



Using Interactive Teaching Materials to Improve Indonesian Students' Numeracy Skills: A Systematic Literature Review

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ABSTRACT

The use of appropriate teaching materials can be used to improve numeracy skills of students in Indonesia. The use of teaching materials at various levels of education in Indonesia is still limited and even if there are not many that are interactive. This research uses the Systematic Literature Review (SLR) method which is guided by PRISMA. The SLR in this article aims to find out the types of interactive teaching materials used to improve numeracy skills at various levels, how they are used and in what materials the use of interactive teaching materials is applied. The articles reviewed are in indexed Indonesian language and specifically contain interactive teaching materials to improve numeracy skills in mathematics learning. Articles were searched using the Publish or Perish application and the Google Scholar database from 2020 to 2024. Based on the inclusion criteria there were 14 articles as primary studies out of 670 articles found. The conclusion obtained is that the types of interactive teaching materials used to improve the numeracy skills of students at various levels are those that use digital devices or not. The way of utilizing interactive teaching materials to improve numeracy skills can be done independently or integrated with media, models or learning approaches. In general, the use of interactive teaching materials to improve numeracy skills is not specific to certain materials. Educators are recommended to develop interactive teaching materials that are a combination of using digital and non-digital devices to improve students' numeracy skills.

Keywords: Interactive Teaching Materials, Numeracy, Mathematics Learning , Systematic Literature Review

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INTRODUCTION

In Peraturan Menteri Pendidikan, Kebudayaan, Riset, Dan Teknologi Nomor 5 Tahun 2022 Tentang Standar Kompetensi Lulusan Pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar, Dan Jenjang Pendidikan Menengah in Chapter V Graduate Competency Standards at the Secondary Education Level Article 9 paragraph 3 (h) states that the graduate competency standards at senior high school / madrasah aliyah / extraordinary high school / package c / other equivalent forms are formulated in an integrated manner in the form of competency descriptions that demonstrate numeracy skills. Article 9 paragraph 3(h) states that numeracy skills are the ability to reason using mathematical concepts, procedures, facts and tools to solve problems related to self, the immediate environment, the surrounding community, and the global community. This is in accordance with Article 9 paragraph 1(c), the SKL in

the education unit of the general secondary education level is focused on knowledge to improve the competence of students to live independently and follow further education. The importance of numeracy skills was also stated in the *World Economic Forum* in 2015. At the forum, Sukaryo & Sari (2024) explained that numeracy is one of the six basic foundations of literacy skills that students must master in this global era. Anderha & Maskar (2021) also emphasized that people must also master these six basic literacies in order to increase competitiveness in facing the challenges of the 21st century. The six basic literacies are literacy, numeracy, science literacy, digital literacy, financial literacy, and cultural and civic literacy.

Ayuningtyas & Sukriyah (2020) explained that numeracy is a term used by Kemdikbud as another name for *PISA's Mathematical Literacy*. Anderha & Maskar (2021) in the publication of their research results suggest that numeracy skills are positively correlated with math learning achievement. Lobo *et al.* (2024) also said the importance of numeracy is not only limited to academic ability but also an essential life skill in facing challenges in this modern era. Hopeman said that students who have good numeracy skills tend to be better prepared to face complex tasks and make data-based information decisions Lobo *et al.* (2024). In fact, they further stated that if each individual mastered these numeracy skills well, not only basic problem solving skills related to mathematics could be found the solution, but also problems with complex levels. Sri Hartatik in Oktariani & Puspaningtyas (2024) stated that students' numeracy skills also reflect how well the numeracy learning process takes place at school.

However, the numeracy achievement value of students in Indonesia in 2024 is still in the medium category because it is between 40% - 70%. This is based on data that can be accessed at <https://raporpendidikan.kemdikbud.go.id/> that the numeracy skills of general elementary school students are 62.62% who reach the minimum score, 65% general junior high school, and 66.3% general high school. Whereas in accordance with the categories listed in the Indonesian education report card, numeracy skills are said to be in a good category if they get an achievement score above 70%, while if they are still 40% - 70%, they are in the medium category and below 40% are in the low category. Of course, considering the important role of numeracy skills for learning in schools and for students' learning achievements, these achievements need to be improved so that they enter the good category.

