



# Motivation and learning media: How do they affect mathematics learning outcomes after the covid-19 pandemic?

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## Abstract

After the pandemic, people began to adjust to the changes during the pandemic. The rapid progress and development of information and technology are now entering the world of education. Information technology has begun to be widely used to support the smooth running of the teaching and learning process, one of which is to support student learning outcomes. This study aimed to determine the differences in student learning outcomes in the control and experimental classes by considering students' learning motivation. This type of research is an experimental study with a 2×2 factorial design. Discrete mathematics learning outcomes for even-semester students in 2021/2022 will be grouped based on learning media (PowerPoint and Kahoot) and student motivation (high and low). To find out the differences in student learning outcomes, a 2-way ANOVA test was carried out using SPSS. The results of this study show significant differences in student learning outcomes between students with high learning motivation and those with low learning motivation. There is no significant difference in learning outcomes between Kahoot learning media and PowerPoint learning media. Then it is known that other factors affect student concentration; namely, an interaction between learning media and learning motivation influences students' learning outcomes. The Kahoot media was proven to make the learning atmosphere more fun during the learning activities. Students were more active in participating in the learning process.

## INTRODUCTION

The Corona Virus Disease 2019 (Covid-19) pandemic engulfs all countries globally as a disease that can spread directly or indirectly from one person to another. The spread of the coronavirus is so fast that the World Health Organization (WHO) has declared Covid-19 as a global pandemic. (Dewi, 2020; Mustakim, 2020; Rigianti, 2020). In connection with the outbreak of the Covid-19 attack, the Minister of Education and Culture of the Republic of Indonesia issued Circular Letter Number 4 of 2020 regarding the implementation of education policies during the spread of Covid-19 (Pramita, Sukmawati, Adini, et al., 2021). The pandemic changed the education system, which initially learned face-to-face to distance learning. This policy was taken to continue the learning process (Sintema, 2020). The post-pandemic new normal is a social condition/habits of individual social behavior in a society that emerged after the Covid-19 outbreak.

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new life habits during the pandemic (Zaenuddin et al., 2021). New adjustments or what we call the New Normal. This new normal includes many things, from lifestyle, actions, and habits. We as humans will continue to grow, both in population and the ability to think and adapt. Advances and developments in information technology are now starting to enter the world of education. Information technology has begun to be widely used to support the teaching and learning process. The development of information technology in schools includes using it to develop learning media (Pramita, Sukmawati, Purba, et al., 2021). Competition is one way that teachers can do to raise students' learning motivation in learning activities (Sardiman, 2016). Through competition, students will be encouraged to win the competition. Competition, in this case, is to get a higher score than his friends. Several students said they felt proud and happy when they got higher scores than their friends based on interviews. It means that most of the students in the class enjoyed it. Optimal or not learning outcomes are strongly influenced by the level of motivation to learn. Expressing motivation is a very important condition in learning (Sardiman, 2016).

Now technology in education is not so foreign to students and teachers. During the COVID-19 pandemic, everyone used technology and learning media to support the learning process. With conditions like today, as a teacher, you must be able to choose the right learning media for use in online and offline learning. This is because learning media is useful for generating learning motivation and student creativity (Wibawanto, 2017). One of the learning media innovations that can be used is in the form of game media. One of them is Kahoot. Kahoot can increase participants' learning motivation so that participant learning outcomes can increase (Ulimaz, 2019), can improve thinking skills and learning outcomes (Ningrum, 2018; Nugraha, 2018; Nurhayati, 2020), and affect learning outcomes, meaning that the use of Kahoot is more effective in the learning process (Betyka et al., 2019; Mafruhah et al., 2019), and effective as a technology-based learning media (Bahar et al., 2020). Kahoot is an online application that teachers can use to create interactive and fun online quiz-based learning media. The Kahoot quiz as a learning medium can be made via the <https://create.kahoot.it/> link. Through this page, the teachers can make quizzes with several questions according to their needs.

