

# Technology Literacy in the Development of Mathematics Learning in Indonesia During the Covid-19 Pandemic

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## ABSTRACT

Mastering technology makes life easier. The ability to use technology or technology literacy in learning has an impact on the development of high-quality learning. This study is a scoping review to investigate the role of technology literacy in the development of mathematics learning during the Covid-19 pandemic in Indonesia. The study was carried out using Arskey and O'Malley's five-stage framework: identifying the research, identifying relevant studies, study selection, charting data, summarizing, and reporting the result. The literature was gathered through Google Scholar. There were 36 articles included through inclusion and exclusion criteria. The finding describes that literacy technology in the pandemic through various uses of technology in mathematics learning activities is classified into four mainframes: the use of digital-based learning media, the use of electronic-based assessment and evaluation tools (e-evaluation), the use of online learning modes that support learning both synchronously and asynchronously, and the design of learning models. The outcome could serve as a model for future learning development in mathematics education and other subjects.

**Keywords:** *Mathematics, scoping review, technology literacy*

## 1. INTRODUCTION

Mastering technology is important in the 21st century. The presence of technology brings convenience to all walks of life, including education. However, there are challenges to applying the technology in learning [1]. Constraints on the application of technology in learning include the availability of infrastructures/facilities and the ability to use and utilize technology or so-called technology literacy.

The ability to use technology is the life skill that needs to be mastered in this era, specifically literacy technology. Literacy technology is defined by UNESCO as the ability to identify, understand, interpret, create, communicate, and compute using printed and written materials associated with varying contexts. Literacy is a continuum of learning that enables individuals to achieve their goals, develop their knowledge and potential, and fully participate in their community and wider society [2].

Scott in [3] states that to live in this era of technology, people need to prepare three main frameworks skills, namely 1) learning and innovation skills, 2) life and career skills, and 3) information, media, and technology skills. Learning and innovation skills consist of communication, critical thinking, and creativity skills (4CS). Life and career skills consist of flexibility and adaptability, initiative and self-direction, social skills, cross-cultural skills, productivity and accountability, leadership, and responsibility. Furthermore, information, media, and technology skills consist of information and media literacy. These skills can be developed through education.

Education is required to adapt and to answer global challenges and the needs of learners in particular. [4] states that in this era almost everything involves using mobile. Therefore, education also needs to involve the use and utilization of technology (technology literacy).

The reasons for using educational technologies may include saving time and improving the effectiveness of students' learning [5]. The use of technology becomes an urgent need in education during Covid-19 pandemic nowadays. During this pandemic, many schools are unable to hold face-to-face teaching-learning activities in the classroom. Other schools decide to close their doors. While the process of teaching and learning becomes a requirement that must still be met. Students can still learn even if they are not in the classroom due to the ease of technology.

Based on the survey of the Internet use in Indonesia by the Indonesian internet service providers association, it is stated that the Internet use in Indonesia during the period from 2019 to the second quarter of 2020 increased. [6] states that almost 197 million, or 74% of Indonesia's population, used the Internet in 2020, a number that is up 8.9% compared to 2019. One of the contributing factors is the implementation of online learning that even penetrates into remote areas. The Ministry of Communication and Information in Press Release No. 149/HM/KOMINFO/11/2020 stated that in the era of the Covid-19 pandemic, the sector that experienced positive growth was the information and communication sector, which was inseparable from the increasing use of digital technology [7]. Based on the survey, it is known that Indonesians' digital literacy has not achieved a "good" score (4.00) yet, although it is already in a moderate position. Various activities carried out in the digital space, including education.

As students and teachers can easily acquire new knowledge and skills through the use of technology,

current technological advancements change the way students learn and teachers teach. The learning process in remote areas is also done online [8]. It has become a phenomenon that needs to be studied to find out the use of technology (technology literacy), especially in developing learning. Several previous studies have explored the use of technology in learning during the COVID-19 pandemic, but it is done in general without the specifications of the subject when each subject matter has different characteristics [9], [10]. This research is focused on the development and application of technology-based mathematics learning in the Covid-19 pandemic. It aims to find out technology literacy in math learning during the covid-19 pandemic, to be a reference for math teachers to develop quality learning.

**2. METHOD**

The study was a scoping review using the Arksey and O'Malley frameworks[11]. Scoping review or scoping study is a form of knowledge synthesis that addresses exploratory research. Arksey and O'Malley's framework consists of five-stage: identifying the research, identifying relevant studies, studying selection, charting data, summarizing, and reporting the result [12]. The data gathering was through Google scholar and filtering by inclusion and exclusion criteria in Table 1. Some screening was done to find out the unique data that were eligible.

**Table 1.** Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Time period	2020 – 2021	Studies outside these dates
Country	Indonesia	Others
Study focus	Literacy technology in mathematics education	The other research
Research method	Quasi experiment, RnD, mix method	Qualitative, survey
Sample	Student (elementary school students – senior high school students)	Others

**3. RESULT AND DISCUSSION**

The search engine (Google Scholar) found 6,930 relevant articles using the keyword "Use of Technology in Mathematical Learning during Pandemic Covid-19". As many as 974 articles were identified and obtained. The next step was to study selection. The selection results using skimming inclusion criteria in Table 1

obtained 135 articles that were ready for the next screening. The results of screening obtained 60 articles. The articles were then filtered again using inclusion criteria, and some articles were excluded because they were double as qualitative designs. Thirty-six articles were ready to be reported based on the series of filer stages obtained using inclusion and exclusion criteria. Figure 1 depicts the process of selecting articles.