In his scientific publication, Han in Winata *et al.* (2021) stated that there are three indicators of numeracy skills. The three indicators are using various kinds of numbers and symbols related to basic mathematics to solve problems in various contexts of daily life, analyzing information displayed in various forms (graphs, tables, charts, diagrams and so on), and interpreting the results of the analysis to predict and make decisions. A problem is said to be able to measure learners' numeracy skills if the context contains these three indicators.

Various efforts have been made by teachers in learning mathematics to improve this numeracy skill. Among them are the use of animated videos (Niswah *et al.*, 2022), pictorial number card media (Lindang *et al.*, 2024), and designing project-based learning, game work, and competition (Lestari *et al.*, 2023). In addition, various interactive teaching materials have also been used by previous researchers

to improve numeracy skills at various levels. These interactive teaching materials include Canva-based interactive media (Rahmawati & Nurafni, 2024a), math comics (Saraswati *et al.*, 2024), educational games (Qomariyah *et al.*, 2024), video math animaker (Putri *et al.*, 2024), and wordwall (Nurma'rifah, 2024).

The teaching material itself according to Mudlofir is a set of materials arranged hierarchically in the form of both written and unwritten materials (Hartono *et al.*, 2022). Based on its form, teaching materials are grouped into two, namely printed and non-printed teaching materials (Mulyasa in (Rustamana *et al.*, 2023)). (Lasmiyati in Hartono *et al.* (2022) states that printed teaching materials are a number of materials prepared in paper that can serve for learning and information delivery purposes. Examples of these printed teaching materials are modules, books, hand outs, Learner Worksheets, and brochures (Mudlofir in (Hartono *et al.*, 2022)). In his research, Syafaruddin suggested the types of teaching materials in non-print form, namely listening teaching materials (audio), seeing and hearing teaching materials (audio visual), and interactive teaching materials (Hartono *et al.*, 2022). Furthermore, (Hartono *et al.*, 2022) stated that interactive is a learning process in which there is two-way communication between teachers and students, students and students, as well as students and learning media.

Prastowo (2021) stated that interactive teaching materials are teaching materials that combine several learning media (audio, video, text, or graphics) that are interactive to control a command so that there is a two-way relationship between teaching materials and their users (Latifah & Utami, 2019).

Jamilah (2020) stated that interactive teaching materials are teaching materials that are active with a certain design and can give back commands to users (students) to carry out activities so that students engage in two-way interaction with the teaching materials being studied. The use of interactive teaching materials is expected to make students active during learning activities in accordance with the response given by the interactive teaching materials. Learners are active if they respond quickly to counter commands to perform an activity in learning. In addition, Simbolon & Purba (2023) revealed that the design of interactive teaching materials must also be in line with the needs of learners in today's digital era, namely with a combination of animation, images, videos, or other media. The use of interactive teaching materials can stimulate learners to gain a more interesting, dynamic learning experience, and according to their needs. The role of teaching materials is very important in the learning process for both teachers and students. This is as stated by Oktaviani that the role of teaching materials for teachers is to save teacher time in teaching, change the role of the teacher from a teacher to a facilitator, and improve the learning process to be more effective and interactive (Hartono *et al.*, 2022). For students, Magdalena *et al.* (2020) stated that the role of teaching materials for students is so that students can learn without the presence/necessity of a teacher, can learn anytime and anywhere they want, can learn at their own pace according to their own chosen sequence, and help the potential to become independent learners. Therefore, interactive teaching materials as a form of teaching material also play an important role in

improving the effective and interactive learning process and helping independence for a learner. Learning with interactive teaching materials is what many researchers have previously proven can improve numeracy skills. This improvement in numeracy skills according to Anderha & Maskar (2021) has implications not only for good problem solving skills in mathematics but also in solving real problems at a more complex level. Interactive teaching materials specifically designed to help learners improve their numeracy skills can be apps, games and online resources. Multimedia elements such as animations, simulations, videos or interactive quizzes in these interactive teaching materials are designed to increase learning motivation and strengthen numeracy skills.

