How Important of Students' Literacy and Numeracy Skills in Facing 21st-Century Challenges: A Systematic Literature Review

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Abstrak

Keterampilan Literasi Berhitung (LNS) merupakan hal mendasar untuk menghadapi tantangan global di abad ke-21. LNS dapat membantu orang mencapai tujuan mereka. Namun, belum ada kajian mendalam mengenai penelitian literasi dan numerasi. Untuk meningkatkan kualitas penelitian literasi dan numerasi, peneliti harus mempelajari banyak literatur untuk dianalisis lebih lanjut. Penelitian ini bertujuan untuk menganalisis kemampuan literasi dan numerasi siswa dalam menghadapi tantangan abad 21. Metode penelitian yang digunakan adalah Systematic Literature Review membaca 27 dokumen dengan mencari kata kunci "literacy", "numeracy", dan "Literacy and Numeracy". Jenis penelitian yang digunakan adalah penelitian kepustakaan dengan tahapan menentukan pertanyaan penelitian, pencarian literatur, pemilihan artikel, membaca makalah secara lengkap, membuat abstraksi, dan melakukan analisis. Teknik analisis data yang digunakan adalah analisis isi. Hasil penelitian menunjukkan bahwa metodologi penelitian yang dominan digunakan adalah kuantitatif; instrumen yang sering digunakan adalah tes dan penilaian. Bidang utamanya adalah matematika; tingkat pendidikan secara keseluruhan adalah sekolah menengah pertama dan pendidikan anak usia dini. Beberapa hasil penelitian motivasi terkait keterampilan literasi dan numerasi antara lain kompetensi digital, video pembelajaran, dan permainan, efektif meningkatkan keterampilan literasi dan numerasi. Selain itu, tidak semua peserta didik memiliki kemampuan membaca dan berhitung yang kuat. Rekomendasi kuat bagi penelitian selanjutnya adalah mengembangkan media pembelajaran berbasis kearifan lokal dengan menggunakan platform Android. Selain itu, peneliti harus menanamkan literasi darurat dalam desain dan studi kasus penelitian yang berorientasi didaktik dan pedagogi..

Kata kunci: Literasi, Numerasi, Abad 21, Systematic Literature Review

Abstract

Literacy Numeracy skills (LNS) are fundamental for facing global challenges in the 21st century. LNS can help people achieve their goals. However, there has not been a thorough study on literacy and numeracy research. To improve the quality of literacy and numeracy research, researchers must study much literature for further analysis. This research aims to analyze students' literacy and numeracy skills in facing 21st-century challenges. The research method used is the Systematic Literature Review to read 27 documents by searching for the keywords "literacy", "numeracy", and "Literacy and Numeracy". This type of research is library research with the stages of determining research questions, searching literature, selecting articles, reading full papers, making abstractions, and conducting analysis. The data analysis technique used is content analysis. The study results show that the dominant research methodology used is quantitative; the instruments often used are tests and assessments. The chief field is mathematics; the overall educational level is junior high school and early childhood education. Some motivational results research related to literacy and numeracy skills includes digital competencies, learning videos, and games, effectively improving literacy and numeracy skills. Furthermore, not all learners have strong reading and numeracy abilities. A strong recommendation for further research is to develop learning media based on local wisdom using the Android platform. In addition, researchers must embed emergent literacy in the design and case study of didactically and pedagogically oriented research.

Keywords: Literacy, Numeracy, 21st Century, Systematic Literature Review

1. INTRODUCTION

Literacy and numeracy research is very urgent because the literacy and numeracy skills of Indonesian students in the PISA survey in 2018 were 379 for mathematics, below the average score for participants in the Organization of Economic Co-operation and Development *Organization of Economic Co-operation and Development* (OECD), namely 489. According to the OECD, in the field of mathematics, about 71% of students do not reach

the minimum competency level of mathematics (Deda et al., 2023; Suprapto et al., 2020). This means that there are still many Indonesian students who have difficulty dealing with situations that require problem-solving skills using mathematics. According to the OECD, in the field of reading, around 27% of Indonesian students have competency level 1b, a level where students can only solve the easiest text comprehension questions, such as picking out information that is stated clearly, for example from the title of a simple and general text or from a simple list (Kesumadewi et al., 2020; Sulo et al., 2012; Zafar et al., 2020).

