Systematic literature study on numeracy literacy activities: How to implement it

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Abstract: This article discusses the significance of numerical literacy in the use of appropriate models and media in mathematics education. The Systematic Literature Review (SLR) used in this article aims to analyze, identify, review, and interpret research on the use of models and learning media in improving students' numeracy literacy. This literature review involves three stages based on the PRISMA (Preferred reporting Items for Systematics Review and Meta-Analyses) flow diagram, namely literature screening with 153 documents, the Eligibility stage resulting in 58 relevant documents, and the Qualification stage producing 42 documents meeting the inclusion criteria. The eligible documents were analyzed using thematic analysis, highlighting main themes related to learning models and instructional media in numeracy literacy based on a review of 36 articles. The aftereffects of the examination demonstrate the way that proper models and learning media can upgrade understudies’ numeracy proficiency abilities and assist them with applying numerical ideas in regular day to day existence. The implementation of numeracy literacy can be done through the use of case examples, problem-solving, and utilization of digital technology. Effective learning models for improving numeracy literacy include project-based learning, problem-based learning, Contextual Teaching Learning (CTL), Realistic Mathematics Education (RME), Game Based Learning, and Flipped Classroom. Several learning media that can be used include instructional videos, software, cultural innovations, and numeracy literacy modules. These approaches can help students become more active and engaged in mathematics learning.

Keywords: Learning media, Learning model, Literacy, Mathematics, Numeracy


INTRODUCTION

In many nations, math is taught as part of the curriculum because it is necessary to be numerately literate in order to use mathematical ideas in everyday life. Numeracy education with regards to this exploration alludes to people’s capacity to comprehend, decipher, and apply numerical ideas in different regular settings (Herman et al., 2023). This includes skills in performing calculations, solving practical mathematical problems, and applying mathematical understanding in everyday decision-making (Noviyana & Sugianti, 2024; Panjaitan et al., 2023). This numeracy literacy also enables students to think rationally, critically, systematically, and make decisions in various contexts (Husna, 2023). Numeracy literacy is the ability to understand and use numbers in various every day, work, and academic contexts (Dieckmann, 2008). This definition provides a precise framework for evaluating the extent to which media and learning models can achieve the goals of numeracy literacy in the research. According to the OECD (2022), mathematical literacy is the capacity to formulate, apply, and interpret mathematical concepts in order to resolve real-world issues. This ability is crucial for making rational judgments and choices in the 21st century. Based on Kemdikbudristek (2023), the
The ranking of numerical literacy in Indonesia in PISA 2022 has increased by 5 positions compared to PISA 2018. Despite an overall decrease of 21 points in international numerical literacy scores in PISA 2022, Indonesia's score only experienced a decline of 13 points, which is still better than the international average. The Ministry of Education and Culture also encourages a collective effort to improve the quality of education for all Indonesian students, aiming for even better results in future PISA assessments.

It is vital to assess the adequacy of involving media and learning models in upgrading understudies' numeracy proficiency in math schooling, as there is as yet restricted precise examination resolving this issue. The reason for this writing survey is to give experiences into the production of proficient learning procedures to upgrade understudies' numeracy and education abilities.

In this article, the author will conduct a systematic literature review on the use of media and learning models in mathematics education to enhance students' numeracy literacy. Media and learning models play a crucial role because: (1) Learning media such as images, videos, and audio assist students in understanding mathematical concepts in everyday contexts, (2) Engaging and enjoyable learning models enhance student motivation, (3) Media and learning models aid in effective information retention, (4) They accommodate diverse learning styles, and (5) Provide varied learning experiences. Subsequently, the objective of this study is to find and assess research on the utilization of learning models and media to further develop understudies' numeracy proficiency in arithmetic schooling. It is trusted that this article will make a positive commitment to the improvement of math schooling in Indonesia.

