



## **Mathematics Learning Innovation During the Covid-19 Pandemic in Indonesia: a Systematic Literature Review**

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**Abstract:** The purpose of this study is to analyze mathematics learning innovations during the Covid-19 pandemic in Indonesia. The research method used is Systematic Literature Review. Data collection was carried out by documenting and reviewing articles related to learning mathematics during the Covid-19 pandemic which were published in the 2020-2021 period in national journals. The data analysis technique used refers to the interactive model by Miles & Huberman which consists of 4 stages, namely data collection, data reduction, data presentation, and drawing conclusions. These findings indicate that (1) Mathematics learning innovation during the Covid-19 pandemic in Indonesia can be done online, offline, or blended learning. The implementation is by means of E-learning, the use of software, the use of learning media, or the use of innovative, effective, and creative models, approaches, and learning methods such as blended learning which are considered in accordance with the conditions and obstacles faced by educators and students, (2) Mathematics learning assessments can be carried out using online, manual, or blended learning-based assessments, (3) The obstacles faced during the Covid-19 pandemic are in the form of unsupported learning facilities and infrastructure, teacher competence and readiness that is not possible, psychological and low ability of students, assessment of learning outcomes that do not go well and is not comprehensive in all areas, lack of cooperation and family awareness, and abstract mathematical objects.

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## **Introduction**

The Covid-19 pandemic is a factor that causes various crises in the global world today. The Covid-19 pandemic has caused paralysis in various sectors, including the world of education. The effects of the Covid-19 pandemic have caused learning not to be carried out face-to-face as usual because it is feared that the spread of the Covid-19 virus will expand, so that what is applied is to stay at home and maintain a distance. Therefore, a solution is needed in the world of education so that the learning process continues even though it is not like when the Covid-19 pandemic has not yet attacked (Ahmad, 2020; Wijaya et al., 2020; Susilawati et al., 2021; Novilanti & Suripah, 2021; Duri et al., 2021; Fadillah et al., 2021).

There are various solutions offered so that learning can still be carried out, namely by applying online, offline, and blended learning. As expressed by Istikhoirini (2021) that online learning is a learning process that can be done during a pandemic that provides new experiences in learning for students. Likewise with the opinion of Yuliati & Saputra (2020) that blended learning is an alternative learning that can be used during a pandemic. However,

learning mathematics is special because learning mathematics emphasizes understanding in terms of concepts and principles, skills in procedures, and requires students to develop their mathematical abilities in solving problems. Therefore, many education observers are interested in conducting research in finding solutions for learning mathematics so that it can run optimally. As done by Handayani & Irawan (2020); Daniati et al., (2020); Astuti & Purwanto (2021) who apply e-learning such as whatsapp, google classroom, zoom, google meet in learning mathematics during the pandemic. However, the reality in the field is that these various learning alternatives are still difficult to apply because of the abstract nature of mathematical objects. As stated by Fauzy & Nurfauziah (2021) that the many formulas and abstract objects make it difficult for students to understand the mathematics topic taught through online. Therefore, educators are required to be able to manage learning creatively and innovatively in order to minimize these problems.

With the various alternatives for learning mathematics offered, it turns out that educators are still hesitant in providing assessments of learning achievement. The assessment that can be given only revolves around the cognitive domain of students. The affective and psychomotor domains are still not reached by learning mathematics using virtual media. The skills and attitudes of students in solving mathematical problems are difficult to measure and assess the extent of their skills. The assignment of assignments still causes confusion in the assessment, because there are still third party elements in completing the tasks given by the educator. As the findings obtained by Ana & Ndole (2021) that the tasks given by educators are not directly carried out by students. However, with the help of parents or siblings. This causes students to be unable to cultivate an independent attitude and think instantaneously in solving problems so that they are able to get good grades without trying hard. However, on the other hand, a third party is an extension of the educator to help students understand the material provided by the teacher. Therefore, as a form of responsibility so that students are able to be independent, critical and confident, it is hoped that there will be cooperation between parents and educators so that students really hone their knowledge and not just pursue good grades.