Literacy skills are fundamental for understanding more complex concepts daily in the 21st century (Irving, 2006; Prihandoko, 2021; Salma, 2019). Literacy skills may help people achieve their goals at any stage. For example, for a student, a lower level of literacy may prevent them from graduating from high school. Moreover, adults will have difficulty finding work, while parents will be unable to disrupt their children's learning process (Iswara et al., 2022; Khofifah & Ramadan, 2021). Numerical literacy is very important for all countries, including Uganda and Indonesia. Only 13.6% of four elementary school children in Uganda can read and understand stories. A similar pattern, researchers observed in numeracy performance, with 31.9% of the four primary school learners achieving the best numeracy level. Uganda's condition is caused by mothers who are not educated (Cahyani et al., 2021; Lubaale et al., 2021).

Furthermore, the variables of children's literacy and numeracy disparity in Uganda are age and grade, individual characteristics, home resources, components of the educational organisation, and locational factors (Khofifah & Ramadan, 2021; Urwick, 2022). In Indonesia, based on the Reading Literacy Activity Index for 34 Provinces issued by the Education Ministry, 24 provinces, or 71%, are classified as having a high literacy level. This data shows that while the general public, particularly students, can read, they cannot comprehend the text's content and meaning. They also strongly desire to answer questions based on information found in reading materials. Because of this, literacy must be improved, one of which is through the minimum competency assessment (AKM) implementation. AKM assists teachers in understanding the literacy of their students, allowing them to plan educational activities that are appropriate for their level or age.

According to the goals of AKM, various learning content can help students develop critical thinking skills, including literacy and numeracy. Students can master other subject content quickly through the basics of these competencies. Numeracy is the knowledge, skill, and behaviour students need to use mathematics in various situations, including introducing and understanding mathematics. It can utilise this knowledge and abilities according to its goals (Iswara et al., 2022; Rohmah et al., 2022). Students also need numeracy skills in their daily activities, for example, calculating the time it takes to arrive at a place or choosing books of good quality but affordable prices. To be a citizen, you must have the ability to understand statistics and graphs in the news, as well as information on government policies and related programs. The importance of numerical ability is highlighted by the daily need to use and apply various mathematical concepts (Geiger, 2018; Monteleone et al., 2018). Despite this, the ability to strike does not appear to be the same as a higher level of mathematical understanding but rather a more complex level of performance.

The way to improve one's numerical skills in the real world is to improve one's mathematical knowledge**.** Thus, it's not just math that makes it easier for people to understand other people's ideas; it also requires numeric skills so that people may access and use more advanced knowledge in various areas of their lives (Geiger, 2016, 2018; Oktafiani et al., 2020). Literacy and numeracy are fundamental skills in facing the 21st century. The aims of this study is to analyze numeracy literacy in facing 21st-century challenges.

2. METHODS

This type of research is library research with the stages of determining research questions, searching literature, selecting articles, reading full papers, making abstractions, and conducting analysis. The data analysis technique used is content analysis. The researchers directed the systematic literature review (SLR) process (Chalkiadaki, 2018; Kalogiannakis et al., 2021; Kernagaran & Abdullah, 2022). The process began with outlining the research's aim, followed by a literature search. The Procedure was then repeated by reading papers' abstracts to catch the prior study's fundamental idea. Reading the entire article became necessary for clarification and in-depth understanding. The Procedure is show in Figure 1.
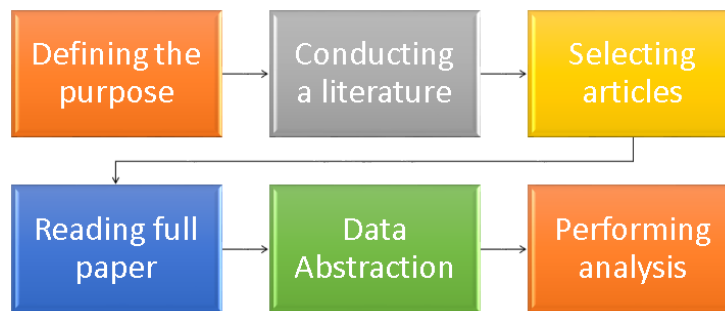

Figure 1. The Procedure of Systematic Review

According to Figure 1, first step researchers set goals based on this research question. The second step is to look for article publication data in three databases: the Eric Institute of Education Sciences, Scopus Elsevier, and the Science and Technology Index (Sinta). The search criteria in the three databases use the keywords "literacy", "numeracy", and "numeracy AND literacy". The search results obtained 90 papers consisting of 20 documents from the Sinta database, 29 from the Scopus database, and 41 from Eric's database. The next stage was to select 37 articles by reading titles, abstracts and keywords from 2013-2022 mathematics and language. The next step is to read 37 full papers; the review focuses on four criteria: how researchers selected the research participant, found the methods and instruments, analysis of data and findings, and the numeracy skills field used in the research in the article belonging to the domains of general mathematics, social sciences, education, language and health sciences. The Sinta Journal and Scopus, an open-access Journal, were selected to identify relevant literacy and numeracy skills studies. Finally, 27 papers choose due to the procedure for study selection. Of the 27 articles used to assess literacy and numeracy abilities, there were six educational articles, eight articles on General Mathematics, 8 Social Science educational articles, and three articles related to language. Two articles related to health sciences. The 27 papers consist of six from the Scopus database, ten from the ERIC Institute of Education Sciences, and 11 from the Science and Technology Index (SINTA).

