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Analysis of Mathematics Learning Independence During the COVID-19 Pandemic

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Abstract

This study aims to describe independent mathematics learning during the COVID-19 pandemic among eighth-grade students at SMP Negeri 2 Langke Rembong. The research was motivated by a lack of student learning independence in online learning, as evidenced by low motivation and interest, which resulted in passive participation in virtual classes. This study employs a descriptive quantitative approach using a survey method. The population consists of all eighth-grade students at SMP Negeri 2 Langke Rembong, totaling 339 students. The sampling technique used was probability sampling with a simple random sampling method, resulting in a sample size of 77 students. The data collection instrument was a Likert-scale questionnaire distributed to students, measuring their mathematics learning independence during the COVID-19 pandemic. The collected data was analyzed using descriptive statistical analysis. The results indicate that eighth-grade students at SMP Negeri 2 Langke Rembong demonstrated a high level of learning independence in mathematics during online learning. Students exhibited strong independence in eight key indicators, including formulating learning objectives, selecting learning strategies, taking the initiative to learn with or without assistance, evaluating their own learning progress, constructing meaning, collaborating with others, diagnosing learning needs, selecting and utilizing resources, and exercising self-control.
Keywords: Independent Learning, Mathematics Learning, Junior High School Students, COVID-19 Pandemic.

Introduction

Education is a means of inheriting values that serve as guidelines for individuals in navigating life. Education plays a crucial role in improving human destiny and civilization, as the quality of a civilization is determined by how well a nation implements its education system (Syafaruddin et al., 2012). If a nation has a high-quality education system, it can be assured that it will be able to compete globally. Therefore, it is necessary to develop superior human resources, which include individuals who are skilled, independent, creative, tenacious, and adaptable to change (Ningrum, 2016; Rifa Hanifa Mardhiyah et al., 2021).

One of the most relevant fields of knowledge in response to the demands of time is mathematics. Mathematics is a rapidly evolving discipline, both in terms of content and its application in daily life. In mathematics learning, students are encouraged to be active, creative, and responsible in solving mathematical problems (Hendriana & Soemarno, 2014). When students can apply the correct concepts to solve mathematical problems, the objectives of mathematics learning can be successfully achieved.

Teachers play a vital role in mathematics education. In the teaching and learning process, teachers are expected to create a conducive learning environment that positively impacts students. A well-managed classroom environment can be achieved through effective classroom management strategies (Sahidin & Jamil, 2013). This is emphasized in the National Education

System Law No. 20 of 2003, which states that “learning is an interaction process between educators and learners, utilizing available learning resources in a learning environment.” The learning process designed by teachers aims to enhance students’ mastery of subject matter and foster creative thinking.

In 2020, the world was struck by a pandemic caused by the Coronavirus Disease (COVID-19). This epidemic became a global pandemic after being declared by the World Health Organization (WHO) due to its rapid spread across various parts of the world. As a result, lockdowns and social distancing measures were implemented in numerous locations. Each country adopted policies based on the number of cases and the risks associated with virus transmission. The pandemic significantly impacted the education system, leading many schools to suspend in-person learning or transition to online learning. Teachers and students were forced to adapt to learning from home through virtual platforms.

Online learning, also referred to as Distance Learning (PJJ), involves interactions between teachers and students through digital platforms, utilizing technology such as Zoom, Google Meet, Skype, WhatsApp, and other online tools. In online learning, students engage in discussions, consultations, assignments, exercises, and exams. Additionally, students are required to be independent in their learning activities (Belawati, 2019). Learning independence is a self-directed learning process in which individuals study without relying on others, taking personal initiative in planning, selecting learning tools and media, and managing the learning process (Sundayana, 2016). Students who possess learning independence tend to be more responsible, disciplined, and self-sufficient in acquiring knowledge (Handayani & Ariyanti, 2020). Therefore, learning independence is crucial for every student, especially in distance learning, where direct teacher supervision is limited.

In mathematics education, learning independence plays a vital role in the learning cycle. The procedural nature of mathematics poses a unique challenge for educators, particularly in a distance learning setting. This is because mathematics is generally more effectively taught through direct, face-to-face instruction (Mahmud & Mahmud, 2021). Students with strong learning independence are more focused, adaptable to their environment, capable of solving problems independently, and demonstrate a sense of responsibility while working efficiently. Conversely, students who lack learning independence struggle with motivation, learning priorities, and adaptation, making it difficult for them to engage effectively in their studies (Wahyu & Sumarmo, 2016). Therefore, learning independence is an essential skill that every student must develop to avoid dependence on others and build self-confidence in their abilities.

