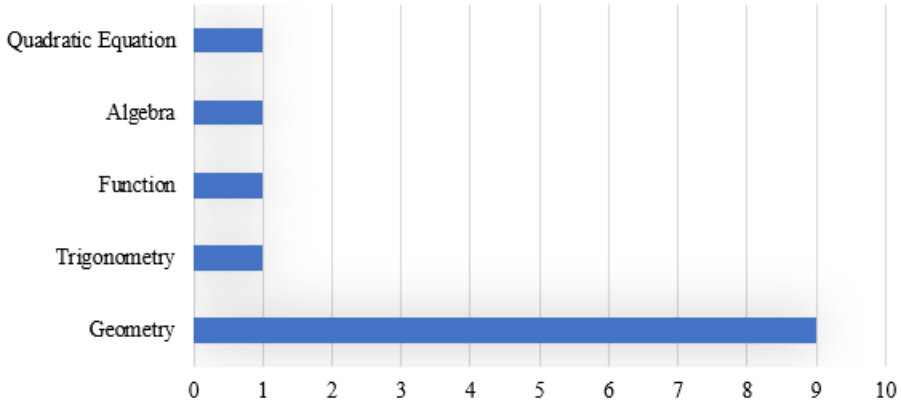

Figure 6. Distribution of Mathematical Materials

Based on Figure 6, various mathematical materials are integrated with learning media. Geometry material with seven studies (Bernard & Senjayawati, 2019; Hasibuan et al., 2018; Mahoney & Hall, 2017; Nurjanah et al., 2020; Rahayu & Kuswanto, 2021), followed by trigonometry with two studies (Hidayat et al., 2019; Wijaya et al., 2020), and one study each for functional material (Setiyani et al., 2020), algebra (Walters et al., 2016), and quadratic equations (Mahpudin et al., 2020).

Geometry becomes the dominating mathematical material as learning media content. It should be noted that geometry has material topics that require good spatial understanding (Casey et al., 2008), and students often even have difficulty understanding it if they only see it from the visual side (Cesaria & Herman, 2019; Enabela Novilanti et al., 2021). For example, on the topic of three-dimensional material, the topic discusses various kinds of three-dimensional shapes that should be presented in three-dimensional space. However, educators only use two-dimensional media in delivering this topic, such as books and blackboards (Rahman et al., 2011). From these conditions, many researchers have developed media that can integrate three-dimensional material, for example, using media based on Augmented Reality (AR) and Geogebra (Mailizar & Johar, 2021; Sun & Chen, 2020).

The abstractness of mathematics often makes students and students feel difficult (Dreyfus, 2002), this results in a dislike of mathematics and considers mathematics difficult, in the end, the value of mathematics and the use of mathematics becomes nil (Andrews, 2009). From these various perceptions,

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experts in education and educators seek solutions to these conditions. Some mentioned that the teacher's way of delivering the material that was inappropriate with the material being taught and the teacher's lack of interest in delivering the material were the main factors in this case (Fathan et al., 2019). Hence, the researchers provided suggestions, including developing learning media to make learning more interesting and active. From this development, it is expected that the value and practicality of mathematics can be achieved well. However, not all mathematics material can be made as learning media content; its use in this material complicates mathematics itself. Therefore, an educator must be intelligent and wise in integrating media into learning mathematics.