**METHOD**

This research utilizes the Systematic Literature Review (SLR) method. The goal of this study is to accumulate auxiliary information gathered from research results connected with learning models and educational media utilized in numeracy proficiency coordinated learning. SLR contains three principal stages, in particular audit arranging, survey execution, and audit detailing. The need for the review, the research questions, and the protocols for the review are all decided upon during the planning phase. Researchers select the most important studies, extract, analyze, and synthesize the data during the review stage. In the audit detailing stage, analysts compose reports to spread discoveries from the writing survey (Xiao & Watson, 2019). This research employs descriptive data analysis methods.

In this review, the information assortment strategy includes auxiliary information assembled from research results connected with learning models and educational media utilized in numeracy proficiency coordinated learning. This is achieved by using the Publish or Perish (PoP) application with the Google Scholar and Open Knowledge Maps database. The information are arranged utilizing consideration rules that will figure out which exploration will be remembered for the chose research assortment (Ferrari, 2015). The exploration instrument in this SLR is a bunch of consideration models. Coming up next are the laid-out consideration rules to set audit limits:

1. This article discusses learning models and instructional media used in numeracy literacy-integrated learning, regardless of school level.
2. The article represents research conducted in Indonesia and has been published in journals listed on Garuda and SINTA.
3. The publication year range is from January 2019 to May 2023.
4. Center around articles revealing observational discoveries in light of quantitative, subjective, and blended strategies. Hence, hypothetical articles and writing surveys are prohibited.
5. Articles distributed in Indonesian or English.
The research guideline used in the article is PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis). According to Pati and Lorusso (2018), PRISMA is an evidence-based flowchart guideline for writing systematic literature reviews. PRISMA-based literature reviews have three distinct advantages: (1) enabling clear and systematic research question definition, (2) identification of inclusion and exclusion criteria, and (3) utilization of scientific literature databases within a specified timeframe (Shaffril et al., 2018). There are clusters of research with the keywords "Numeracy Literacy and Learning Models" comprising 84 relevant documents, and with the keywords "Numeracy Literacy and Learning Media" comprising 75 relevant documents. Therefore, based on the overview, the Research Questions (RQs) in this study are as follows:

RQ 1: How can the depiction of the execution of numeracy proficiency learn regarding the extended time of distribution?

RQ 2: How can the portrayal of the execution of numeracy proficiency learn regarding the instructive level?

RQ 3: What learning models are most commonly used in numeracy literacy-based learning?

RQ 4: What learning media are used in numeracy literacy-based mathematics education?

RQ 5: What types of the mathematical skills can be brought forth in numeracy literacy-based learning?

This research will proceed to the accompanying phase, the first stage of the systematic literature review, after the Research Questions have been established. Introducing keywords for information search purposes is part of this stage. Table 1 is the search string used to search for articles in Open Knowledge Maps and Google Scholar.

Table 1. List of Search Strings for Article Retrieval

<table>
<thead>
<tr>
<th>Database</th>
<th>Keywords</th>
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<tbody>
<tr>
<td>Open Knowledge Maps</td>
<td>&quot;Numeracy Literacy and Learning Models&quot;, &quot;Numeracy Literacy and Learning Media.&quot;</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>&quot;Mathematical Literacy,&quot; &quot;Numeracy Literacy-Based Learning Models,&quot; &quot;Numeracy Literacy-Based Learning Media.&quot;</td>
</tr>
</tbody>
</table>

Based on the PRISMA flowchart in the Figure 1, the stages of this literature study can be outlined as follows. The Screening stage of the literature review involved 153 documents, with 58 documents passing through after excluding irrelevant ones. The Eligibility stage involved manual exclusion and selection based on author criteria, including time period, document type, language, and indexing. After the screening stage, 58 documents remained. The qualification stage resulted in 42 documents that met the inclusion criteria after removing 95 irrelevant documents.
The reports that passed the qualification cycle were broken down utilizing topical examination to distinguish the primary subjects connected with learning models and learning media in numeracy education. The audit of the 36 articles remembered for this study utilized topical information examination. Topical examination is a strategy used to help with investigating and detailing examples or subjects in light of information gathered by scientists (Braun & Clarke, 2006). According to Fereday and Muir-Cochrane (2006), thematic analysis was used to organize and present a comprehensive overview of the collected data. Consequently, three primary themes emerged: learning models in numeracy proficiency, learning media in numeracy education-based learning, and improvement of numerical abilities through numeracy education-based mastering. The qualitative analysis of the data revealed learning models, learning media, and mathematical abilities that could be improved for literacy-based numeracy instruction.