When starting the game, through the quiz made, a pin will be obtained that connects the student to the quiz created by the teacher. The PIN is then displayed in front of the class so that students in the class know it. Students will be asked to enter their "game PIN" and name when using Kahoot. Based on research (Solmaz & Cetin, 2017) comparing the use of the Interactive Response System (IRS), namely Kahoot, Socrative, and Plicker. The study results were that 75% of students stated that Kahoot was fun when used in learning activities. Through the Kahoot application, teachers can provide material through questions in a quiz that asks for student responses to answer and is given a score. Each score/rank will be displayed in front of the class. According to the study results (Smith & Brauer, 2018), 85% of students stated that they always try to answer every Kahoot quiz correctly. This is evidence that most students are encouraged to answer each Kahoot quiz as well as possible. This is the background for researchers to research how learning media and motivation affect mathematics learning outcomes.

Based on observations about computer education students' motivation and learning outcomes, FKIP Lambung Mangkurat University, when studying discrete mathematics after the pandemic, tended to be relatively low. In addition, previously, students only studied online from their homes. Now, after the pandemic, students are asked to enter class by following the health protocols, so they are still not used to studying after the pandemic. Good internet access and an

LCD projector interest researchers in creating fun learning, especially for discrete mathematics learning. This is also supported by (Pramita, Sukmawati, Adini, et al., 2021; Sartika & Octafianti, 2019), who stated that the Kahoot application was very suitable to be used as an evaluation tool. Besides that, it helps to learn to be more interesting, not boring. Further, increases the creativity and activity of students not only for mathematics but can be used for all subjects.

Several studies have discussed the effectiveness of Kahoot media on learning outcomes (Ilmiyah & Sumbawati, 2019; Kudri & Maisharoh, 2021; Setiawati et al., 2018), learning motivation (Sinaga et al., 2022), learning independence (Izzati & Kuswanto, 2019), interest in learning (Kusumaningrum & Pramudiani, 2021) and understanding of students' mathematical concepts (Ntjalama & Murdiyanto, 2020). Some articles do not explain the motivation studied or whether these students have high/low motivation. Based on the previous article, this article aims to determine the differences in student learning outcomes in the control class using PowerPoint and the experimental class using Kahoot by considering the student's learning motivation after the COVID-19 pandemic, which is divided into 2, namely high motivation and low motivation. This is the background for researchers to research how learning media and motivation affect mathematics learning outcomes.

## METHODS

Research design considers the possibility of moderating variables that affect the treatment (independent variable) on the results (supervision variable). This research is a quasi-experimental type of research. This experimental research uses a 2x2 Factorial Design. The factorial design paradigm can be described in Table 1. as follows.

**Table 1.** 2x2 Factorial Design

Learning Motivation	Learning Media	
	PowerPoint (X1)	Kahoot(X2)
High (Y1)	X1 Y1	X2 Y1
Low (Y2)	X1 Y2	X2 Y2

Descriptions:

X1 Y1: Students who use PowerPoint learning media to learn and have high learning motivation.

X2 Y1: Students who use Kahoot learning media to learn and have high learning motivation.

X1 Y2: Students who use PowerPoint learning media to learn and have low learning motivation.

X2 Y2: Students who use Kahoot learning media to learn and have low learning motivation.

The purpose of this study is to find out the differences in student learning outcomes in mathematics material which in delivering the material uses PowerPoint media (X1) and student learning outcomes in learning using Kahoot media (X2) by paying attention to highly motivated students (Y1) and lowly motivated students (Y2). Hypothesis testing in this study is as follows: The first hypothesis is, Is there a difference in the learning outcomes of students who have high learning motivation and students who have low learning motivation?

Ho: There is no difference in the learning outcomes of students with high learning motivation and those with low learning motivation.

Ha: There is a difference in the learning outcomes of students with high learning motivation and those with low learning motivation. The second hypothesis is, Is there any influence on student learning outcomes between using PowerPoint and Kahoot learning media?

Ho: There is no effect on student learning outcomes between using PowerPoint learning media and Kahoot learning media.

Ha: There is an effect on student learning outcomes between using PowerPoint learning media and Kahoot learning media. The third hypothesis is, Is there any interaction between Kahoot learning media and students' learning motivation on student learning outcomes?

Ho: There is an interaction between Kahoot learning media and students' learning motivation on student learning outcomes.

Ho: There is no interaction between Kahoot learning media and students' learning motivation on student learning outcomes.