With various alternatives offered, there are various obstacles. Obstacles in the mathematics learning process such as power outages, poor networks, the use of large internet quotas, limited learning facilities (such as laptops and cellphones), lack of competence in using virtual application features (Whatsapp, Zoom, Google Classroom, and other), lack of enthusiasm and motivation in learning, students who do not understand the material provided, and so on (Wijaya et al., 2020; Handayani & Irawan, 2020; Sari & Gaelagoy, 2020; Wahyuni & Kusumawati, 2021; Fauzy & Nurfauziah, 2021). Meanwhile, obstacles in terms of assessment of learning outcomes, such as assessments that only focus on the cognitive domain, assessment of tasks that still have interference with third parties, assessment of learning outcomes that are not optimal due to psychological factors of students, and others (Kisno et al., 2020; Ana & Ndole, 2021; Fadilla et al., 2021). With these various obstacles, it becomes a task and homework for education observers to be able to find solutions to overcome the problems faced in the world of education in this New Normal era.

Based on the background that has been described, the purpose of this study is to analyze mathematics learning innovations during the Covid-19 pandemic in Indonesia. So that the findings from this study can be a reference in further research related to mathematics

learning innovations with various obstacles and problems during the Covid-19 pandemic in Indonesia. It is the duty of all of us to find the best solution for the New Normal life.

### Research Method

The research method used is systematic literature review. This method is a method that focuses on the stages or processes of identification, study or analysis, evaluation, as well as interpreting and making conclusions based on relevant research results in accordance with the research focus contained in journals in a systematic and structured that predetermined stages so that it becomes a problem solving (Triandini et al., 2019).

The data used is secondary data obtained indirectly by using articles in national journals. The steps in the Systematic Literature Review consist of: (1) Planning, this step is the formulation of the next stage and determining research questions. (2) Review, this stage focuses on searching literature from various articles in the database, then the literature (articles) is grouped according to type. (3) Documentation. In this step, all the findings from the selected literature are written down and then elaborated. The findings become the basis for answering research questions.

Based on the steps that have been set, a search for journal articles is carried out on the databases of Google Scholar, DOAJ, Neliti, Research Gate, and Garuda with the keywords learning mathematics and the Covid-19 pandemic. The articles used are articles that have been published in the 2020-2021 period as many as 24 literatures. After that, the literature (articles) related to learning mathematics and the Covid-19 pandemic was grouped. The data analysis technique refers to the interactive model by Miles & Huberman (Suciati, 2018) which consists of 4 stages, namely: (1) data collection, at this stage the articles are collected based on the keywords learning mathematics and the Covid-19 pandemic, (2) data reduction, at this stage the articles that have been collected are selected according to the chosen problem in the study, then the data is analyzed by summarizing, coding, tracing themes, and creating groups, (3) data presentation, this stage the data is arranged based on the group by tabulating the data, and (4) drawing conclusions, this stage is a process of drawing conclusions based on the findings obtained.

### Results and Discussion

The results of the research in this literature review are an analysis and summary of data from various articles that have been obtained from national journals. Based on the search, twenty-four (24) related articles were obtained which are presented in table 1, table 2, and table 3. In table 1, articles related to mathematics learning innovations are grouped during the Covid-19 pandemic which consists of 12 articles. Of the 12 articles, 5 qualitative articles, 2 quantitative articles, 2 Classroom Action Research articles, 2 R&D articles, and 1 mixed methods article were obtained.

**Table 1. Mathematics Learning Innovations During the Covid-19 Pandemic**

Researcher and Year	Findings
(Wijaya et al., 2020)	The use of learning videos can be a solution to the problem of poor internet during the corona virus pandemic.
(Istikhoirini, 2021)	The use of Edmodo is effectively used in mathematics online learning.
(Susilawati et al., 2021)	The combination of the inquiry learning model with the ETD method with