RESULTS AND DISCUSSION

Results

Based on the mapping of article planning conducted through systematic study, out of 159 documents obtained from Open Knowledge Maps and 341 documents from Google Scholar regarding learning models and media implemented in numeracy literacy-based mathematics education, a total of 36 articles entered the final review process. The analysis of the selected documents is analyzed for the diversity or heterogeneity of numeracy literacy-based learning implementation based on the year of publication, educational level, frequently used learning models and media, as well as mathematical skills utilized in the research to be analyzed.

Study Based on the Publication Year (RQ1)

The research search in this SLR is limited to the period between January 2019 and May 2023. Details of the distribution of research within that timeframe are presented in Figure 2.

In light of Figure 2, it is reasoned that the quantity of distributed examinations connected with the execution of numeracy education-based learning changes and varies between the years 2019 to 2023. The highest number of published articles was in 2022, with a total of 22 articles.

Study Based on the Education Level (RQ2)

Furthermore, the selected articles in this criterion cover various educational levels, including primary schools (SD/MI), junior high schools (SMP/MTs), senior high schools (SMA/MA), and vocational schools (SMK). The research subjects commonly used in these studies are students at the primary school (SD/MI) and junior high school (SMP/MTs) levels. The distribution of articles is shown in Figure 3.
Figure 3 shows that there are 14 articles on the implementation of numeracy literacy-based learning at the elementary school level, followed by 9 articles at the junior high school level and 1 article at the senior high/vocational school level. Because, in accordance with Piaget’s cognitive development stage, children aged 7 to 12 are in the concrete operational development phase, literacy skills in mathematics are required at the elementary and junior high school levels. According to Ekowati and Suwandayani (2018), children use concrete thinking to solve problems during this stage. Practical, contextual, and related-to-issues-in-everyday life numeracy literacy skills support this.

Learning Models In Numeracy Literacy (RQ3)