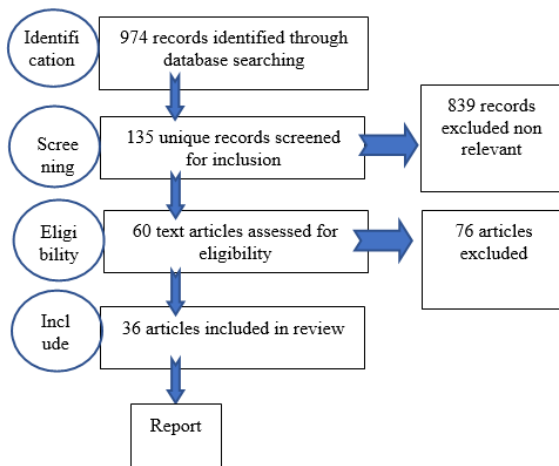


Figure 1 Article selection flow

Based on the results of the literature review by using the scoping review method, 36 articles reported that there were 72.97% in an innovation in the development of technology-based mathematical learning (development research), which shows learning-based technology becomes necessary to improve the quality of learning in the Covid-19 pandemic and online learning in the future. This implies that the level of technological literacy of teachers and learners is increasing, which is evident through the ability of teachers to design technology-based learning and the ability of learners to utilize technology in learning.

In addition to learning development innovations, some studies [13]–[21] are designed using quasi-experiments to determine the effectiveness of technology in learning. The results showed that mastering and using technology (technology literacy) has a significant impact on the improvement of the quality of learning, the increase in learners' motivation, and the improvement of learners' competence.

The technological literacy used in math learning is grouped into four parts: 1) as a learning media, 2) assessment and evaluation tools, 3) as a mode of learning, and 4) learning design.

**Learning Media.** Mathematics education in pandemic times involves technological literacy. The use of technology in mathematics learning appears in the teacher's ability to create technology-based learning media such as digital learning modules [22], [23], teaching materials and worksheets [24]–[31], HoloMath learning media [15], making e-comic-based learning mathematics [32], [33], developing media learning: multimedia, animation and video learning [34]–[37], developed educationally electronic games based on android [13], [14], [38], the use of application-based such as augmented reality [39], and GeoGebra. Based on the perspective of teachers and learners, this technology-based learning media can facilitate learners

in learning at home, create more interesting learning, and facilitate teachers in managing the classroom.

**Assessment and Evaluation Tools.** One of the benefits of technological development in learning is the use of technology as assessment and evaluation tools. A teacher who has technological literacy skills can develop technology-based assessments. The development of technology-based assessments can be done by using Hot Potatoes [40], e-test, quizzes [41], [42], and so on. Assessment and evaluation tools based on technology have several advantages, including making assessment easier for teachers to evaluate the learning process that suits the characteristics of students, the student environment, and developing student intelligence. Thus, the development of a technology-based assessment provides convenience and efficiency in the implementation of assessment systems.

**Supporting Learning Modes.** Learning in Covid-19 pandemic cannot be done face-to-face in the classroom. Nevertheless, with the ease of technology, it can be designed as though learners and teachers meet in the classroom. Technology literacy is supporting learning modes in mathematics education. It consists of synchronous and asynchronous segments. Synchronous learning modes such as Zoom [43] and Google Meet. While asynchronous learning modes utilize media such as What's App Group [8], Google Classroom [16], [19], [43]–[45], Google Suite [21], Edmodo [18], and Moodle [46]. In addition, teachers can design teaching-learning processes by using a combination of some of these learning media.

**Learning Design.** Technology supports innovation in learning. Teachers who have technology literacy skills can design effective and efficient learning. Flipped classrooms, blended learning, and e-learning are examples of technology-based learning designs [17], [20]. Some studies conducted on blended-based learning found that technology-based learning had a positive impact compared to conventional learning. The same result is found in the flipped classroom and e-learning by Android-based learning. The flipped classroom design using technology such as videos makes learning easier for a student to study at home. Creating Android-based e-learning development "Fun Math" can improve students' understanding and motivate them to learn mathematics.

Thus, it can be concluded that technological literacy in the development of mathematical learning is valuable. Technology literacy in mathematics education provides learners, teachers, and parents with convenience. The finding is in line with [9] that the application of technology literacy has a critical role in improving learners' competence, increasing the interaction of teachers and learners in online learning, and facilitating the delivery of learning materials. Moreover, the learning process takes place properly.

Technology literacy in learning can be applied in other lessons, like social science, character education, and religious education. However, to apply technology literacy in learning to the maximum, the expertise of teachers and students and the readiness of learning facilities need to be considered. Technology literacy and available facility resources affect effective and efficient learning and give a positive impact on students.

#### 4. CONCLUSION

Technology literacy in the development of mathematics learning in the Covid-19 pandemic period is realized in the use of digital-based learning media, the use of electronic-based assessment and evaluation tools (e-evaluation), the use of online learning modes that support learning both in synchronously and asynchronously, and the design of learning models. Technology literacy has a positive impact on learning progress.

The development of technology-based mathematics learning that has been produced need to be applied in the learning process. Paying attention to the readiness of learners and the infrastructure facilities can bring a significant impact on improving students' competence and can create quality learning.

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