This interactive teaching material is made in digital form to facilitate its use and can be accessed from laptops/computers and also students' cellphones (Hartono *et al.*, 2022). Teaching materials that use digital devices (digital-based such as computers, laptops, or cellphones) and are equipped with other multimedia by Kosasih (2021) are called digital teaching materials. Therefore, interactive teaching materials based on digital devices are called digital interactive teaching materials. Hartono *et al.*, (2022) state that the difference between interactive and non-interactive teaching materials is that interactive teaching materials are a combination of audio, books, and multimedia, while non-interactive teaching materials only contain books or rather printed teaching materials.

The literature review that focuses on the utilization of interactive teaching materials to improve numeracy skills at various levels of education is a novelty offered in this research. This is because SLR that has been conducted by previous researchers has not specifically discussed the extent to which the utilization of interactive teaching materials to improve the numeracy skills of students at various levels.

Since the Covid-19 pandemic in mid-2019, there have been significant changes in the way of learning and teaching due to the demands of a pandemic situation that does not allow offline learning to be carried out. This has implications for the many innovations and utilization of digital technology in the use of interactive teaching materials to accommodate the changing demands of the times and situations due to the pandemic. Therefore, this study took literature published between 2020 and 2024 because in that period there was a significant increase in the use of interactive teaching materials in learning.

In the period 2020 to 2024, based on data from <https://scholar.google.com/> there is no SLR that specifically examines the extent of the utilization of interactive teaching materials to improve numeracy skills. Therefore, this study aims to collect, review, and analyze the use of interactive teaching materials to improve numeracy skills at various levels of education.

The problem formulations in this study are:

1. What are the types of interactive teaching materials used to improve the numeracy skills of students at various levels from 2020 - 2024?
2. How to utilize interactive teaching materials to improve the numeracy skills of students at various levels from 2020 - 2024?

3. In which materials are interactive teaching materials used to improve the numeracy skills of learners at various levels from 2020 - 2024?

METHOD

Research Design

The method used in this article is a systematic literature review or more commonly called a *Systematic Literature Review* (SLR). SLR uses a structured and systematic approach to obtain, evaluate, and analyze information or evidence contained in the scientific literature. The main objective of SLR is to systematically identify, evaluate and summarize the literature relevant to the research question set (Kitchenham, 2004).

Research Data

The articles reviewed in this study are articles that are relevant research and meet the predetermined inclusion criteria and were published in the period 2020 to 2024. To ensure the accuracy and quality of the data, the articles reviewed were indexed articles in Sinta or National Proceedings. The reason for selecting articles from these journals is to ensure that the articles have gone through a rigorous review process and have a positive impact on science. The article search process was carried out by researchers using the Publish or Perish application and <https://scholar.google.com/>.