The results of the analysis of the discussion themes in the selected documents yielded one of the main themes, namely the learning models extensively studied in numeracy literacy, totaling 30 articles. The research findings based on the established inclusion criteria can be seen in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Writers, Year</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Kafiar et al., 2021)</td>
<td>Problem-Based Learning (PBL) enhances students’ mathematics literacy based on Higher Order Thinking Skills (HOTS) and develops their abilities in analysis, evaluation, and synthesis.</td>
</tr>
<tr>
<td>2</td>
<td>(Pamungkas &amp; Franita, 2019)</td>
<td>PBL enhances students’ mathematical literacy, critical thinking, and creativity, while also promoting active engagement and social skills.</td>
</tr>
<tr>
<td>3</td>
<td>(Sulasih et al., 2022)</td>
<td>Problem-based mathematics learning enhances students’ literacy, numeracy, as well as critical and creative thinking abilities, through the application of mathematical concepts in everyday life contexts.</td>
</tr>
<tr>
<td>4</td>
<td>(Wati &amp; Syafitri, 2022)</td>
<td>STEM-based PBL effectively enhances students’ numeracy literacy through integrated learning experiences involving science, technology, engineering, and mathematics, while also developing higher-order cognitive abilities.</td>
</tr>
<tr>
<td>5</td>
<td>(Nisa, 2023)</td>
<td>PBL aided by Quizizz effectively enhances students' numeracy skills through enjoyable and interactive learning experiences, as well as instant feedback from the Quizizz application.</td>
</tr>
<tr>
<td>6</td>
<td>(Awami et al., 2022)</td>
<td>PBL effectively enhances numeracy literacy through the development of critical thinking, creative thinking, independent problem-solving skills, and helps overcome fear and lack of confidence in solving mathematical problems.</td>
</tr>
<tr>
<td>7</td>
<td>(Simamora et al., 2022)</td>
<td>Etnomathematics-based PBL actively involves students in learning and enhances their understanding of mathematical concepts and social skills.</td>
</tr>
<tr>
<td>8</td>
<td>(Widiastuti &amp; Kurniasih, 2021)</td>
<td>PBL with Cabri 3D V2 enhances students’ numeracy literacy, aids in visualizing mathematical concepts, and develops students’ critical and creative thinking skills.</td>
</tr>
<tr>
<td>No.</td>
<td>Writers, Year</td>
<td>Findings</td>
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</tr>
<tr>
<td>9</td>
<td>Mawarsari &amp; Wardani, 2022</td>
<td>The implementation of PBL enhances understanding of mathematical concepts, critical and creative thinking skills, and active student engagement in everyday problem-based learning.</td>
</tr>
<tr>
<td>10</td>
<td>Ambarwati &amp; Kurniasih, 2021</td>
<td>PBL aided by YouTube media enhances numeracy literacy in understanding mathematical concepts, and moreover, as a learning resource, it provides an engaging learning experience and motivates students.</td>
</tr>
<tr>
<td>11</td>
<td>Kurnila et al., 2022</td>
<td>PBL with portfolio assessment enhances mathematical literacy and helps students monitor and evaluate their learning progress.</td>
</tr>
<tr>
<td>12</td>
<td>Nurlaela &amp; Imami, 2022</td>
<td>PBL is effective in improving students' mathematical literacy and helps increase their motivation and interest in learning.</td>
</tr>
<tr>
<td>13</td>
<td>Prasetya et al., 2023</td>
<td>PBL enhances students' mathematical literacy in understanding, communication, and develops problem-solving and teamwork skills within groups.</td>
</tr>
<tr>
<td>14</td>
<td>Sumarno et al., 2022</td>
<td>The integrated project-based learning approach enhances bilingual students' literacy and numeracy. Students become actively engaged, involved, and capable of understanding and applying literacy concepts.</td>
</tr>
<tr>
<td>15</td>
<td>Faridah et al., 2022</td>
<td>Project Based Learning (PjBL) is effective in improving numeracy literacy skills, social skills, and collaboration among students, as well as their ability to understand mathematical concepts.</td>
</tr>
<tr>
<td>16</td>
<td>Hamidah &amp; Listiani, 2022</td>
<td>PjBL can enhance students' mathematical literacy skills and also increase their motivation and active participation in mathematics learning.</td>