3. RESULTS AND DISCUSSION

Result

Base on Figure 2, it acquired an overall of papers in the general math (mathematics education) area from 27 articles selected. It suited the field of study, which was more significant than research in other disciplines. As a result, the discussion point will be examined in greater depth regarding the instruments, data analysis, and research methodologies employed in these sorts of papers. One item will be interpreted, and afterwards, another. The typical research methodology used in numeracy skills research is the

quantitative study, and the instruments and tools used are tests and assessments is show in Figure 3.
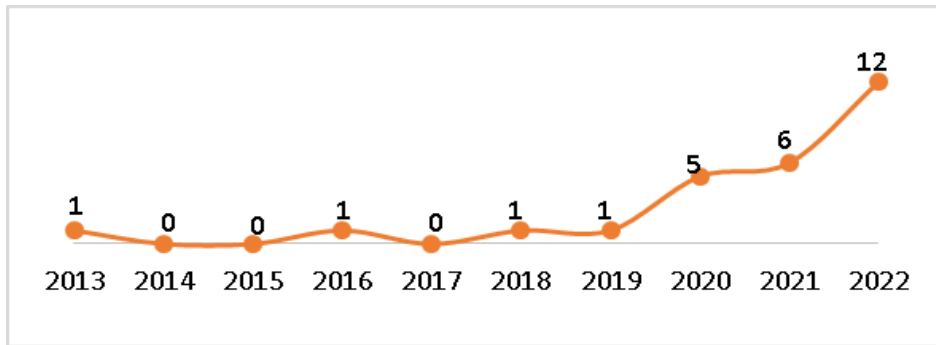

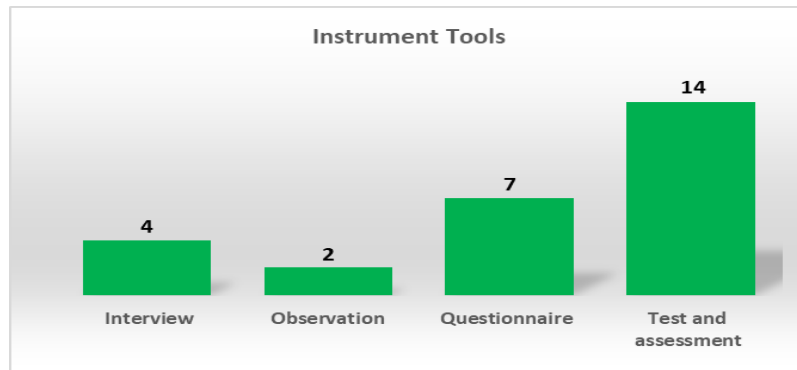**Figure 2**. Trend Research of Literacy and Numeracy

Figure 3. Frequency of Instrument Tools in Studies

Based on Figure 3, the most widely used instrument tools are tests and assessments, namely 14 documents followed by 7 document questionnaires, 4 document interviews, and two documents using observation as instrument tools. Methodology in studies is show in Figure 4.
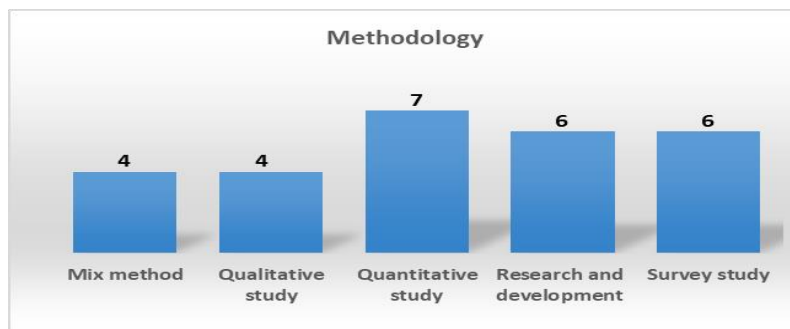