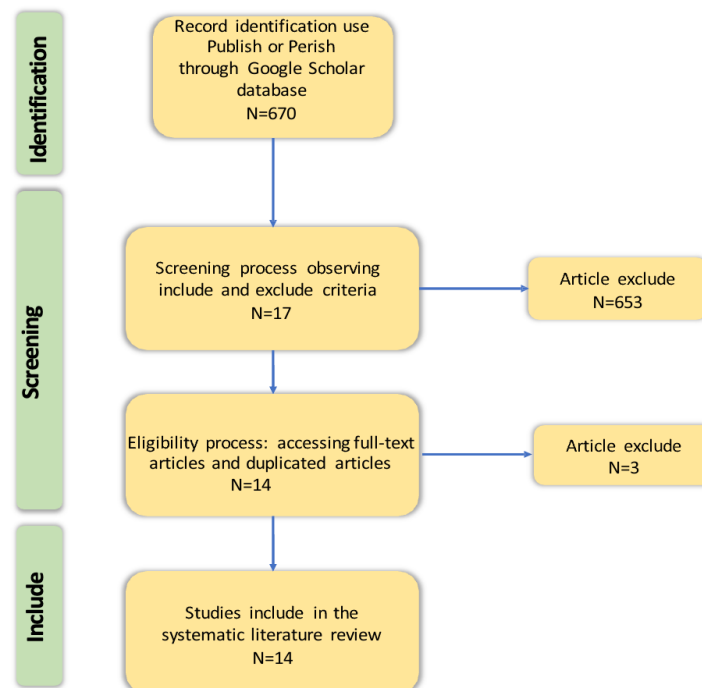
Data Collection

This study uses the Systematic Literature Review (SLR) method which is guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach. The PRISMA guidelines used include eligibility criteria, information sources, search strategies, selection processes, data collection processes, and data items (Ridho & Dasari, 2023). The data used in this study were obtained through electronic search and retrieval using the Publish or Perish application and Google Scholar. The search was conducted using the keywords “Teaching Materials”, “Interactive, ‘Numeracy Skills’”. The articles obtained from the main search stage were then reviewed and evaluated based on the inclusion criteria to obtain research data related to the research objectives. A total of 671 articles were found with these keywords, then the screening process was carried out using predetermined inclusion and exclusion criteria, as listed in table 1.

Table 1. Inclusion and Exclusion Criteria

No	Inclusion Criteria	Exclusion Criteria
1.	Publication between 2020 – 2024	Publication before 2020
2.	Indexed journals	Unindexed journals, SLRs, Journal Reviews, Book Reviews, Books, Dissertations, theses, blogs and more.
3.	Specifically related to the use of interactive teaching materials in learning Mathematics elementary, junior high, and high school / vocational school	the use of interactive teaching materials other than in learning elementary, junior high, high school / vocational mathematics
	Using Indonesia language	Other than Indonesia language
4.	Articles on improving numeracy skills	Article on improving numeracy skills

After filtering articles based on the inclusion criteria in Table 1, 14 articles were used as data in this study. The flowchart of literature selection is shown in Figure 1.

**Figure 1.** Inclusion and Exclusion Criteria

RESEARCH RESULTS

Systematic Literature Review (SLR) in this study was conducted by analyzing articles related to the use of interactive teaching materials on students' numeracy skills. Based on the results of the article analysis, the results obtained as many as 14 articles that are relevant to the use of teaching materials on the numeracy skills of students at elementary, junior high and high school / vocational school levels.

Types of Interactive Teaching Materials Used to Improve Numeracy Skills

Based on the 14 articles that have been reviewed, the results of the types of interactive teaching materials used to improve the numeracy skills of students at various levels from 2020 - 2024 are presented in the following diagram.

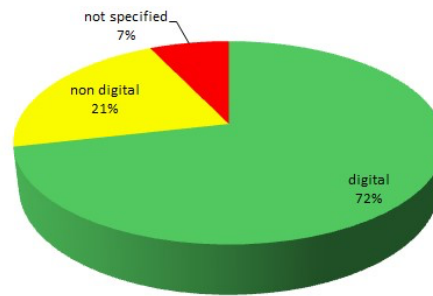


Figure 2. Types of Interactive Teaching Materials to Improve Numeracy Skills

Based on the 14 articles reviewed in this study, it turns out that the types of interactive teaching materials used at various levels of education in Indonesia are 72% digital interactive teaching materials, 21% non-digital, and there are as many as 7% that are not identified whether digital or non-digital based. As much as 72% of the use of digital interactive teaching materials comes from 6 articles studied at the elementary level, 2 articles at the junior high school level and all articles studied from the high school level. The use of non-digital teaching materials as much as 21% was obtained from 2 studies at the elementary level and 1 study at the junior high school level. In addition, there is still 1 study at the elementary level that cannot be identified the type of interactive teaching materials used in the study.

Digital interactive teaching materials used at the elementary level are Canva-based, Educandy Match Up interactive games, Wordwall in the form of web-based applications, PMRI-based multimedia, Video Math Animaker, and digital literacy control cards. At the junior high school level there are Permath Apps and the use of interactive E-modules while at the high school level there are Liveworksheet-based E-LPDs and the use of Canva in TaRL. Non-digital interactive teaching materials were still found to be used at the elementary level in the form of math comics and snakes and ladders games with magic boxes while at the junior high school level in the form of couple numeracy cards. At the elementary level, there is still one study on the use of educational games that does not specifically explain the name, game rules or devices used.