During the pandemic, students' learning independence has significantly differed from normal conditions. Learning independence in a traditional classroom setting tends to be more effective due to direct face-to-face interactions between students and teachers, which facilitates engagement and motivation. However, during the COVID-19 pandemic, learning independence became more challenging as students had to rely on technology and the internet for their education. This shift in the learning environment has reinforced the idea that learning independence is a critical factor in determining students' academic success and completion of coursework in an online setting (Wahyu & Sumarmo, 2016).

Based on unstructured interviews with the mathematics teacher at SMP Negeri 2 Langke Rembong, it was revealed that Google Classroom was used in the online mathematics learning process. The evaluation of learning was conducted through skills assessments, cognitive evaluations, and daily tests. Students carried out independent learning using their student companion books, but if they encountered difficulties, they could consult with the teacher via applications such as WhatsApp. Students appeared to be enthusiastic and actively engaged in

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online mathematics learning. However, several challenges were identified, including the lack of Android devices, poor internet connectivity, or insufficient internet quota.
Despite these challenges, students were expected to learn independently as they needed to keep up with the material, complete assignments, and undergo evaluations such as competency tests, cognitive tasks, daily tests, and the Final Semester Assessment (PAS). The objective of this study is to describe the level of mathematics learning independence during the COVID-19 pandemic among eighth-grade students at SMP Negeri 2 Langke Rembong.

Method

This study is a survey-based research with a quantitative descriptive approach. The purpose of this study is to analyze the value of each variable, whether one or more independent variables, without establishing connections or comparisons with other variables (Khoiri, 2018). Quantitative research is commonly used to study a specific population or sample (Sugiyono, 2013). The quantitative data in this study was obtained from an analysis of student scores on a learning independence questionnaire.

The population in this study consists of all eighth-grade students at SMP Negeri 2 Langke Rembong. The sampling technique used was probability sampling with a Simple Random Sampling method. The sample in this study consisted of 77 students from eighth grade at SMP Negeri 2 Langke Rembong. The data collection process was carefully designed to ensure the most appropriate and accurate method was used, allowing for the acquisition of valid and reliable data. The primary data collection technique employed in this study was the questionnaire method.

Results

This section presents the study results on mathematics learning independence during the COVID-19 pandemic. The research data consists of mathematics learning independence scores of eighth-grade students at SMP Negeri 2 Langke Rembong for the 2021/2022 academic year.

The study was conducted from October 18–25, 2021, and the collected data was analyzed descriptively to describe the overall learning independence of students. The data analysis included measures of central tendency (mean, median, mode, maximum, and minimum values) and measures of data dispersion (standard deviation and variance). The mathematics learning independence scores were calculated using Microsoft Excel 2013. A summary of these calculations is presented in Table 1.

Table 1. Recapitulation of Calculation Results Independence Study

	Independence Study Student
Mean	71.32
Median	71
Variance	3.72
Standard deviation	1.93
Min Score	67
Max Score	76
Range	9

Table 1 presents the results of the calculation of students' mathematics learning independence scores, with a mean of 71.32, median of 71, variance of 3.72, standard deviation

of 1.93, minimum score of 67, maximum score of 76, and a range of 9. The analysis in this study utilizes descriptive statistics. The data was obtained from students' responses to the mathematics learning independence questionnaire. This quantitative data was analyzed in the form of percentages to determine trends in students' learning independence. To better illustrate these trends, the classification of mathematics learning independence was further visualized through a diagram representation. The following section outlines the classification of data.

Independence Study Student Based on Statement Items

Mathematics learning independence during the COVID-19 pandemic among students engaged in online learning was assessed through a mathematics learning independence questionnaire completed by the respondents. The percentage of student responses shows an overall average of 79.24%. This data indicates that almost all students fall into the independent category in mathematics learning during the COVID-19 pandemic, particularly through online learning. The average student responses for each item can be seen in Table 2 below.