</tr>
<tr>
<td>17</td>
<td>Hadi &amp; Zaidah, 2022</td>
<td>The numeracy literacy skills and self-efficacy of madrasah students in realistic mathematics are high, but systematic efforts are needed, including teacher training, curriculum development, and research on factors influencing students' self-efficacy.</td>
</tr>
<tr>
<td>18</td>
<td>Maghfiroh et al., 2021</td>
<td>The approach of Indonesian Realistic Mathematics Education (PMRI) is effective in enhancing students' numeracy literacy skills in elementary schools.</td>
</tr>
<tr>
<td>19</td>
<td>Diva et al., 2022</td>
<td>The implementation of PMRI (Realistic Mathematics Education in Indonesia) with Higher Order Thinking Skills (HOTS) questions effectively enhances students' numeracy literacy, as well as aids in their understanding of mathematical concepts and critical thinking skills in HOTS comprehension tests.</td>
</tr>
<tr>
<td>20</td>
<td>Istiana et al., 2020</td>
<td>Realistic Mathematics Education (RME) learning has a positive impact on students' numeracy literacy skills, helping them understand mathematical concepts and develop analytical skills and problem-solving abilities.</td>
</tr>
<tr>
<td>21</td>
<td>Muhammad, 2022</td>
<td>The implementation of the Catung game culture innovation significantly enhances students' literacy and numeracy abilities, making it enjoyable, interactive, and effective, while actively engaging students.</td>
</tr>
<tr>
<td>22</td>
<td>Huda &amp; Cacik, 2023</td>
<td>The implementation of the TGT (Team Game Tournament) Model with the Rolling Ball activity enhances students' literacy and numeracy skills while increasing motivation and interaction among students in their learning process.</td>
</tr>
<tr>
<td>23</td>
<td>Ulfa et al., 2022</td>
<td>The utilization of game-based mastering upgrades education and numeracy abilities and is likewise successful and pleasant in working on the proficiency and numeracy capacities of grade school undergraduates.</td>
</tr>
<tr>
<td>24</td>
<td>Muqtafia et al., 2022</td>
<td>Mathematics learning with the CTL (Contextual Teaching and Learning) approach enhances students' numeracy skills. Students connect mathematical concepts to everyday life, gain understanding, and are able to solve problems and communicate systematically.</td>
</tr>
<tr>
<td>25</td>
<td>Mulyandani &amp; Hasyda, 2022</td>
<td>The implementation of the Contextual Teaching and Learning (CTL) model, specifically the CRH (Connecting, Reflecting, and Harnessing) type, effectively enhances numeracy literacy skills and develops critical thinking, communication, collaboration, motivation, and active participation in learning.</td>
</tr>
<tr>
<td>26</td>
<td>Sirait et al., 2022</td>
<td>Etomathematics-based CTL (Contextual Teaching and Learning) enhances students' numeracy literacy skills by enabling them to develop an understanding of mathematical concepts through cultural experiences and everyday life.</td>
</tr>
<tr>
<td>No.</td>
<td>Writers, Year</td>
<td>Findings</td>
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</tr>
<tr>
<td>27</td>
<td>(Yani et al., 2021)</td>
<td>The CTL approach supported by animated comics enhances the numeracy literacy skills of lower-grade students and also helps develop their creativity and critical thinking abilities.</td>
</tr>
<tr>
<td>28</td>
<td>(Mauza et al., 2022)</td>
<td>The implementation of the integrated STEAM learning model with KNISLEY (Knowledge, Numeracy, Inquiry, Science, Literacy, Engineering, and You) is effective in improving numeracy literacy and student learning outcomes, especially in understanding mathematical concepts and developing problem-solving skills, collaboration, communication, critical thinking skills, and self-confidence.</td>
</tr>
<tr>
<td>29</td>
<td>(Saniah &amp; Nindiasari, 2023)</td>
<td>The implementation of Flipped Classroom integrated with the Discovery Learning model is effective in improving numeracy skills, especially for students with high mathematical disposition.</td>
</tr>
<tr>
<td>30</td>
<td>(Rosalinda &amp; Rahmawati, 2022)</td>
<td>The implementation of the MACATUNG cultural innovation for numeracy literacy in elementary schools is effective in improving students’ literacy and numeracy skills.</td>
</tr>
</tbody>
</table>