Figure 4. Methodology in Studies

Based on Figure 4, the dominant methodology used is a quantitative study, namely seven documents, followed by research development of 6 papers, six documents utilising the survey method, four documents using a qualitative study as a methodology and four documents using a mixed method as a methodology. The content areas, participants and educational level is show in Figure 5.
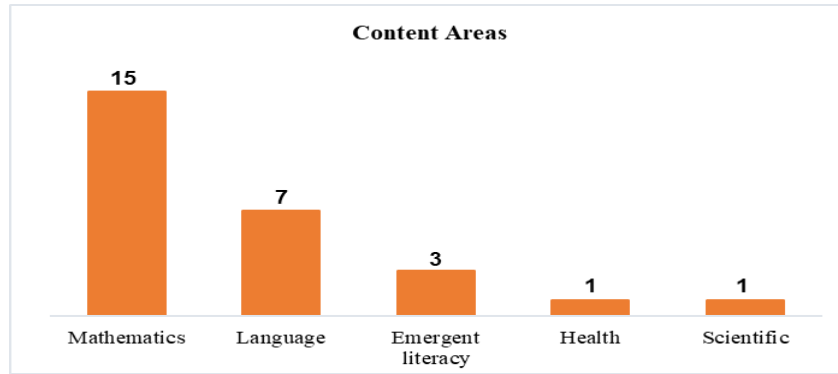
Figure 5. Frequency of Content Areas in all Studies

Based on Figure 5, the dominant context area is mathematics, namely 15 documents, followed by language with seven papers, 3 in the emergent literacy area, 1 in the health area and 1 in the scientific area. The educational level in the systematic review is show in Figure 6.
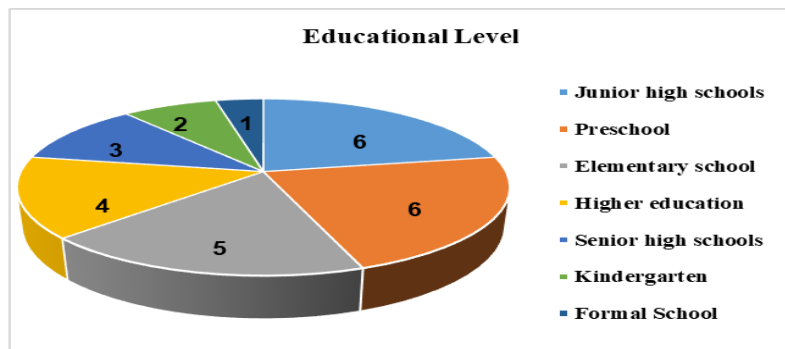

Figure 6. The Educational Level in the Systematic Review

Based on Figure 6, the dominant Educational Level is Junior high schools and preschool level, namely six documents each. At the same time, in Elementary school, five papers, three copies at the Higher education level, three at the Senior high school level, two at the Kindergarten level, and one at the Formal School.

Discussion
Motivational Outcomes Research

The review results indicated that Numeracy skills greatly enhanced the HSRT-N domain in pharmacy students (Carpenter et al., 2022; Genlott & Grönlund, 2013). Reading skills were enhanced in writing skills. Language media use positively influences children's developing language skills. In addition, Student Worksheets (LKPD), as stated in AKM, are valid and practical to implement in math learning (Miftah & Setyaningsih, 2022; Putri et al., 2022). LSLC resources contain cultural values that fulfil realistic, applicable, and successful requirements.

Furthermore, video learning is effective regarding SNL abilities and digital literacy skills (Dore et al., 2020; Winarni et al., 2021). The IBL model affects learners' numeracy abilities. Mathematics problems Significantly increase kids' numeracy abilities. The Math Zap game of cards is a handy instructional tool for improving students' numeracy calculation abilities of fractions, percentages, and decimals (Alvionita et al., 2022; Singh et al., 2021).

The review results also indicate a positive relationship between M.D. scores and emergent literacy in 5 years old children. There is also a positive correlation between digital

competency with D.C., digital security, and digital development mastery (Juhaevah, 2022; Prihandoko, 2021). However, Students with poor abilities do not satisfy the numeracy literacy parameters, students with moderate abilities have multiple numeracy literacy criteria that are not fulfilled, and students with high capacity can meet the numeracy literacy criteria (Özkür, 2020; Rezky et al., 2022). The disparity in achievement in literacy skills shows that not all students can solve broadly related general problems in everyday life. Not all students can analyse the information obtained from questions and then carry out analytical interpretations to make predictions and draw conclusions (Genlott & Grönlund, 2013; R & Ratnasari, 2022). So, research is needed to support improving students' literacy and numeracy skills, especially students in isolated areas.