Table 2. Description Average Answer Students on Each Statement Item

Number Statement	Percentage of Answer Results Student					Average
	Strongly agree	Agree	Disagree	Don't agree	Strongly Disagree	
1.	22.08%	32.47%	22.08%	16.88%	6.49%	69.35%
2.	28.57%	49.35%	18.18%	2.59%	1.3%	80.77%
3.	16.88%	24.68%	18.18%	14.68%	1.3%	78.96%
4.	37.66%	51.95%	6.5%	3.9%	0%	84.67%
5.	12.98%	79.22%	2.6%	2.6%	0%	80%
6.	5.2%	89.61%	2.60%	3.9%	0%	78.70%
7.	12.98%	79.22%	3.9%	0%	3.9%	78.74%
8.	7.79%	85.71%	2.60%	1.3%	2.60%	78.96%
9.	18.18%	75.32%	2.60%	3.9%	0%	81.55%
10.	15.60%	75.32%	6.50%	1.3%	1.3%	80.51%
11.	11.68%	77.92%	5.2%	5.2%	0%	79.22%
12.	12.98%	75.32%	6.50%	2.60%	2.60%	79.22%
13.	12.98%	73.32%	3.9%	6.50%	1.3%	78.44%
14.	7.79%	84.41%	5.2%	2.60%	0%	79.74%
15.	16.88%	72.72%	0%	7.79%	2.60%	78.44%
16.	12.98%	76.62%	11.68%	3.9%	0%	79.74%
17.	7.79%	84.41%	0%	5.2%	2.60%	79.48%
18.	10.38%	80.51%	3.9%	5.2%	0%	78.96%
Overall average						79.24%

The overall results of the calculations indicate that the average percentage of student responses is 79.24%. This finding suggests that the average level of mathematics learning independence among eighth-grade students at SMP Negeri 2 Langke Rembong during the COVID-19 pandemic is 79.24%, placing it in the high category for learning independence through online media.

Independence Study Student Based on The indicator

Students' learning independence can be assessed through several indicators, including diagnosing learning needs independently, taking initiative in learning with or without assistance, formulating or selecting learning objectives, choosing learning strategies, collaborating with others, selecting and utilizing learning resources, evaluating their own learning outcomes,

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constructing meaning, and exercising self-control. The learning independence of eighth-grade students at SMP Negeri 2 Langke Rembong is analyzed based on the percentage calculation of these indicators.

The following section presents the average percentage of responses for each indicator, calculated using the formula:

$$P = \left(\frac{F}{N}\right) \times 100\%$$

The results are summarized in Table 3.

Table 3 Average Percentage Data Answer Group Indicator

Number	Indicator	Percentage Per Indicator	Category
1	Take the initiative Study with or without help of others	76.36%	Tall
2	Diagnose need learn it Alone	82.33%	Tall
3	Formulate or choose objective Study	79.22%	Tall
4	Select and use source	78.96%	Tall
5	Choose learning strategies , and evaluate results learn it Alone	80.43%	Tall
6	Cooperate with other people	78.83%	Tall
7	Build meaning	79.09%	Tall
8	Control self	79.39%	Tall
Overall Average		**79.24%**	**Tall**

Table 3 presents the average percentage of student responses for each learning independence indicator. The initiative to study independently with or without assistance resulted in a score of 76.36%, indicating a high level of independent learning initiative among students. The ability to diagnose learning needs independently achieved a score of 82.33%, placing it in the high category as well.

For the formulation and selection of learning objectives, students scored an average of 79.22%, demonstrating a strong ability to set and determine their own learning goals. The ability to select and utilize learning resources received an average score of 78.96%, which is also categorized as high. Additionally, students' ability to choose learning strategies and evaluate their own learning outcomes resulted in an average score of 80.43%, indicating a high level of self-regulation in learning.

On the cooperation with others indicator, students scored 78.83%, showing that collaborative learning skills were well developed. Similarly, the ability to build meaning received an average score of 79.09%, reflecting high cognitive engagement in learning. Lastly, the self-control indicator scored 79.39%, suggesting that students were capable of regulating their own learning process effectively.

Based on the survey data from 77 eighth-grade students at SMP Negeri 2 Langke Rembong, as shown in Table 4.2, it can be concluded that a significant number of students responded positively to the mathematics learning independence questionnaire, indicating that they were able to effectively engage in online learning.

Independence Study Student By Level

The mathematics learning independence data in this study was obtained from the scores recorded after students completed the mathematics learning independence questionnaire. Based on these scores, the percentage distribution of learning independence levels among eighth-grade students at SMP Negeri 2 Langke Rembong was determined. The classification of learning independence levels is illustrated in Figure 1 below.