The population in this study was 162 even semester students for the 2021/2022 academic year who were in the Computer Education Study Program FKIP Lambung Mangkurat University. Then the research sample was taken from as many as 37 students who programmed discrete mathematics courses. The provision of material with two other media is carried out in 2 classes: class X1 with 19 students as the control class and X2 with 18 students as the experimental class. The instruments of this research are discrete mathematics learning outcomes test instruments and learning motivation questionnaires. The purpose of the discrete mathematics learning outcomes test instrument is to see the level of achievement of learning outcomes to reveal whether there are differences in the use of media in discrete mathematics learning. Meanwhile, the learning motivation questionnaire instrument aims to identify and classify students based on the type of high or low motivation so that it will be known what media is suitable for the student's learning motivation in discrete mathematics learning.

### Data Analysis

The first stage is Validation Analysis. The validation results carried out by experts are used as a reference for the validity of using media or materials in research. To calculate the percentage of valid media and materials, use the following formula.

$$\text{Percentage Validation (\%)} = \frac{\text{Total score}}{\text{criteria score}} \times 100 \dots(1)$$

Description:

Criteria Score = Highest Score Item × Number of Items × Number of Validators

The second stage is Analysis of Student Learning Motivation: Data on the level of student motivation obtained through the instrument of student learning motivation. The instrument is filled in by giving a checkmark (√), representing a score of 1 – 4 on the answers that are considered by how they feel, namely: Strongly Agree, Agree, Disagree, and Strongly Disagree. Furthermore, the students' responses were analyzed by calculating the number and percentage obtained from each student, namely the total score of each aspect with the maximum and multiplied by 100% as follows:

$$P = \frac{f}{N} \times 100\% \dots(2)$$

Descriptions:

P: Percentage of Student Learning Motivation

f: Score obtained  
 N: Maximum score

After obtaining the percentage of student learning motivation, the score will be categorized into low and high. The results of the percentage score of student learning motivation are matched first with several criteria, namely:

**Table 2.** Learning Motivation Criteria

Persentase Respon	Respond	Criteria
$85\% \leq \text{response} < 100\%$	Very High	High Learning Motivation
$70\% \leq \text{response} < 85\%$	High	
$50\% \leq \text{response} < 70\%$	Less High	Low Learning Motivation
$0\% \leq \text{response} < 50\%$	Not High	

Based on these criteria, students' learning motivation will be grouped into two: high learning motivation and low learning motivation. High motivation to learn consists of positive and very positive response results. In contrast, the low criteria consist of less positive and not positive responses.

The third stage is the analysis of learning outcomes: The analysis of student learning outcomes data is that student learning outcomes are given after treatment in the form of learning activities in class using two different media for each class. Data on student learning outcomes were obtained from the post-test scores of each student given at the last meeting. The formula used to determine the students' post-test scores are:

$$\text{Student Scores} = \text{Number of Question Items Answered Correctly} \times 2.2 \dots(3)$$

The students' scores obtained through post-test scores will later be grouped based on four groups in this study. Furthermore, it will be processed using the SPSS application.

## RESULTS AND DISCUSSION

In this section, research data will be presented from three subjects consisting of subjects with high ability (S-1), subjects with medium ability (S-2), and subjects with low ability (S-3). The issue is taken based on problem-solving skills that students can do. The following findings are Learning using Kahoot media in the experimental class was carried out for three sessions: pretest, material-giving, and post-test sessions. When studying in class, students can use smartphones or laptops. All the names of students who have taken the quiz will appear on the screen. This activity is shown in Figure 1.



**Figure 1.** Students Joined Kahoot Quiz

At the first meeting, before using Kahoot in learning activities, students were asked to fill out a learning motivation instrument to measure each student's level of learning motivation. The pretest session was carried out before learning began, then continued with the session of giving material. After the time to answer the pretest questions runs out, the teacher will provide students with material related to these questions. Next, the last session is the post-test session. The post-test session is given at the end of the learning activity after the students have studied all the material. This activity is shown in Figure 2.



**Figure 2.** Students Did the Post-Test in the Class

Based on learning motivation for the entire sample, 37 students obtained the results in Table 3.