Recommendations for Future Research

The first education articles aim to contribute to the development of improved ways for teaching young children to read and write. We tested a novel technique in two first-grade classes, with two more serving as a group to be monitored. Previous study used an experimental study method with a research instrument in the form of a formative assessment to achieve its objectives (Genlott & Grönlund, 2013). This study involved 87 students seven years old consisting of 45 males and 42 females from the National School Board. The second paper using data from beginning readers, this investigation investigates the relationships between online procedures (as evaluated by eye movements) and literacy (and associated) metrics (Dore et al., 2020; Kim et al., 2020; Prihandoko, 2021).

Next, study proposed analysing five-year-old children's M.D. and nascent literacy abilities (Özkür, 2020). To achieve its goals, this study uses the Quantitative study method, namely the relational screening model. Then study is utilized 47 different instruments, comprising 28 in the big MD and 19 in a suitable MD for 160 preschool children five years old, consisting of 80 males and 80 females. Furthermore, previous research combining digital literacy studies and learning styles can increase students' meta-cognitive thinking while listening (Arono et al., 2022; Miftah & Setyaningsih, 2022). In this study used a quantitative research method, namely the ex-post-facto method involving 242 students from universities. There is study compared to typical peers who develop (Alvionita et al., 2022). This study used a survey study method with instruments in the form of 55 completed questions regarding 325 preschool-age children (the ages between 48 and 60 months).

Next, there are study that explore students' numeracy literacy skills in solving quadrilateral and trapezoidal area problems using descriptive qualitative (Chan & Scalise, 2022; R & Ratnasari, 2022). The instruments used were test questions and interview guidelines with 38 JHS students. Research is only limited to describing students' numeracy abilities. It is necessary to take action on how to maintain students' numeracy abilities which are already good, and how to improve students' low numeracy skills. There is also studies that want to create learning resources comprised of teaching modules, student worksheets (LKS), and TKN questions through an interactive teaching paradigm based on LSLC that is valid, practical, and successful in promoting tribal traditional values (Juhaevah, 2022; Putri et al., 2022). There is also study that used the Thiagarajan development model (4D), involving two lecturers, one teacher, and 65 high school students (Rezky et al., 2022; Winarni et al., 2021). Interviews, observing the use of instructional tools, examinations of learning results in the form of numeracy skills, and student response surveys. Instruments use in the form of interview guides, observations of the implementation of learning tools, learning outcomes tests in the form of numeracy abilities, and student response questionnaires.

Based on the explanation of the eight articles in the field of education in Table 3, it was found that there were three studies research which used local wisdom as a context in learning mathematics to support students' numeracy skills (Juhaevah, 2022; Putri et al., 2022;

Rezky et al., 2022). Previous study presented their research to investigate the effectiveness of this Math Zap game of cards in assisting learners in enhancing their numeracy abilities, as well as their attitude about utilising it as a pedagogical tool (Singh et al., 2021). Previous research research aims to improve executive function (E.F.) and Numeracy skills, involving 53 preschool children 3–5 years old, consisting of 31 females and 22 males (Hudson et al., 2021). Supported by study that investigate numeracy skills and use a descriptive study method, namely a cross-sectional study (Aunio et al., 2016).

Considering the comments from the eight social science papers in Table 4, it was found that no research used local wisdom as a starting point in designing classroom learning (Adedoyin & L.A., 2018; Purnomo et al., 2022; Singh et al., 2021). The Numeracy Skills Instrument, which was limited to the development stage, and not yet at the dissemination stage. In addition, several researchers did not specify the gender of their participants (Musliman et al., 2013; Purnomo et al., 2022; Tegeh et al., 2021). Their research shows that it was not very in-depth, only limited to describing the data collected without regard to the background of the participants.

Some important points which are the strengths of this SLR are the disparity in achievement in literacy skills shows that not all students can solve broadly related general problems in everyday life (Anwar, 2021; Carpenter et al., 2022; Johar et al., 2022). As a result, literacy and numercy research to support 21st century skills is urgently needed, especially in remote and isolated areas. Recommendations and implementation of the results of the literature review based on the fields of education, general mathematics, social science, language, and health science are presented in Table 3 to Table 7. Furthermore, the implementation of this study are furhter study of literacy and numeracy abilities of elementary school students in remote areas very needed.

The strong recommendations for future research on literacy and numeracy abilities are developing local wisdom-based learning media using the Android platform to improve students' literacy and numeracy skills. It should be noted that future research is not limited to exploring students' literacy and numeracy abilities, especially emergent literacy. However, it must arrive at a design and action research case study so that other researchers can imitate it and be repeated elsewhere.

