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Influence of the Blended Learning Method on Student Achievement in Mathematics Lessons

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ABSTRACT

Background. The characteristics and achievements of each student are different. This is influenced by the methods, interests, talents, media, sources, environment, and even strategies of the students themselves. A blanded learning method that combines traditional classroom learning with online-based learning can make a big impact in the world of education. It will provide opportunities for students to learn with more flexibility. It also creates a more engaging learning experience.

Purpose This study aims to find out how much the use of blended learning method affects students' achievement. This achievement is more specific to mathematics learning. This is because there are often difficulties in understanding mathematics learning by students. Therefore, the blended learning method is considered to be able to influence learning, especially mathematics.

Method. The method used in this research is quantitative. This method is considered suitable as a measuring tool. This is because the effect of using the blanded learning method on student achievement can be measured by a number scale. So that it can be read or understood through graphs, percentages, or data processing. Research using quantitative methods that have the characteristics of using numbers will be more in line with this research.

Results. The result of this study explains that the use of blanded learning method will affect students' achievement in learning mathematics. The blanded learning method that combines traditional and online-based learning will enrich the learning experience. Not only that, this method will also provide a combination of different methods, media, sources, environments, and even learning strategies.

Conclusion This research can be concluded that the use of blanded learning method will provide innovation in learning. It will support different ways of learning from students. In addition, it will also help teachers in the flexibility of organising learning time. On the other hand, it will also help students who have difficulty in following face-to-face learning.

KEYWORDS

Blanded, Influence, Learning

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INTRODUCTION

Learning is a series of processes that contain things both internally and externally in a learner (Johnson, 2019). In addition, it is also designed as well as possible by educators for optimisation efforts. In essence, it is a process

of interaction between learners either with learning resources, each other, or educators (Khosla, 2020). This process will be meaningful if the surrounding environment or conditions are conducive. Learning is also individualised and contextualised (Panyajamorn, 2022). The result of this learning will form a whole person with excellence in each learner. Learning will also connect knowledge with relevant things in life. So that teachers will also easily provide application and students understand the meaning of what is conveyed (Ihnatova, 2022). This process is not just memorising the concepts or material provided. Rather, it is a process of connecting concepts that results in a full understanding of the material (Lu, 2020). Teachers will be required to continue to explore things that exist in students. This is useful to help fuse the concept with the new knowledge being taught.

The growth of technology both in Indonesia and other countries provides a great opportunity for education. the government continues to strive to map the many varieties of digital facilities that exist. These facilities range in both hardware and software (Putra, 2021). The world of education is impacted by globalisation. The birth of innovations in technology-based learning methods that provide great benefits for students and educators. One of them is the blanded learning method that provides collaborative learning (Deng, 2022). Metode blanded learning memberikan kesempatan untuk menyatukan inovasi dan teknologi yang ditawarkan oleh pembelajaran online Blanded learning methods provide an opportunity to incorporate the innovation and technology offered by online learning (Dermawan, 2023). Student interaction and participation will influence the sustainability of this method. The collaboration that this method offers from media, devices, even with humans will bring changes to the learning pattern.

The effect of blanded learning method on mathematics learning leads to positive impacts. The emergence of initiative, motivation, and interest from students to learn mathematics. This is because there are differences in the way students learn. Even differences in the speed of understanding of relatively different students (Warren, 2021; Yang, 2019). So the existence of blanded learning brings significant changes. It is able to support students' varied learning styles. In addition, it also helps students in adjusting the pace of learning (Awamleh, 2020; Guibin, 2021; Wu, 2021). The flexibility of place and time in the implementation of learning adds to the positive impression of students. Students can repeat online learning anywhere and anytime they want. But behind the positive side there is certainly a negative side. Limited resources or infrastructure create new obstacles for students and educators. In addition, internet conditions and even proficiency in using applications supporting blanded learning methods. This can be overcome with support from the government and school centres.