Figure 4 represents the data from 30 research articles found in Table 2, which are studies conducted within the past 5 years (2019 - 2023) on the implementation of learning models in numeracy literacy. In Figure 4, it can be observed that the most commonly used learning model is Problem Based Learning (PBL) with 41% of the articles, followed by Realistic Mathematics Education (RME) and Contextual Teaching Learning (CTL) with 13% each, and Project Based Learning (PjBL), Game Based Learning, and STEM with 9% each. There are also 6% of other articles that utilize different learning models, but with the lowest number of articles.

**Learning Media in Numeracy Literacy (RQ4)**

Meanwhile, in terms of the criteria for instructional media used in numeracy literacy-based mathematics learning, there are a total of 9 selected articles, as shown in the Table 3. Figure 5 illustrates a concept map showcasing frequently used teaching media in research focused on numeracy literacy learning.
Based on literature findings, several media can be used in numeracy literacy learning, including flipbook, Quizizz, STEM based teaching materials, worksheets, software Cabri 3D, problem cards, instructional videos, animated comics and YouTube media.

**Table 3. Study on Instructional Media in Numeracy Literacy**

<table>
<thead>
<tr>
<th>No.</th>
<th>Writers, Year</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Musyafak &amp; Agoestanto, 2022)</td>
<td>The use of STEM-based instructional materials that focus on numeracy literacy can enhance students' critical thinking skills in PBL (Problem-Based Learning) instruction.</td>
</tr>
<tr>
<td>2</td>
<td>(Widiastuti &amp; Kurniasih, 2021)</td>
<td>The utilization of Cabri 3D V2 software enhances students' numeracy literacy skills and facilitates teachers in designing problem-based learning with interactive mathematical models.</td>
</tr>
<tr>
<td>3</td>
<td>(Khusna &amp; Warli, 2022)</td>
<td>PBL worksheets are effective in enhancing students' literacy and numeracy skills while also developing critical and creative thinking abilities.</td>
</tr>
<tr>
<td>4</td>
<td>(Nasution et al., 2022)</td>
<td>Since students are guided to construct concepts through problem cards during the learning process, providing problem cards is effective in improving students' mathematical calculation skills.</td>
</tr>
<tr>
<td>5</td>
<td>(Winarni et al., 2021)</td>
<td>Mathematics instructional videos enhance students' motivation, interest, and understanding of mathematical literacy concepts, as well as their digital literacy skills in the current digital era.</td>
</tr>
<tr>
<td>6</td>
<td>(Yani et al., 2021)</td>
<td>Animated comics are effective as a mathematics learning media that is engaging and interactive. They enhance the interest, motivation, and numeracy literacy skills of lower-grade students through sequentially presented and clear visuals.</td>
</tr>
<tr>
<td>7</td>
<td>(Ambarwati &amp; Kurniasih, 2021)</td>
<td>Using YouTube as a learning media in the Problem-Based Learning (PBL) model effectively enhances students' numeracy literacy skills through engaging and interactive learning resources that help students visualize mathematical concepts.</td>
</tr>
<tr>
<td>8</td>
<td>(Sandy et al., 2022)</td>
<td>The flipbook learning media is effective for use in numeracy literacy-based learning, as it provides an interactive and engaging platform for students.</td>
</tr>
<tr>
<td>9</td>
<td>(Nisa, 2023)</td>
<td>Quizizz as a tool in the Problem-Based Learning (PBL) model, can help students understand mathematical concepts interactively and in an enjoyable manner. It assists teachers in evaluating students' understanding through interactive questions and immediate feedback provided by the application. Additionally, Quizizz enables students to engage in independent practice.</td>
</tr>
</tbody>
</table>

**Study by Type the Mathematical Skills (RQ5)**

This study also identified several 21st-century skills, including at least 11 mathematical hard and soft skills. As shown in Figure 6, which represents the implications of numeracy literacy-based learning, these skills include critical thinking, creativity, mathematical reasoning, problem-solving, and mathematical communication, aligning with the descriptions stated in (OECD, 2022).

Furthermore, from the selected 36 articles, it was found that the implemented instructional models and teaching media in numeracy literacy-based mathematics instruction not only enhance numeracy literacy skills but also improve several other higher-order thinking skills in mathematics. Several potential implications for educators and policymakers are that the learning models and instructional media identified in this research can serve as a source of inspiration. Educators can adapt effective strategies and methods to enhance students' numeracy literacy. It is essential to implement teacher training programs to support the development of learning materials based on the learning models and instructional media identified in this study. These materials can be tailored to meet local and global needs in order to fulfill numeracy literacy standards.
Based on inclusion criteria, research related to integrated learning models and instructional media with numeracy literacy was most significantly published in 2022, totaling 22 articles. The research methods used were highly diverse, but many researchers were interested in capability analysis and literature studies. Subsequently, studies emerged that linked it with mathematical abilities, learning models, and appropriate instructional media used for numeracy literacy learning. Based on research findings, the implementation of numeracy literacy learning is predominantly studied at the elementary (SD/MI) education level. Some of the influencing factors include, for example, the elementary school level being considered a crucial foundation in developing numeracy skills (Akbar et al., 2023), this can provide insights into how the numeracy learning process begins and evolves (Manguni, 2022), numeracy literacy at the elementary level is often viewed as a preliminary step in forming an understanding of mathematical concepts (Safitri, 2023), research at the elementary level can support early intervention efforts to identify and address difficulties in numeracy literacy from an early stage, providing opportunities for early improvement (Ulumiah, 2022), research at the elementary level can also offer insights to educators on the most effective teaching methods and suitable approaches to aid the development of numeracy literacy in the early stages of education (Sutama et al., 2022).