How To Utilize Interactive Teaching Materials To Improve Numeracy Skills

Based on the results of the analysis of 14 articles obtained, researchers obtained data on how to use interactive teaching materials to improve numeracy skills which are presented in the following diagram.

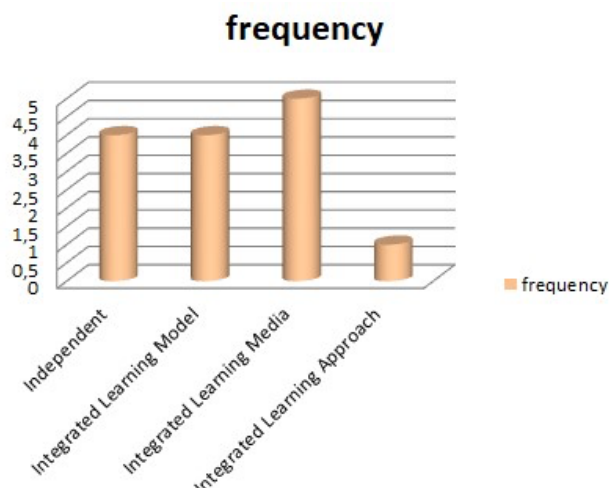


Figure 3. How to Use Interactive Teaching Materials to Improve Numeracy Skills

Based on the data displayed in Figure 3, it turns out that it is dominated by research that states how the use of interactive teaching materials to improve numeracy skills is integrated with interactive learning media, namely as many as 5 studies and 3 of them are at the elementary level, while at the junior and senior high school levels there is only 1 study each that discusses it. In addition, interactive teaching materials are evenly used independently and integrated with learning models to improve numeracy skills at the elementary, junior high and high school levels and only one article states that the use of interactive teaching materials can be integrated with PMRI type learning approaches at the elementary level.

Elements that Use Interactive Teaching Materials to Improve Numeracy Skills

Furthermore, data regarding the material elements that use interactive teaching materials to improve numeracy skills are presented in the following figure.

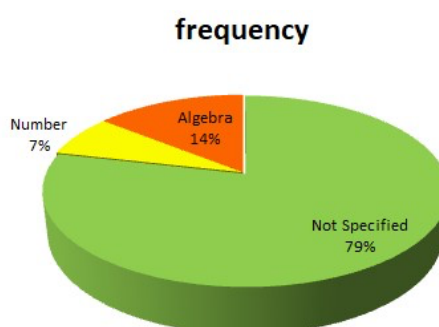


Figure 4. Material Elements Using Interactive Teaching Materials to Improve Numeracy Skills

Based on the data presented in Figure 4, it turns out that there are 79% of articles, namely 11 out of 14 studies that use interactive teaching materials to improve numeracy skills not only on certain material elements. However, there are also studies that state using interactive teaching materials to improve numeracy skills in Algebra elements, namely at the junior and senior high school levels as

much as 1 study each. At the elementary level there is only 1 study that uses interactive teaching materials to improve numeracy skills in certain elements, namely the Numbers element.

DISCUSSION

In the results section, it has been mentioned that there are 72% of studies that use digital interactive teaching materials to improve the numeracy skills of students at various levels of education. This is in line with what Hartono *et al.*, (2022) stated that interactive teaching materials are used in digital form to facilitate their use. Digital interactive teaching materials were found to be most widely used at the elementary level. These interactive teaching materials are either used independently or integrated in learning media in the form of videos, applications, web, or interactive games. This certainly cannot be separated from Piaget's cognitive development theory proposed by Santrok in Wardani (2022) that children aged 7 to around 11 years are in the concrete operational stage. Slavin states children at this stage can form concepts, see relationships, and solve problems, but only as long as they involve familiar objects and situations (Wardani, 2022). Whereas according to Setyani *et al.* (2023) the development of children's numeracy skills is very important for their cognitive development. Efforts to improve numeracy skills should indeed be tailored to the stage of cognitive development of students so that the results are optimal.