	audiovisual learning media can be an alternative for learning mathematics.
(Novilanti & Suripah, 2021)	GeoGebra software has a positive effect and is effectively used as a medium for learning mathematics that can attract students' interest in learning.
(Astuti & Purwanto, 2021)	The reciprocal teaching model assisted by Google Meeting has an effect on students' mathematical communication skills.
(Wahyuni & Kusumawati, 2021)	The use of Microsoft Office 365 learning activities can be used in the learning process.
(Duri et al., 2021)	Mathematics learning can be done by providing modules, material summaries, and assignments to students.
(Daniati et al., 2020)	There is an increase in motivation and learning outcomes by using the Google Classroom-based E-Learning Learning Model.
(Fadillah et al., 2021)	Ispring interactive media is feasible and can be used in learning mathematics.
(Dewi et al., 2020)	In learning mathematics, online methods (presentations and questions and answers) and offline methods (discussions and exercises) are used to teach difficult material.
(Handayani & Irawan, 2020)	WhatsApp group applications, google class rooms, google forms, zoom meetings and google meet with a realistic mathematical approach can help students understand the material.
(Ahsan et al., 2021)	Student Worksheets based on Computational Thinking can be an alternative for learning mathematics.

Based on the explanation above, innovation in learning mathematics during the Covid-19 pandemic can be done online, offline, or blended learning. The implementation can be done by:

- (1) Online learning (E-Learning) can be via Whatsapp, Google Classroom, Google Meeting, Google Form, Zoom and Edmodo learning,
- (2) Use of software such as geogebra application, Microsoft Office 365, and interactive media Ispring,
- (3) Use of learning media such as learning videos, Student Worksheets based on Computational Thinking, giving modules, summarizing materials and giving assignments,
- (4) Application of models, approaches, or learning methods such as Reciprocal Teaching, Realistic Approaches, as well as creative methods or Blended Learning (a combination of online and offline learning).

This presentation is in accordance with the findings of Daniati et al. (2020), Handayani & Irawan (2020), and Istikhoirini (2021) who explained about online learning (E-Learning). Likewise with Wahyuni & Kusumawati (2021), Novilanti & Suripah (2021), and Fadillah et al. (2021) which discusses applications (software) that can be used as an alternative in learning mathematics. Wijaya et al. (2020), Duri et al. (2021), and Ahsan et al. (2021) argues about learning media that is a solution in the mathematics learning process for areas experiencing network or quota problems. While Dewi et al. (2020), Astuti & Purwanto (2021), and Susilawati et al. (2021) explains the application of models, approaches, or learning methods that can be combined or used with mathematics learning conditions during the Covid-19 pandemic.

The solutions from various mathematics learning innovations that have been described can be used according to the environmental conditions of educators and students. Effective, creative and innovative mathematics learning that is used is what is needed during the Covid-19 pandemic at this time. In table 2, the grouping of articles related to the assessment of mathematics learning during the Covid-19 pandemic consists of 5 articles. Of the 5 articles, 4 of them are qualitative articles and the rest are R&D articles.

**Table 2. Assessment of Mathematics Learning During the Covid-19 Pandemic**

Researcher and Year	Findings
(Ana & Ndole, 2021)	The assessment of mathematics learning is effective even though it only focuses on the cognitive aspect.
(Wahyudi et al., 2020)	Quizizz can be an alternative assessment of mathematics learning.
(Salim et al., 2020)	Augmented reality-based math worksheets are of high quality and can be used in blended learning or flipped learning.
(Ahmad, 2020)	Assessment that can be applied online-based assessment, portfolio, and self-assessment.
(Suhairi & Santi, 2021)	Learning assessment can be done with blended learning-based assessment by combining synchronous and asynchronous learning.

Based on table 2 above, it is obtained that the learning assessment can be done online or not. In other words, the assessment of mathematics learning during the Covid-19 pandemic can use online, manual, or blended learning-based assessments. The assessment includes:

- (1) Online-based assessments can use the Quizizz application, Augmented Reality-based Mathematics Worksheets, Google Classroom, and so on.
- (2) Manual-based assessments can be in the form of providing portfolios, self-assessments, project assignments, and others.
- (3) Blended Learning-based assessment can also be done by combining synchronous and asynchronous learning.