This research is considered very important and has deep reasons to be researched. The use of blanded learning method on student achievement in mathematics learning is very important. This method is able to provide evidence of its positive impact on students' understanding. The blanded learning method is able to provide supporting media (Saibaba, 2022; Vo, 2022). So that there is an increase in students' understanding of concepts and fluency in mathematical procedures. On the other hand, the blanded learning method is also able to improve students' mathematical literacy. The social restrictions that apply during the pandemic make the blanded learning method an effective solution to continue the learning process. The continuation of the learning process without reducing the quality of education is strongly supported by the blanded learning method. So this research is important to be developed as an adaptive and effective learning strategy. Especially in the situation of direct social restriction.

This research will contribute significantly to the learning of mathematics. So that it can improve students' achievement of learning. This research will provide insights into improving effective teaching practices in integrating mathematics learning technology. It can be used by teachers to

improve teaching practices. It can also help in adjusting the mathematics curriculum to be more responsive to students. Presentation of data that can be used by policy makers to support educational initiatives (Mtshali, 2020; Padmadewi, 2022). It also offers recommendations for professional programmes including blanded learning training. The existence of blanded learning provides new innovations for the improvement of technology-based tools and platforms that will support effective and engaging mathematics learning. It will trigger an expanded understanding of how students integrate with mathematics materials in a blended learning environment.

The innovation initiated in this research is the effect of blanded learning method on students' achievement towards learning mathematics. Previous research on Technology Usage and Students Performance: The Influence of Blended Learning (Moghavvemi, 2023) explained the effect of blanded learning on the use of technology and student performance. Meanwhile, this research is more centred on students' achievement in learning mathematics. The difference of the research is on what is affected by the use of blanded learning. The blended learning method that affects student achievement in learning mathematics. The similarity in these two studies is the blanded learning method and the effect on students.

The purpose of the research was to measure the effect of blanded learning on students. In addition, it measures how this method is able to provide an understanding of mathematics learning for students. On the other hand, it is useful to evaluate the thinking ability of students. So as to be able to solve problems related to mathematics. Positive and negative effects can be known. This will help minimise the risks in the learning process. Teachers will be helped by identifying the influence of blanded learning in learning. Identifying the challenges and obstacles that often occur for students and teachers and the strategic steps that can be taken.

The research hopes that the use of the blanded learning method will provide a new way of improving student achievement in mathematics learning. Appropriate adjustment of the method will help students feel comfortable and understand the material presented. With the collaboration that occurs in the blanded learning method, it can increase students' interest and talent in mathematics. The researcher's biggest hope is that this article can contribute to the development of the world of education and technology. In addition, it can also be taken into consideration for further research with a more in-depth discussion. It is hoped that the right strategy in using blanded learning for students will reduce the negative risks that arise.

RESEARCH METHODOLOGY

Research Design

This study uses a quantitative method. A study that presents results in the form of numbers. The statements presented are 20 items that will be inputted into Google from. Google from is a medium between the subject and the researcher. The use of Google from is relatively easy to access and easy to share (Jia, 2021). This will lead to quick and efficient feedback. In the inputting of questions about the effect of blanded learning method on students' achievement in learning mathematics. The method used is useful to facilitate the formulation of results from the statements and views of the selected subjects. This method is a form of research or data collection in the form of numbers that can be tested and measured. Finally, the researcher will review the responded results from both teachers and students.

Research Procedure

The implementation of a systematic series of steps to collect, analyse, and provide an understanding of the data conducted by this research. The research began with the process of requesting permission from teachers and students who would be asked questions. The next stage, the

questions are elaborated into a questionnaire form found on Google from to be distributed. Responses from subjects will be percented for ease of calculation. This process is carried out until the desired data is fulfilled. Statements are presented using good and correct language so that they are easily understood by both teachers and students. So that collection can be done quickly and does not take much time. This will make it easier for the research to test the data and examine the various advantages and problems that occur when using audio visual media.

Research Subjects

This research focuses on students and teachers from various levels who use the blanded learning method. The researcher acts as a collector of every answer given by teachers and students to the statements given. This research will be very important in measuring how influential the blanded learning method is on student achievement in learning mathematics. In addition, it also provides the reason for each response given. Providing the advantages and disadvantages of this method. This will provide an overview to teachers in the use of appropriate methods in learning. So that this way can be an effort to anticipate the risks that will arise when using technology. Even the risk of using blanded learning method for students and teachers.