Mathematical ability

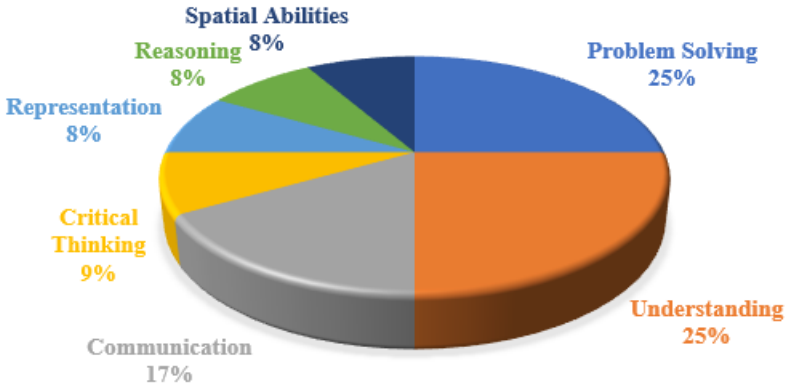

Figure 7. Distribution of Mathematical Ability

We found a variety of mathematical abilities that can be developed through this learning media. These various media include mathematical problem-solving ability, mathematical understanding, mathematical communication, mathematical critical thinking, mathematical representation, mathematical reasoning, and spatial abilities. Looking at Figure 6, mathematical problem-solving (Hasibuan et al., 2018; Hidayat et al., 2019; Walters et al., 2016) and mathematical understanding (Bernard & Senjayawati, 2019; Nurjanah et al., 2020; Wijaya et al., 2020) being the most with each being discussed in three studies, then two studies discussing mathematical communication (Mahoney & Hall, 2017; Setiyani et al., 2020) and mathematical representation (Mahpudin et al., 2020; Rahayu & Kuswanto, 2021), and one study each discussing critical mathematical thinking (Rahayu & Kuswanto, 2021), mathematical reasoning (Negara et al., 2022), and spatial abilities (Hermita et al., 2021).

In learning mathematics, the results of using instructional me pretty quite varied. This is based on the needs of students in learning. Mathematics is often a scourge in learning (Dreyfus, 2002; Prasetya et al., and 2020), the difficulty in understanding makes the role of this media used to help students understand mathematical material (Akmalia et al., 2021). Poor understanding will impact poor learning outcomes as well, me,anwhile poor mathematics learning outcomes are based on students' low

mathematical problem-solving abilities (Yoshikawa et al., 2012). Likew, use for other abilities that can affect students' mathematics learning outcomes, such as mathematical reasoning abilities, mathematical criticality, and mathematical representation. So that the role of this media can provide an increase in mathematics learning outcomes through increasing students' mathematical abilities.

Affective Influence

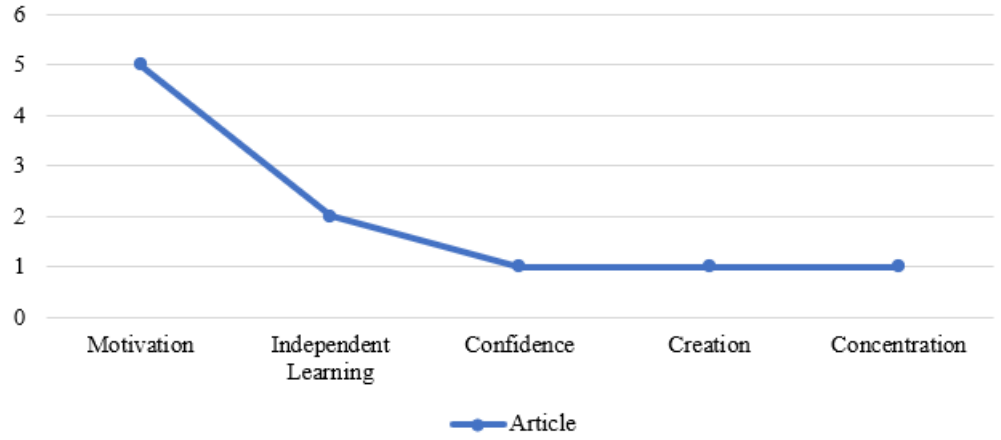

Figure 8. Affective Influence Distribution

In addition to cognitive mathematical aspects, affective aspects can also be improved in the use of this learning media, either directly or indirectly. We have found various affective aspects in review articles, learning motivation being the most in our findings with five studies (Mahpudin et al., 2020; Negara et al., 2022; Nurjanah et al., 2020; Rahayu & Kuswanto, 2021; Walters et al., 2016), then learning independence with two studies (Hasibuan et al., 2018; Setiyani et al., 2020), and self-confidence (Bernard & Senjayawati, 2019), creation (Mahoney & Hall, 2017), and learning concentration (Hidayat et al., 2019) one study each.