Therefore, at the elementary level, many researchers use digital interactive teaching materials in the form of interactive games or videos and animations that are very suitable for use at the elementary level to improve their numeracy skills. In research conducted by Priyatna, the educational game application received a very interesting response from respondents so that this application was able to increase students' learning motivation in Mathematics (Lobo *et al.*, 2024). Based on the data in Yustin's research in Pitanti, the results of a significant increase in math learning were also obtained and respondents liked providing media and learning reactions using educational games made (Lobo *et al.*, 2024). This is because the use of interactive games, animations, videos integrated in an application or web, is a situation and object that is familiar to them especially in this digital era. This is in line with what Niswah stated that learning feels easy to understand and fun if it is game-based (Lobo *et al.*, 2024).

In addition to digital interactive teaching materials, it turns out that there is also research by Saraswati *et al.* (2024) which reveals that the use of interactive teaching materials that are not based on digital devices can also improve the numeracy skills of students at the elementary level. This interactive teaching material is integrated with math comic learning media. In addition, there are also Herninda *et al.* (2024) who use interactive teaching materials integrated with media couple numeracy of junior high school students. In addition, there is similar research conducted by Mumazizah *et al.* (2023) who independently developed a snakes and ladders game based on magic boxes to improve the numeracy skills of elementary school students. The three interactive teaching materials, although not used with

digital devices, can still improve numeracy skills because they are based on interactive games or interactive learning media that can make learning effective and interactive.

Besides being integrated with media, the use of interactive teaching materials can also be integrated with learning models or approaches. Based on the results of the article review in this study, the learning model used is a cooperative learning model, namely Project Base Learning. This is as stated by Indriani *et al.* (2023) as the result of her research that there was an increase in numeracy in mathematics learning using the Project Based Learning Model. In line with this research, research conducted by Pamungkas in Indriani *et al.* (2023) shows that learning using the PBL model has more effect on improving numeracy skills than the usual learning model. This is because the application of the PBL model has a significant effect on the ability to think critically in solving problems around and has a good impact on activities such as mathematical numeracy, critical thinking skills and making decisions in solving a problem (Indriani *et al.*, 2023).

Based on the results in this study, it turns out that in 11 studies the use of interactive teaching materials to improve numeracy skills is not specialized in certain materials. This is in line with what is stated by Anandita (2024) that numeracy is the ability to apply number concepts and number counting skills in everyday life, for example at home, school, or in social life. Kemdikbud in Anandita (2024) also states that the numeracy context includes personal, socio-cultural, and scientific contexts (Mellyzar *et al.*, 2023). Based on the definition and scope of the numeracy context, numeracy skills do not refer to certain materials or subjects but include the ability to apply numeracy in real life. Therefore, the use of interactive teaching materials that use contextual approaches such as PMRI is effective for improving numeracy skills because it is closely related to the numeracy context.

However, there are 3 studies that use interactive teaching materials to improve numeracy skills that specialize in certain elements only, namely in the element of Numbers at the elementary level and in the element of Algebra at the junior high school and vocational school levels. Two of them used Interactive E-Modules and E-LKPD to improve numeracy skills. This is certainly in accordance with the purpose of making modules and LKPD which are indeed specialized only in certain materials.

CONCLUSION

Based on the analysis using the SLR method, it can be concluded that the types of interactive teaching materials in mathematics learning used to improve the numeracy skills of students at various high school levels are digital interactive teaching materials and those that do not use digital devices. These interactive teaching materials are made more interesting and creative in the form of animations, educational games and learning videos. The use of interactive teaching materials to improve numeracy skills can be used independently or integrated in learning media modules, cooperative learning models or contextual-based learning approaches. The learning media used can be interactive games, animations or videos. The media can be application or web-based. The use of interactive teaching materials to improve numeracy skills is not specific to certain materials or lessons. This is in accordance with the

understanding and context of numeracy which includes numeracy application skills in real life. The use of interactive teaching materials to improve numeracy skills that are specialized in certain materials is in the form of E LKPD or E-modules because LKPD and modules are designed only for certain materials. Therefore, it is suggested that further research can take a discussion on the use of hybrid interactive teaching materials (a combination that uses digital and non-digital devices) to improve students' numeracy skills because there is no research on this matter.

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