Based on the literature review above, Problem Based Learning (PBL) is effective in improving mathematical literacy and student engagement in learning, as supported by research findings (Wahyudi et al., 2021; Buyung et al., 2020; Purwanti et al., 2019; Siagan et al., 2019). PBL also develops 21st-century skills and mathematical problem-solving abilities. In this regard, the role of the teacher as a facilitator and guide in PBL is crucial. Project Based Learning (PjBL) is a learning method that supports numeracy literacy activities, with students taking responsibility for their learning and producing projects that demonstrate their knowledge (Bell, 2010). PjBL offers advantages in advanced technology skills, communication, and advanced problem-solving. However, for effective implementation, careful consideration should be given to the selection of appropriate projects, clear project guidelines, the formation of balanced groups, teacher coaching and guidance, as well as objective project evaluation (Holmes & Hwang, 2016).

The Realistic Mathematics Education (RME) approach is effective in improving mathematical literacy and students' independent character by integrating PBL and ICT (Wardono et al., 2018; Dianawati et al., 2018). For effective use of PMRI, teachers need to understand the basic principles of PMRI, design lessons that integrate realistic aspects, create questions that encourage critical and creative thinking, provide opportunities for active student participation, and utilize media and technology in teaching (Sembiring et al., 2008). As stated in Kebritchi et al. (2010), Game-based learning can enhance numeracy literacy as it motivates and actively engages students in learning mathematics. Games can provide enjoyable and immersive learning experiences, strengthening students' understanding of mathematical concepts.
However, according to (Ilhan, 2021), for effective use of game-based learning, several factors need to be considered, including: (1) selecting games relevant to the content, (2) integrating games with the curriculum and instruction, (3) adjusting games to match student characteristics and appropriate difficulty levels, (4) maintaining focus on learning objectives, (5) using technology that supports learning, and (6) measuring effectiveness for evaluation purposes.

Contextual Teaching Learning (CTL) is a teaching model that uses real-world contexts to help students relate mathematical concepts to everyday life. This lines up with the affirmation by Afni and Hartono (2020) that CTL upholds numeracy-based discoverying that is connected with the utilization of arithmetic in day to day existence. However, in its implementation, CTL needs to consider effective stages, appropriate context selection, and assessment aligned with CTL concepts (Maryani & Widjajanti, 2020). Other teaching models such as STEM, Flipped Classroom, and culturally-based mathematics learning can also be integrated into numeracy literacy education. This is in line with research by Ferme (2018) on the important role of STEM in numeracy, Uzunboylu and Karagozlu (2015) on Flipped Classroom as an educational innovation, and Aikenhead (2021) which states that culturally-based mathematics learning will help students understand mathematical concepts and increase their interest.

The mathematics teaching model that can be integrated into numeracy literacy using video media (Winarni et al., 2021) is the blended learning or flipped classroom model (Saputra & Mujib, 2018). These models combine videos with other interactive activities for flexible learning and increased student engagement. The use of videos can facilitate students' understanding of the material, both in problem-based learning for initial information (Janah et al., 2019) and in introducing relevant information sources. However, the use of videos should be combined with interactive activities such as discussions or student explorations for effective learning.