Research Ethics

Good research will not override the researcher's manners and ethics. Research ethics is an important aspect in conducting this activity. Research ethics is a form of basis, foundation, behaviour, direction that will help researchers in carrying out their duties. This is useful for maintaining the comfort and safety of both subjects and researchers (Lavery, 2018; Thompson, 2018). Research ethics will also regulate the attitude and behaviour of researchers. Research ethics will provide a sense of comfort, security, and lack of discrimination against subjects and researchers. So that the research process can run easily. The process of collecting data and information will no longer be difficult. This aspect includes consent and permission from the research subject. The data collected will be kept safe from personal property rights. The research will be conducted in a fair and impartial manner. Coercion of will will not occur during the conduct of the research. Furthermore, the researcher appreciates every response given by all parties who have helped.

Data Collection Technique

This data collection uses a questionnaire listed in google from. The questionnaire was distributed to teachers and students via WhatsApp. This aims to make it easier to answer and recap the answers given. This method can save time and costs in collection. Each answer responded by the subject through the questionnaire will be automatically recorded and percentageed. The percentage results are inputted into excel to carry out the next process. The process is a data calculation using the SPSS application. The calculation is to compare the response results from both parties to the effect of blanded learning method on achievement in learning mathematics.

Table 1 Sample Population

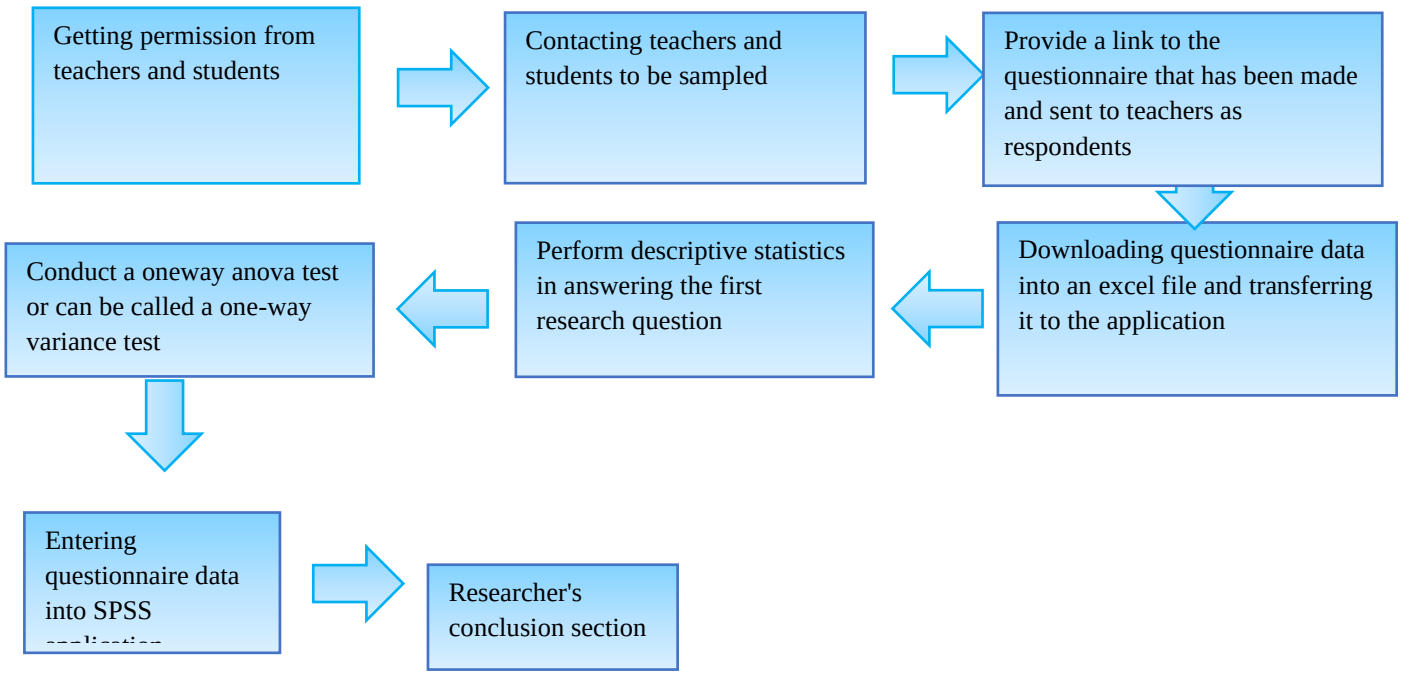
NO	**Department of**	Number of Participants	Percentage
1.	Teacher	10	40%
2.	Student	15	60%