4. CONCLUSION

According to the review's findings and research questions, the quantitative study is the most commonly employed research approach in numeracy skills research. The instrument tools used are tests and assessments. The dominant contest area is mathematics, and the prevailing educational level is junior high schools and preschool levels. Some motivational outcomes of literacy and numeracy investigation are digital competencies, learning videos, and games that effectively improve literacy and numeracy skills. Furthermore, not all pupils have strong reading and numeracy abilities.

5. REFERENCES

Adedoyin, O. O., & L.A., C. (2018). Predictors of numeracy skills giftedness in young children: Perceptions of Botswana early childhood practitioners. *African Educational Research Journal*, *6*(4), 218–227. https://doi.org/10.30918/aerj.64.18.080.

Alvionita, D. M., Rahayu, W., & Hakim, L. El. (2022). The Influence Of Online Inquiry-Based Learning Model On Numeration Ability In View From Us Loc Of Control [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3), 1775–1788. https://doi.org/10.24127/ajpm.v11i3.5492.

Anwar, M. (2021). Development of Foreign Language Teaching Material Based on Higher Order Thinking Skills (HOTS) to Increase Student s ' Literacy Skills. *Jurnal Eralingua*, *5*(2), 565–578. https://doi.org/10.26858/eralingua.v5i2.26863.

Arono, Arsyad, S., Syahriman, Nadrah, & Villia, A. S. (2022). Exploring the effect of digital literacy skill and learning style of students on their meta-cognitive strategies in listening. *International Journal of Instruction*, *15*(1), 527–546. https://doi.org/10.29333/iji.2022.15130a.

Aunio, P., Mononen, R., Ragpot, L., & Törmänen, M. (2016). Early numeracy performance of South African school beginners. *South African Journal of Childhood Education*, *6*(1), 8. https://doi.org/10.4102/sajce.v6i1.496.

Cahyani, D., Inggrid, Nulhakim, L., & Yuliana, R. (2021). Pengembangan Media Pembelajaran Scrapbook Dongeng Fabel Terhadap Minat Literasi siswa SD. *MIMBAR PGSD Undiksha*, *9*(2), 337. https://doi.org/10.23887/jjpgsd.v9i2.35271.

Carpenter, R. E., Coyne, L., Silberman, D., & Takemoto, J. K. (2022). Enhanced numeracy skills following team-based learning in United States pharmacy students: a longitudinal cohort study. *Journal of Educational Evaluation for Health Professions*, *19*(29), 29. https://doi.org/10.3352/jeehp.2022.19.29.

Chalkiadaki, A. (2018). A systematic literature review of 21st century skills and competencies in primary education. *International Journal of Instruction*, *11*(3), 1–16. https://doi.org/10.12973/iji.2018.1131a.

Chan, J. Y., & Scalise, N. R. (2022). Numeracy skills mediate the relation between executive function and mathematics achievement in early childhood. *Cognitive Development*, *62*(January), 101154. https://doi.org/10.1016/j.cogdev.2022.101154.

Deda, Y. N., Nasruddin, N., Bagus, I., Pascima, N., Liunokas, A. B., Ndandara, A., & Supardi, R. (2023). *Development of Android-Based Learning Media in Indonesia : A Systematic Literature Review*. *6*(2), 110–117. https://doi.org/10.18421/SAR62.

Dore, R. A., Logan, J., Lin, T. J., Purtell, K. M., & Justice, L. (2020). Characteristics of Children's Media Use and Gains in Language and Literacy Skills. *Frontiers in Psychology*, *11*, 1–22. https://doi.org/10.3389/fpsyg.2020.02224.

Geiger, V. (2018). Generating Ideas for Numeracy Tasks across the Curriculum. *Proceedings of the 41st Annual Conference of the Mathematics Education Research Group of Australasia*, *July*, 314–321. https://eric.ed.gov/?id=ED592434.

Geiger, V. (2016). Teachers as Designers of Effective Numeracy Tasks. *In White, B., Chinnappan, M. & Trenholm, S. (Eds.). Opening up Mathematics Education Research (Proceedings of the 39th Annual Conference of the Mathematics Education Research Group of Australasia)*, *2013*, 254–261. https://eric.ed.gov/?id=ED572390.

Genlott, A. A., & Grönlund, Å. (2013). Improving literacy skills through learning reading by writing: The iWTR method presented and tested. *Computers and Education*, *67*, 98–104. https://doi.org/10.1016/j.compedu.2013.03.007.