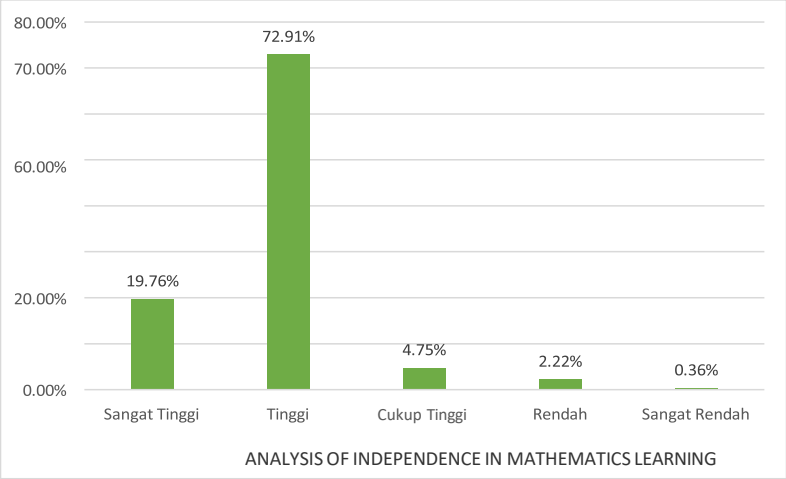


Figure 1. Percentage Diagram of Grouping Students' Mathematics Learning Independence

Based on Figure 1, the majority of eighth-grade students at SMP Negeri 2 Langke Rembong demonstrated a high level of independence in learning mathematics during the COVID-19 pandemic. Among 77 students who completed the questionnaire, 72.91% fell into the high independence category, while 19.76% exhibited very high independence. Additionally, 4.75% of students had a moderate level of learning independence, while 2.22% were categorized as having low independence, and only 0.36% displayed very low independence. These findings indicate that most students were capable of self-directed learning, managing their studies effectively despite the challenges of online learning.

The study was conducted at SMP Negeri 2 Langke Rembong during the COVID-19 pandemic, a period in which social and physical distancing policies significantly impacted the learning process. As a response, the school adopted online learning methods to ensure continuity in education. Before conducting the study, the researcher coordinated with school authorities and mathematics teachers to finalize the research procedures. The study officially took place between October 18–25, 2021, with a preliminary instrument trial on October 11, 2021. The primary data collection tool used in this study was a questionnaire designed to measure students' independence in learning mathematics.

The analysis of research data highlights several key aspects of students' independence in learning mathematics. Students demonstrated high initiative in studying independently at home, actively engaging with additional learning resources such as Google, YouTube, and discussions with peers. Additionally, students were able to diagnose their own learning needs, effectively set and achieve learning goals, and select appropriate study strategies. Many students also exhibited strong self-regulation skills, with a high percentage of them taking responsibility for their learning outcomes. However, some students encountered challenges, such as poor internet connectivity and limited access to digital devices, which impacted their ability to participate fully in online learning. Despite these obstacles, the majority of students

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maintained high motivation and independence, reinforcing the importance of self-directed learning skills in an online education environment.

The Importance of Education and Its Influence on Independent Mathematics Learning

Education serves as the foundation for building a strong and progressive civilization. A high-quality education system not only provides individuals with the knowledge necessary for daily life but also enhances a nation's global competitiveness. Among the various disciplines, mathematics plays a crucial role in the development of society. It fosters critical thinking, creativity, and problem-solving skills, enabling students to analyze and solve complex issues independently.

In mathematics education, teachers play a key role in creating a conducive learning environment. A well-structured and engaging classroom atmosphere is essential for stimulating students' creative thinking and motivating them to achieve their learning objectives. This becomes even more significant during disruptive events such as the COVID-19 pandemic, which has necessitated adaptations in teaching and learning methods to ensure continuous education despite limitations.

The Impact of the COVID-19 Pandemic on Mathematics Learning

The COVID-19 pandemic has posed significant challenges to the global education system. With the enforcement of social and physical distancing measures, learning has transitioned from traditional face-to-face instruction to online learning formats. This shift has placed greater demands on students' learning independence, as direct interaction with teachers has been significantly reduced. Consequently, self-regulated learning skills have become essential for academic success.

Online learning platforms such as Google Classroom, WhatsApp, and Zoom have enabled students to continue their education remotely. However, several challenges persist, including limited internet access, insufficient technological resources, and decreased student motivation. In this context, students with higher levels of learning independence have shown greater adaptability to online learning environments. In contrast, students who are more dependent on direct teacher supervision often struggle to stay engaged and manage their studies effectively. Therefore, fostering learning independence is crucial in preparing students to overcome academic challenges in any learning setting.

Discussion

The results of this study indicate that the level of mathematics learning independence among eighth-grade students at SMP Negeri 2 Langke Rembong during the COVID-19 pandemic was categorized as high, with an average percentage of 79.24%. Data analysis was conducted descriptively by calculating measures of central tendency (mean, median, and mode) as well as measures of data dispersion (variance and standard deviation). Based on the score recapitulation, the average learning independence score was 71.32, with a score range between 67 and 76. Furthermore, based on learning independence indicators, most students demonstrated a high level of learning initiative, the ability to diagnose their learning needs, and the capacity to formulate and select learning objectives effectively. Additionally, students showed competence in selecting and utilizing learning resources, evaluating their own learning outcomes, constructing meaning, and exercising self-control during online learning.