Table 2 Details of the research sample

No	**Choice Category**	Tier Number
1	Strongly Agree (5)	>90%
2	Agree (4)	70-80%

3	Disagree (3)	50-60%
4	Strongly Disagree (2)	0-40%
Total		100%

Figure 1 Data collection and data analysis tools



RESULT AND DISCUSSION

The blanded learning method in education has a positive impact. The blended learning method that provides collaboration from various aspects of learning support brings an increase in student achievement. Increased student achievement can occur with a combination of varied media, environments, methods, and ways of learning. So that students can adjust the pace of learning. The existence of post-covid 19 outbreak with the application of blanded learning method is able to adapt to the situation. Learning using the blanded learning method is a combination of traditional and online learning methods. Understanding of mathematics concepts also improved. This subject, which is considered difficult by students, can use the blanded learning method. This method allows strengthening students' understanding of mathematics material.

The increase in mathematical literacy is influenced by the blanded leaning method. So that students are sought to be able to understand and apply mathematical concepts in various ways. This statement is supported by the notion of learning that must be relevant to everyday life. So that the concepts in learning can be related to reality. In addition, this method will affect the problem-solving process in learning mathematics. This will be a key competency for students to improve learning achievement. Therefore, the blanded learning method is an innovation that will provide significant changes and benefits to education, especially mathematics learning. The resulting improvement is not only limited to memorisation, but concept understanding, application, and problem solving. The following is a table of statements from teachers and students regarding the effect of the blanded learning method on student achievement in learning mathematics.

Table 3 Teachers' responses to the effect of blanded learning method on students' achievement in learning mathematics

NO	Question	SS (%)	S (%)	TS (%)	STS (%)
1	Teachers feel that the blanded learning method increases students' interaction with the learning material	60%	40%	0%	0%
2	With blended learning, teachers can give feedback faster to students	40%	60%	0%	0%
3	Teachers see an increase in students' understanding of mathematics concepts since implementing blended learning.	60%	33%	7%	0%
4	Blended learning allows teachers to be more flexible in organising learning time	53%	47%	0%	0%
5	Teachers can monitor students' learning progress more effectively with blended learning	53%	47%	0%	0%
6	This method helps students who have difficulty following classroom learning to learn at their own pace	53%	47%	0%	0%
7	Blended learning facilitates better collaborative learning among students	60%	40%	0%	6%
8	Teachers find it easier to tailor learning materials to students' individual needs	47%	53%	0%	0%
9	Learning becomes more interesting and interactive with blended learning	53%	47%	0%	0%
10	Teachers see improvement in students' fluency in mathematical procedures	40%	53%	7%	0%

In the table above, it is clear that there is a similar percentage of several different items. Almost all answered strongly agree and agree to the statements submitted. Although some still disagree. The statement in item 3 regarding teachers seeing an increase in students' understanding of mathematics concepts since implementing blanded learning. As well as in item 10 regarding the improvement of students' fluency in mathematical procedures. This is based on some limitations of access and technology skills of both students and teachers. It is also supported by the differences in students' learning styles. There are some students who find it more difficult to understand mathematics learning through online. On the other hand, there are also difficulties in managing learning independently. This is because the use of blanded learning requires a higher level of discipline from students. Technical problems that often occur will also affect the learning process of students. These things are felt to interfere with the understanding and also the smoothness of the learning process of mathematics.