Hudson, K. N., Ballou, H. M., & Willoughby, M. T. (2021). Short report: Improving motor competence skills in early childhood has corollary benefits for executive function and numeracy skills. *Developmental Science*, *24*(4), 1–9. https://doi.org/10.1111/desc.13071.

Irving, K. E. (2006). The impact of technology on the 21st century. *Teaching Science in the 21st Century*, *March 1981*, 3–19. https://cmapsconverted.ihmc.us/rid=1JVHR9TKT-1VMCFZP-SHW/21st century.pdf.

Iswara, H. S., Ahmadi, F., & Ary, D. Da. (2022). Numeracy Literacy Skills of Elementary School Students through Ethnomathematics-Based Problem Solving. *Interdisciplinary Social Studies*, *2*(2), 1604–1616. https://doi.org/10.55324/iss.v2i2.316.

Johar, R., Wahyuna, A., & Maidiyah, E. (2022). Development of Numeracy Problems with

the Context of Herbal Medicines in Junior High School. *Jurnal Didaktik Matematika*, *4185*, 280–297. https://doi.org/10.24815/jdm.v9i2.27783.

Juhaevah, F. (2022). Developing mathematics problems using local wisdom context of Maluku to improve students' numeracy. *Jurnal Elemen*, *8*(1), 323–339. https://doi.org/10.29408/jel.v8i1.4524.

Kalogiannakis, M., Papadakis, S., & Zourmpakis, A. I. (2021). Gamification in science education. A systematic review of the literature. *Education Sciences*, *11*(1), 1–36. https://doi.org/10.3390/educsci11010022.

Kernagaran, V., & Abdullah, A. (2022). A Systematic Literature Review of Flipped Learning in English as Second Language (ESL) Context. *International Journal of Instruction*, *15*(2), 793–814. https://doi.org/10.29333/iji.2022.15243a.

Kesumadewi, D. A., Agung, A. A. G., & Rati, N. W. (2020). Model Pembelajaran CIRC Berbantuan Media Cerita Bergambar Meningkatkan Hasil Belajar Bahasa Indonesia Siswa SD. *MIMBAR PGSD Undiksha*, *8*(2), 303–314. https://doi.org/10.23887/jjpgsd.v8i2.25524.

Khofifah, S., & Ramadan, Z. H. (2021). Literacy conditions of reading, writing and calculating for elementary school students. *Journal of Educational Research and Evaluation*, *5*(3), 342–349. https://doi.org/10.23887/jere.v5i3.37429.

Kim, Y. G., Petscher, Y., & Vorstius, C. (2020). The Relations of Online Reading Processes (Eye Movements) with Working Memory , Emergent Literacy Skills , and Reading Proficiency The Relations of Online Reading Processes (Eye Movements) with. *Scientific Studies of Reading*, *00*(00), 1–19. https://doi.org/10.1080/10888438.2020.1791129.

Lubaale, Y. A. M., Nakabugo, G., & Nassereka, F. (2021). Learning outcome in literacy and numeracy in Uganda: Mining Uwezo assessment data to demonstrate the importance of maternal education. *IASSIST Quarterly*, *45*(3–4), 1–15. https://doi.org/10.29173/iq1001.

Miftah, R. N., & Setyaningsih, R. (2022). Development of LKPD Based on Minimum Competency Assessment (AKM) on geometry material to Improve Numeral Literacy skills [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3), 2199–2208. https://pdfs.semanticscholar.org/270a/5c262f9b600f93c7b1bfb87d7193cf3dd00e.pdf.

Monteleone, C., White, P., & Geiger, V. (2018). Defining the Characteristics of Critical Mathematical Thinking. *Annual Meeting of the Mathematics Education Research Group of Australasia*, *July*, 559–566. https://ojs.lib.buu.ac.th/index.php/education2/article/view/7040.

Musliman, R., Rahayah, S., & Din, R. (2013). Assessing Students ' Spatial Intelligence for Literacy and Numeracy Skills. *Procedia - Social and Behavioral Sciences*, *90*(InCULT 2012), 695–701. https://doi.org/10.1016/j.sbspro.2013.07.142.

Oktafiani, D., Nulhakim, L., & Alamsyah, T. P. (2020). Pengembangan Media Pembelajaran IPA Berbasis Multimedia Interaktif Menggunakan Adobe Flash Pada Kelas IV. *Mimbar PGSD Undiksha*, *8*(3), 527–540. https://doi.org/10.23887/jjpgsd.v8i3.29261.