The findings also suggest that high learning independence significantly aided students in adapting to the online learning system during the COVID-19 pandemic. Despite challenges such as limited internet access and technical difficulties, most students maintained high motivation to learn mathematics independently. Factors such as personal initiative, family

support, and the instructional strategies employed contributed to the high level of learning independence. These results emphasize the importance of developing teaching strategies that foster student independence, both in online and face-to-face learning environments, to enhance the effectiveness of mathematics education in the future.

The results of this study indicate that the mathematics learning independence of eighth-grade students at SMP Negeri 2 Langke Rembong during the COVID-19 pandemic was categorized as high, with an average percentage of 79.24%. These findings align with the study conducted by Sutama, Hartini, & Novitasari (2019), which found that learning independence in mathematics can be integrated into the curriculum structure and school activities. Systematic planning of learning independence, carried out by school principals and teachers, contributes to increasing students' motivation to learn mathematics independently. In this study, students' initiative in seeking additional learning resources and active participation in online learning demonstrate that the learning strategies and habits established within the education system can shape independent learning behavior, as similarly observed in Madrasah Tsanawiyah.

Moreover, this study is also relevant to research on differences in mathematics learning independence based on gender, conducted by Setiawan, Sujiwo, & Panglipur (2024). Their study found that male and female students exhibited different levels of learning independence, with females demonstrating slightly higher independence than males. However, the results of this study indicate that, in general, students maintained a high level of independence in mathematics learning, with no significant differences based on gender. This suggests that the learning environment, including the methods used during the pandemic, played a crucial role in enhancing students' overall independence. Meanwhile, another study by Ghassani et al. (2023) revealed that learning independence in mathematics within the *Merdeka Curriculum* framework remains relatively low and requires more effective instructional methods. The discrepancy between these findings suggests that the implementation of distance learning during the pandemic fostered greater learning independence compared to traditional face-to-face instruction. Therefore, the results of this study serve as a reference for developing instructional strategies applicable in various educational settings to enhance students' mathematics learning independence.

The findings of this study reinforce the theory that learning independence is a crucial factor in the success of mathematics education, especially in the context of online learning. These results support the concept that learning independence is not solely dependent on individual characteristics but can also be influenced by the learning system applied. In this case, online learning during the COVID-19 pandemic has provided students with the opportunity to develop initiative, time management skills, and independent learning strategies. This study enriches the literature on learning independence in mathematics education, particularly in situations that require adaptation to technology and remote learning. Furthermore, these findings demonstrate that instructional approaches in mathematics can contribute to increasing student motivation and engagement, aligning with various theories of *self-regulated learning* in education.

Practically, the results of this study provide valuable insights for educators and policymakers in designing instructional strategies that enhance student learning independence. With the proven effectiveness of online learning in fostering independent learning in mathematics, schools may consider adopting *blended learning* models that combine online and offline methods, allowing students more flexibility in managing their study pace. Additionally, teachers can develop instructional methods that encourage students to actively seek learning resources independently, such as using interactive modules, digital learning platforms, and project-based learning techniques. Another implication of this study is the importance of

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fostering learning independence from an early stage, ensuring that students do not solely rely on teacher instructions but also cultivate critical thinking and problem-solving skills in mathematics learning. These findings also serve as a foundation for educational institutions to design teacher training programs focused on enhancing student learning independence through innovative and adaptive teaching strategies.

Conclusion

The level of mathematics learning independence during the COVID-19 pandemic was categorized as high across eight key indicators: taking the initiative to learn with or without assistance, formulating and selecting learning objectives, choosing learning strategies, evaluating learning outcomes, collaborating with others, constructing meaning, diagnosing learning needs, selecting and utilizing learning resources, and exercising self-control. These findings highlight the strong adaptability of students in managing their own learning processes despite the shift to an online learning environment.

This study confirms that learning independence is a critical factor in ensuring the success of online learning, particularly in procedural subjects like mathematics. Although students faced challenges such as limited access to technology and unstable internet connections, those with high learning independence were able to remain engaged, productive, and effectively comprehend the material. Their ability to self-regulate and seek additional resources played a crucial role in maintaining their learning progress.

However, additional efforts are required from schools and teachers to support students with limited access to educational resources. Providing learning facilities, technology training, and enhanced supervision can serve as effective solutions to bridge the digital divide and optimize online learning outcomes in the future. Ensuring equitable access to quality education will help all students develop the necessary skills to succeed in independent learning environments.

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