Table 4 Students' responses to the effect of using blanded learning method on students' achievement in learning mathematics

NO	Question	SS (%)	S (%)	TS (%)	STS (%)
1	Students like being able to learn online and offline, so students don't feel burdened.	53%	47%	0%	0%

2	Blended learning makes students more responsible for their own learning	60%	40%	0%	0%
3	Students feel more comfortable asking questions and discussing in an online forum than in class	20%	80%	0%	0%
4	Online materials help students understand lessons that are difficult in class	40%	60%	0%	0%
5	Students can repeat the lesson material whenever needed	53%	47%	0%	0%
6	Collaboration with friends is easier with the online tools provided	40%	60%	0%	0%
7	Students feel more prepared for exams because they can study in different ways	53%	47%	0%	0%
8	Blanded learning helps students organise their study time better	27%	73%	0%	0%
9	Students are more motivated to learn because this method is more interesting	40%	60%	0%	0%
10	Students feel they have increased achievement in maths with blended learning	60%	40%	0%	0%

In the table above, it can be seen that each statement chose higher agree responses and supported by strongly agree responses. The proposed statements and students' responses illustrate that the blanded learning method will support the learning process of mathematics. This is based on the collaboration of face-to-face and online learning. So that students who do not understand can repeat in online learning. This will help students to adjust their learning pace. The attitude of responsibility will also grow from students in the learning process. In addition, it will also help improve the discipline of students. The preparation of students for the exam is also more mature with the collaborative learning method. Students also feel that collaboration with friends is easier when via online.

Table 5: Teachers' responses to the effect of blanded learning method on students' achievement in mathematics learning using oneway anova test.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
X.1	Teacher	2.800	7	.400	3.500	.060
	Guru	.800	7	.114		
	Total	3.600	14			
X.2	Teacher	1.900	7	.271	1.118	.444
	Teacher	1.700	7	.243		
	Total	3.600	14			
X.3	Teacher	4.433	7	.633	3.410	.064
	Teacher	1.300	7	.186		
	Total	5.733	14			
X.4	Teacher	2.533	7	.362	2.111	.173
	Teacher	1.200	7	.171		
	Total	3.733	14			

X.5	Teacher	2.033	7	.290	1.196	.410
	Teacher	1.700	7	.243		
	Total	3.733	14			
X.6	Teacher	2.533	7	.362	2.111	.173
	Teacher	1.200	7	.171		
	Total	3.733	14			
X.7	Teacher	2.400	7	.343	2.000	.190
	Teacher	1.200	7	.171		
	Total	3.600	14			
X.8	Teacher	2.433	7	.348	1.872	.214
	Teacher	1.300	7	.186		
	Total	3.733	14			
X.9	Teacher	2.433	7	.348	1.872	.214
	Teacher	1.300	7	.186		
	Total	3.733	14			
X.10	Teacher	4.033	7	.576	3.103	.079
	Teacher	1.300	7	.186		
	Total	5.333	14			

The table above is a sample of teachers tested using the oneway anova technique. The total sum of squares in item 10 is 5,333, df 14, mena square 0.576, F 3.103, and ssig 0.079. This is about teachers seeing an increase in students' fluency in mathematical procedures. This statement has a rejection of 7% of the data collection results. This is because there are several obstacles that will interfere with the smooth running of this method. This is like the stuttering of the use of technology. So that the blanded learning method is not implemented effectively.

Table 6 Student responses to the effect of blanded learning method on student achievement in mathematics learning using oneway anova test

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
X.1	Students	1.233	7	.176	.493	.814
	Students	2.500	7	.357		
	Total	3.733	14			
X.2	Students	2.600	7	.371	2.600	.115
	Students	1.000	7	.143		
	Total	3.600	14			
X.3	Students	1.400	7	.200	1.400	.334
	Students	1.000	7	.143		
	Total	2.400	14			
X.4	Students	2.100	7	.300	1.400	.334
	Students	1.500	7	.214		
	Total	3.600	14			
X.5	Students	2.233	7	.319	1.489	.306
	Students	1.500	7	.214		

	Total	3.733	14			
X.6	Students	3.100	7	.443	6.200	.014
	Students	.500	7	.071		
	Total	3.600	14			
X.7	Students	2.233	7	.319	1.489	.306
	Students	1.500	7	.214		
	Total	3.733	14			
X.8	Students	1.433	7	.205	.956	.523
	Students	1.500	7	.214		
	Total	2.933	14			
X.9	Students	1.600	7	.229	.800	.612
	Students	2.000	7	.286		
	Total	3.600	14			
X.10	Students	3.600	7	.514	.	.
	Students	.000	7	.000		
	Total	3.600	14			

The table above shows the responses of students to the statements related to the effect of blanded learning method on students' achievement in learning mathematics. Toal sum squares 3,600, df 14, mean square 0.514, with F and Sig none. This statement is about students feeling they have increased achievement in maths with blended learning. This is supported by the ease of access and also being able to view the material repeatedly. So that students feel excited and motivated to learn. Learning using blanded learning method is creative and interesting. This is what supports the increase in student achievement.