Cognitive abilities in students greatly influence their affective abilities (Shih et al., 2010). Thinking that mathematics is complex for students may not be because mathematics is indeed difficult to understand, this could be a child's affective disorder (Reyes, 1984). In learning mathematics, the initial building blocks are not the concepts but the reasonable assumptions of mathematics to make mathematics enjoyable so that mathematics is easy to learn. The role of learning media provides an atmosphere that can attract students' attention to learning so that students' enthusiasm for learning in the classroom also increases (Fitria, 2023). In addition, students get direct experience using this learning media (Puspitarini & Hanif, 2019). According to the theory of Dale Edgar (1970), more direct or concrete experiences in learning can provide good learning outcomes.

Poor learning outcomes are often caused because students also have poor mathematical problem-solving skills (Renkl, 1999). From a cognitive perspective, this is clearly due to students' need to

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understand mathematics. Meanwhile, from an affective perspective, there are many underlying factors, including students' lack of confidence in solving the problem. Low self-confidence disrupts the psychological aspect so that students' mentality in working on problems becomes unsure of their answers, resulting in not optimal student learning outcomes (Strand et al., 2014). Conversely, according to Surya & Putri (2017), increasing self-confidence increases students' independence in solving math problems.

In solving mathematical problems, the more often a student is trained in problem-solving, the more accustomed he will be to finding new strategies for solving mathematical problems effectively (D'Zurilla & Goldfried, 1971). Besides that, a teacher must also think of other effective ways to be applied to improve learning outcomes. These strategies can be applied in learning and outdoor learning. Using learning media can be a strategy for teachers to increase student learning independence outside of learning (Puspitarini & Hanif, 2019). Students can explore the media provided by the teacher to understand the material more deeply. However, it should be noted that learning media can provide practical benefits in learning if used according to their function, and the function of learning media is to support the achievement of learning objectives, not as an alternative way to achieve learning objectives (Lawrence & Tar, 2018). Therefore, an educator must be wise in choosing and using the media used in learning.

CONCLUSIONS AND SUGGESTIONS

Acquisition of review articles comes from the Scopus journal database (n=7), ERIC (n=32), and Proquest (n=74). Through the PRISMA approach as an article screening flow, 12 review articles were obtained as material for answering research questions. Indonesia is the largest country in the distribution of research areas discussed in review articles, 9 out of 12. The high school level has the most in terms of the application of instructional media because, at that level, the math material is already abstract, and students have difficulty understanding math material. The rapid development of the times has resulted in a high research trend in the field of technological development, especially in learning media that integrates technology in it. The types of media used vary, starting from media made from scratch or developing existing media. The various types of media give rise to a variety of mathematical material developed through learning media, this includes geometry with seven studies, trigonometry with two studies, and one study each for function material, algebra, and quadratic equations. Regarding mathematical cognitive abilities can be developed through learning media, including: (1) mathematical problem-solving abilities, (2) mathematical understanding, (3) mathematical communication, (4) critical mathematical thinking, (5) mathematical representation, (6) mathematical reasoning, and (7) spatial

abilities. In addition to cognitive abilities, affective abilities can also be developed. This includes independent learning with two studies, self-confidence, creation, and concentration in learning.

LIMITATIONS AND RECOMMENDATIONS

This research is limited to searching articles in the Scopus, ERIC, and ProQuest databases in the last decade. Further researchers can expand the scope of research by taking review articles from other journal databases, such as Web of Science, Sage, Taylor & Francis, and others at different time frames. Future research can redevelop or deepen the research questions on this topic, and it is possible to get different findings to complement our findings.

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