Özkür, F. (2020). Analyzing Motor Development and Emergent Literacy Skills of Preschool Children. *International Education Studies*, *13*(4), 94. https://doi.org/10.5539/ies.v13n4p94.

Prihandoko, L. A. (2021). The Interplay between Digital Competencies and Information Literacy in Academic Writing Online Class during COVID-19 Pandemic (PLS-SEM Approach). *Eralingua: Jurnal Pendidikan Bahasa Asing Dan Sastra*, *5*(1), 234. https://doi.org/10.26858/eralingua.v5i1.18843.

Purnomo, H., Sa'dijah, C., Hidayanto, E., Sisworo, S., Permadi, H., & Anwar, L. (2022).

Development of instrument numeracy skills test of minimum competency assessment (MCA) in Indonesia. *International Journal of Instruction*, *15*(3), 635–648. https://doi.org/10.29333/iji.2022.15335a.

Putri, M. A. K., Pambudi, D. S., & Kurniati, D. (2022). Development Of Using Cultural Value Lesson Study-Based Learning Devices For Learning Community To Improve Numeration [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 2567. https://doi.org/10.24127/ajpm.v11i4.6164.

R, J. R., & Ratnasari. (2022). Student Numerical Literacy in Solving Quadrilateral and Trapezoidal Problems [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(3), 2533–2544. https://doi.org/10.24127/ajpm.v11i3.5714.

Rezky, M., Hidayanto, E., & Parta, I. N. (2022). Students' Numerical Literacy Ability in Solving Socio-Cultural Context Questions on the Topic of Geometry at the Junior High School Level [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(2), 1548. https://doi.org/10.24127/ajpm.v11i2.4879.

Rohmah, A. N., Sutama, S., Hidayati, Y. M., Fauziati, E., & Rahmawati, L. E. (2022). Planning for Cultivation Numerical Literacy in Mathematics Learning for Minimum Competency Assessment (AKM) in Elementary Schools. *Mimbar Sekolah Dasar*, *9*(3), 503–516. https://doi.org/10.53400/mimbar-sd.v9i3.51774.

Salma, A. (2019). Analisis Gerakan Literasi Sekolah Terhadap Minat Baca Siswa Siswa Sekolah Dasar. *Mimbar PGSD Undiksha*, *7*(2), 1–10. https://doi.org/10.23887/jjpgsd.v7i2.17555.

Singh, P., Hoon, T. S., Md Nasir, A., Md Ramly, A., Md Rasid, S., & Meng, C. C. (2021). Card game as a pedagogical tool for numeracy skills development. *International Journal of Evaluation and Research in Education*, *10*(2), 693–705. https://doi.org/10.11591/ijere.v10i2.20722.

Sulo, T., Kendagor, R., Kosgei, D., Tuitoek, D., & Chelangat, S. (2012). Factors affecting research productivity in public universities of Kenya: The case of Moi University, Eldoret. *Journal of Emerging Trends in Economics and Management Sciences*, *3*(5), 475–484. https://journals.co.za/doi/abs/10.10520/EJC127672.

Suprapto, N., Sunarti, T., Suliyanah, Wulandari, D., Hidayaatullaah, H. N., Adam, A. S., & Mubarok, H. (2020). A systematic review of photovoice as participatory action research strategies. *International Journal of Evaluation and Research in Education*, *9*(3), 675–683. https://doi.org/10.11591/ijere.v9i3.20581.

Tegeh, I. M., Astawan, I. G., Sudiana, I. K., & Kristiantari, M. G. R. (2021). Murder Learning Model Assisted By Metacognitive Scaffolding To Improve Students' Scientific Literacy and Numeracy Skills Through Science Studies in Elementary Schools. *Jurnal Pendidikan IPA Indonesia*, *10*(4), 618–626. https://doi.org/10.15294/jpii.v10i4.32926.

Urwick, J. (2022). Dimensions of inequality in children's literacy and numeracy in Uganda: Evidence from a household-based assessment. *International Journal of Educational Development*, *88*. https://doi.org/10.1016/j.ijedudev.2021.102525.

Winarni, S., Kumalasari, A., Marlina, M., & Rohati, R. (2021). The Effectiveness of Mathematics Learning Videos to Support Students' Numerical and Digital Literacy Skills [In Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 574. https://doi.org/10.24127/ajpm.v10i2.3345.

Zafar, M. W., Shahbaz, M., Sinha, A., Sengupta, T., & Qin, Q. (2020). How renewable energy consumption contribute to environmental quality? The role of education in OECD countries. *Journal of Cleaner Production*, *268*, 122149. https://doi.org/10.1016/j.jclepro.2020.122149.