Learning is a series of processes of understanding a concept internally and externally. It is also related to students, teachers, and learning media. Learning mathematics is something that is classified as difficult among students. Students who are unable to apply the formulas and concepts taught will make it difficult to solve problems. In addition, students do not understand the material explained by the teacher. Another factor is the boredom that occurs during the learning process of mathematics. Applying the right method for learning mathematics will improve student achievement. Different ways of learning will affect understanding. Understanding will later affect achievement. This is what teachers must understand to choose learning methods for students. Learning maths requires concentration and accuracy in calculations. Some students will understand if explained directly and some must be explained slowly and even repeatedly. The blanded learning method will support the learning process of mathematics.

Blanded learning method is a combination of face-to-face or traditional learning with online learning. So this will help students to adjust the pace of learning. On the other hand, it will also help students to repeat learning anywhere and anytime. Teachers and students will also get the impression of flexibility in terms of place and time. Collaboration between students will also be easier via online. There is no noisy atmosphere that will disrupt the lesson. So that the smoothness in learning mathematics will be formed. On the other hand, the blanded learning method will increase the sense of responsibility and discipline in students. The learning process using this method is more interesting and varied. So that there is no boredom in students when learning mathematics. The existence of concept understanding by students will lead to the ability to solve mathematical problems. The

improvement of this ability will give students more independent and collaborative activities that support.

The use of blanded learning can be through a rotational model. This model allows the flexibility of students to learn online or face-to-face according to their needs. It can also be applied with flipped classroom or google classroom. This method will help students learn the material online and apply it in more interactive classroom activities. Project-based learning can also be applied. This method will provide the possibility of integrating collaborative learning process. Thus, blanded learning can be customised to fulfil the learning needs of the students. Students will also have a more interactive and enjoyable learning experience.

The positive effect can also bring negative effect on the use of blanded learning. The risk of cheating in the implementation of exams and assignments will increase if it is done online. This method also uses technology, so it will allow for potentially high dependency. This will become a problem if students or teachers are not wise in using access. Another challenge is the lack of skills of students and even teachers in using technology. This will affect the effectiveness of learning. Assessment and monitoring in blanded learning method can be more complicated than traditional learning. The change from traditional method to blanded llearning method will change the mindset of education for students. The use of software will be an obstacle for this learning method. Unstable internet or unsupportive gadgets will create instability.

Technical challenges that are inevitable in using this method can be anticipated. Implementation of training and development for teachers and students when using this method. Orientation or introduction to digital tools, educational applications in online learning. Adequate technical support and infrastructure. Having stable internet, software, hardware will certainly affect the use of this method. Encourage students and teachers to establish good communication with each other so as not to experience difficulties when delivering material. High student involvement will affect the learning process. The more active the students are, the more interesting and interactive the learning will be.

CONCLUSION

It can be concluded that blanded learning method is a combination of traditional and online learning. This method is considered to have a positive impact on student achievement in mathematics. Through this method, students and teachers benefit from time and place flexibility. Access to a wider range of learning resources. Thus improving students' understanding of mathematical concepts and skills. Effective implementation of blended learning requires careful planning. Adequate infrastructure and training and technical support for teachers and students. Although there are challenges such as dependence on technology and the need for digital skills. Strategic solutions can be applied to overcome these obstacles. In addition, it maximizes the potential of blanded learning methods. Overall, blanded learning promises to improve the quality of mathematics learning and student learning outcomes.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation.
Author 2: Conceptualization; Data curation.
Author 3: Data curation; Investigation.
Author 4: Writing - review and editing.
Author 5: In-vestigation.

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