This is in line with the research of Wahyudi et al. (2020), Salim et al. (2020), and Ahmad (2020) who raised the issue of online-based assessment. Furthermore, Ahmad (2020) explained again that assessments can not only be done online, but can be done manually such as providing portfolios and self-assessments. Meanwhile, Suhairi & Santi (2021) explained the assessment based on blended learning. However, although various forms of assessment have been described that can be used, the assessment of learning mathematics only touches on the cognitive domain, not yet reaching the affective and psychomotor domains. This is in line with the findings of Ana & Ndole (2021) that the assessment of mathematics learning outcomes only focuses on cognitive aspects. So it still needs an in-depth study to find a solution for the assessment of the affective and cognitive aspects. In table 3, the articles are grouped based on obstacles in learning mathematics during the Covid-19 pandemic which consists of 12 articles. Of the 12 articles, there are 9 qualitative articles, 1 Classroom Action Research article, 1 quantitative article, and 1 mix methods article.

**Table 3. Obstacles in Learning Mathematics During the Covid-19 Pandemic**

Researcher and Year	Findings
(Wijaya et al., 2020)	Online learning during the corona virus pandemic is less effective due to various factors such as the learning environment, the internet, and low



	student interest in learning.
(Wahyuni & Kusumawati, 2021)	The use of learning activities during the pandemic using Microsoft Office 365 has several obstacles experienced by teachers and students in their use such as bad signals, servers are down and difficult to access, additional internet quota fees, unlimited teaching hours, lack of communication and socialization between teachers and students, mastery in the use of Microsoft Office 365 which is still low.
(Hulukati et al., 2021)	The use of e-learning (zoom, whatsapp, google classroom) in learning mathematics during the Covid-19 pandemic was in the poor category.
(Handayani & Irawan, 2020)	There are some limitations on the infrastructure to support learning activities and the large use of internet quotas.
(Ana & Ndole, 2021)	Although Mathematics learning during the Covid-19 pandemic is still carried out optimally, and the assessment process for learning outcomes is also good but the affective and psychomotor aspects are not effective. In addition, students do not directly do the assignments given, but are assisted by their parents or siblings.
(Kisno et al., 2020)	There are difficulties in assessing students' conceptual understanding of mathematics up to the determination of the final grade of the semester.
(Fadilla et al., 2021)	Problems faced by students such as difficulty understanding learning material, no motivation to learn, and not mastering learning well.
(Sari & Gaelagoy, 2020)	Mathematics learning has not been going well and effectively due to several factors such as students who are not able to do assignments, do not have cellphones, and poor internet networks.
(Fauzy & Nurfauziah, 2021)	The obstacles faced by students are inadequate internet network, limited mobile memory, limited teacher interaction, use of formulas, and abstract objects in mathematics.
(Huzaimah & Amelia, 2021)	The obstacles experienced are inadequate internet facilities and networks, the delivering material that triggers boredom and laziness, and limited communication.
(Asmuni, 2020)	The teacher's barriers are the lack of IT mastery and limited student supervision, student barriers such as being less active in learning, limited facilities and internet networks, and parents' barriers are limited time in accompanying children.
(Suhairi & Santi, 2021)	The weakness of blended learning-based learning is that students are less active in submitting responses via Whatsapp and the practice of copying and pasting assignments.

Based on the presentation of the research results in table 3, it was found that mathematics learning during the Covid-19 pandemic was less effective and did not work well, and online learning was in the poor category. This is in accordance with the findings of Wijaya et al. (2020), Sari & Gaelagoy (2020), and Hulukati et al. (2021) who revealed that mathematics learning did not work well and effectively during the Covid-19 pandemic. The causes of learning mathematics during the Covid-19 pandemic did not run well and effectively, namely:

- (1) Learning facilities and infrastructure that do not support, such as an impossible learning environment, poor internet network, large internet quota, not having a cellphone or laptop, full cellphone memory.

- (2) Teacher competencies and readiness that are not possible, such as unlimited teaching hours, lack of communication, interaction and socialization between teachers and students, low IT mastery, lack of enthusiasm for material delivery, and others.
- (3) Psychological and Low student abilities, such as low interest in learning and motivation, feeling bored and lazy, lack of IT mastery, not mastering lessons so they are unable to do assignments and are less active in learning mathematics, as well as copy and paste assignments.
- (4) Assessment of learning outcomes that do not go well and are not comprehensive in all areas, such as the assessment of affective and psychomotor aspects that are less affordable, the difficulty of assessing and measuring the conceptual understanding of students' mathematics, the difficulty of determining the final grade of the semester.
- (5) Lack of cooperation and family awareness, such as providing excessive assistance to students in order to obtain the desired grades, lack of supervision, limited time for parents in mentoring, and emotional family in accompanying students.
- (6) Abstract mathematical objects, such as the use of symbols, formulas, and procedures in learning mathematics that cannot be understood if only read, as well as skills needed in learning mathematics such as geometry.