Participant Worksheets (LKPD) are effective teaching media utilized in various instructional models such as Problem-Based Learning (Astuti, 2021), Discovery Learning (Osin et al., 2019), and Contextual Teaching and Learning (Agustina, 2019). LKPD serves as tools to understand problems, engage in exploration, and connect learning materials with everyday life contexts. However, the effectiveness of using LKPD depends on appropriate design and implementation within the instructional context, supported by suitable approaches and learning strategies. Another media is Animated Comics, which can be effective when used in project-based learning models that prioritize creativity and visualization. In this instructional model, students are challenged with projects involving problem-solving or product development, utilizing various resources, including creative media such as animated comics. Through these projects, students can develop critical thinking skills, creativity, collaboration, and deepen their understanding of the learned concepts (Yani et al., 2021).

Flipbooks or electronic modules can be effective teaching media in various instructional models such as problem-based learning, project-based learning, and flipped classroom (Soheb & Widiyanti, 2022; Ningtyas et al., 2020; Wijayanto & Zuhri, 2014; Danuri & Nurjanah, 2022). In problem-based learning, flipbooks can be easily accessed by learners anytime and anywhere, assisting them in acquiring information and solving given problems. In project-based learning, flipbooks can provide guidance and references for learners in project implementation. In flipped classrooms, flipbooks can be used as self-learning materials before or after instructional activities. Quizizz is effective in various instructional models, particularly in technology-based and digital technology-based learning, such as blended learning, flipped classroom, or remote learning (during pandemic situations). Quizizz can enhance the effectiveness of learning and can be utilized in mathematics instruction through interactive games that actively involve learner participation. The type of mathematical skill most commonly developed in numeracy literacy-based learning research is critical thinking. This is supported by a study conducted by Kintoko et al. (2022), which states that numeracy literacy can enhance critical thinking abilities.
CONCLUSION

Some learning models such as PBL (Problem-Based Learning) and PjBL (Project-Based Learning) are effective in enhancing numeracy literacy. PBL can improve mathematics skills based on higher-order thinking and student engagement in learning. PjBL can facilitate numeracy literacy-based learning activities through inquiry, technology, communication, and problem-solving approaches. PMRI (Realistic Mathematics Education) with the use of ICT (Information and Communication Technology) and blended learning can also be effective alternatives, but attention is needed in their implementation. Learning media such as instructional materials, Cabri 3D software, participant worksheets (LKPD), problem cards, instructional videos, animated comics, flipbooks, and Quizizz can enhance the effectiveness of learning activities. Instructional videos and flipbooks are effective in blended learning or flipped classroom models. Instructional materials, LKPD, and problem cards are effective in problem-based learning (PBL), discovery learning, and contextual teaching learning (CTL) models.

Animated comics are effective in project-based learning models. Quizizz is effective in technology-based and game-based learning models. E-modules are also effective in various learning models depending on the context and learning objectives. It was found that in numeracy literacy learning activities, various models or approaches and learning media contribute to the development of 21st-century skills necessary to address global challenges. With respect to suggestions, further exploration is expected to investigate the strong and inhibitory variables in executing numeracy education learning exercises, for example, educational program support, educator ability, or understudies' earlier information and discernments connected with numeracy proficiency, to grasp the logical elements that impact execution and distinguish improvement procedures to upgrade the execution of numeracy education learning, especially at the secondary school and professional school levels, as the quantity of related articles on these points is as yet restricted.

Students must have a solid understanding of how to solve a variety of mathematical problems in a variety of situations, making numerical literacy an essential skill that affects other cognitive processes (Clerkin & Gilligan, 2018; Gabriel et al., 2020). Domu et al (2023) and Han et al (2017) affirm that literacy skills significantly contribute to social, economic, and individual as well as societal well-being. These suggestions are expected to inspire and guide future research in further exploring the implementation of numeracy literacy learning activities and making tangible contributions to the development of effective numeracy literacy learning approaches.

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