This is in line with the findings of Wijaya et al. (2020), Handayani & Irawan (2020), Sari & Gaelagoy (2020), Asmuni (2020), Wahyuni & Kusumawati (2021), Fauzy & Nurfauziah (2021), and Huzaimah & Amelia (2021) who discussed issues related to facilities and infrastructure faced in the mathematics learning process during the Covid-19 pandemic. In addition, Asmuni (2020), Wahyuni & Kusumawati (2021), Fauzy & Nurfauziah (2021), Huzaimah & Amelia (2021) explained the problem of teacher competence and readiness in dealing with learning during the Covid-19 pandemic. The obstacles faced by students are described by Wijaya et al. (2020), Asmuni (2020), Wahyuni & Kusumawati (2021), Fadilla et al. (2021), Huzaimah & Amelia (2021), and Suhairi & Santi (2021) in their research. Apart from this, Kisno et al. (2020) and Ana & Ndole (2021) explained the problems in the assessment of student learning outcomes. Furthermore, Asmuni (2020) and Ana & Ndole (2021) reiterated the problems related to the role of families towards students in the learning process during the Covid-19 pandemic. Meanwhile, Fauzy & Nurfauziah (2021) re-explained the problems faced in the mathematics learning process, namely those related to abstract mathematical objects, such as the use of symbols and formulas as well as procedures and skills used in learning mathematics.

With various obstacles that can be faced during the Covid-19 pandemic, effective, creative, and innovative learning is very much needed in the world of education, especially in learning mathematics in Indonesia. One of the innovative, effective, and creative learning that can be used is Blended Learning. Blended learning combines online learning and face-to-face learning. In Blended Learning, various software and learning media can be applied, such as the use of geogebra applications and learning videos that can make it easier for educators to explain mathematical concepts, principles, and procedures. The abstract nature of mathematics becomes an obstacle for students if learning is only done online. Likewise, educators will find it difficult to teach if learning is only done offline because it is limited by physical distance.

Apart from learning methods, assessment of learning outcomes is also an important thing that educators need to pay attention to, especially during the Covid-19 pandemic. Project assignments can be given to students. However, this cannot maximally measure student learning outcomes due to the possibility of interference from the family in completing the task. Giving online-based quizzes can also be given in measuring learning outcomes. However, it cannot measure the psychomotor domain of students. Therefore, assessment of learning outcomes based on Blended Learning can be a solution so that all areas of learning outcomes can be reached properly and maximally.

### Conclusion

Based on the results of this study, it was concluded that (1) Mathematics learning innovation during the Covid-19 pandemic in Indonesia could be done online, offline, or blended learning. As for the implementation by means of E-learning, the use of software, the use of learning media, or the use of innovative, effective, and creative models, approaches, and learning methods such as blended learning which are considered in accordance with the conditions and obstacles faced by educators and students, (2) Mathematics learning assessments can be carried out using online, manual, or blended learning-based assessments, (3) The obstacles to learning mathematics during the Covid-19 pandemic are in the form of unsupported learning facilities and infrastructure, teacher competence and readiness that is not possible, psychological and low ability of students, assessment of learning outcomes that do not go well and is not comprehensive in all areas, lack of cooperation and family awareness, and abstract mathematical objects.

### Recommendation

The recommendation given are: (1) school principals provide adequate and possible support and facilities to teachers in realizing creative, effective, and innovative mathematics learning during the Covid-19 pandemic, (2) teachers are expected to be more innovative and creative. in creating fun mathematics learning for students with various obstacles during the Covid-19 pandemic so that learning objectives can be carried out properly, such as the application of blended learning, (3) parents are expected to work well together in assisting students in dealing with the process mathematics learning during the Covid-19 pandemic, and (4) for other researchers it can be a reference for developing further research in finding solutions or other alternatives to mathematics learning during the Covid-19 pandemic.

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