**Table 3.** Number of Students in Each Group

Learning Motivation	Learning Media	
	PowerPoint (X1)	Kahoot(X2)
High (Y1)	X1 Y1 High Learning Motivation with PowerPoint Media 13 Students	X2 Y1 High Learning Motivation with Kahoot Media 8 Students
Low (Y2)	X1 Y2 Low Learning Motivation with PowerPoint Media 6 Students	X2 Y2 Low Learning Motivation with Kahoot Media 10 Students

After obtaining the grouping of students' motivation levels and post-test scores, the data were processed using the SPSS application. Until the following results are obtained:

**Table 4.** Descriptive Statistics

Motivation to Learn	Learning Media	Mean	Std Deviation	N
High	Powerpoint	57.8224	12.03856	13
	Kahoot	60.5236	10.12717	8
	Total	58.2456	11.2457	21
Low	Powerpoint	49.6875	8.90801	6
	Kahoot	39.2647	7.16789	10
	Total	42.6000	9.05654	16
Total	Powerpoint	55.5000	11.69660	19
	Kahoot	49.6094	14.07224	18
	Total	52.4597	13.20932	37

So that the average value of high learning motivation and using PowerPoint media is 57.82, the average score for highly motivated students taught using Kahoot media is 60.52. This means that students who are highly motivated and given material with Kahoot media have an average learning outcome of 2.70 higher than students who are highly motivated but are given material through PowerPoint media. Based on the average student learning outcomes, each group tends to be low. This is the impact of the low student learning outcomes. In contrast, the results of hypothesis testing are in Table 5.

**Table 5.** Two Path Anova Test Results, Tests of Between-Subjects Effects

Dependent Variable: posttest

Source	Type III Sum of Square	df	Mean Square	F	Sig.
Corrected Model	4786,822a	2	1595,607	15,801	,000
Intercept	146047,762	1	146047,762	1446,307	,000
Learning Motivation	3040,047	1	3040,047	30,106	,000
Learning Media	151,024	1	151,024	1,504	,225
Learning Motivation*Learning Media	675,836	1	675,836	6,693	,012
Error	5856,827	23	100,880		
Total	181268,750	37			
Corrected Total	10643,649	36			

a. R Squared= .450 (Adjusted R Squared= .421)

The results of the two-way ANOVA test on each variable are shown in Table 5, namely the first hypothesis about student learning motivation factors rejecting H0 and accepting Ha. The conclusion is the difference between student learning motivation and student learning outcomes. So, in this study, the hypothesis is accepted that there is a significant difference in learning outcomes between students with high learning motivation and those with low learning motivation.

The second hypothesis regarding the influence of learning media obtained a significance value of  $0.225 > 0.05$ . This condition means that H0 is accepted. So, for the learning media factor, there is no significant difference in student learning outcomes between using PowerPoint learning media and Kahoot learning media. So, in this study, it was found that there was no effect of the use of learning media on student learning outcomes.

Calculating the significance of the interaction between learning motivation and learning media obtained a value of  $0.012 < 0.05$ . Because the significance value is  $< 0.05$ , then H0 is

rejected. So it can be interpreted that there is an interaction between Kahoot learning media and student learning motivation on student learning outcomes.

This research was implemented in 4 meetings with details of 3 times the material and 1-time post-test. Each meeting has 2 lesson hours, which is 100 minutes. At the first meeting, time was taken to fill out motivational questionnaires. Then the experimental class was continued by preparing a Kahoot on their respective smartphones/laptops and continued with the pretest. So that the first material is given with a remaining duration of about 45 minutes, and the duration for the post-test is 15 minutes.

The second and third meetings are based on the schedule and research planning. Students are only given the basics of mathematical logic. Next, in the fourth meeting, namely the implementation of the post-test, students were asked to answer the post-test questions according to the material that had been previously given.

The findings during the learning activities in the experimental class took place. First, the students stated that it was the first time they had used Kahoot learning media, which was very interesting and challenging. Second, all students play an active role in participating in learning activities. Even some students feel ordered to solve all the test questions quickly and want to have the highest score. Students have special pride when their names are displayed on the LCD screen. Following previous studies, Kahoot can make students play an active role in learning activities (Bicen & Kocakoyun, 2018; Pramita, Sukmawati, Adini, et al., 2021; Sartika & Octafianti, 2019; Sintema, 2020; Wang & Lieberoth, 2016).

Students focus on speed to answer and achieve the highest score. However, this affects the students' concentration when listening to the teacher's explanation. Some students hurry to move on to the next question to know the score faster. So in answering questions, sometimes students do not give the correct answer. It affects student learning outcomes in implementing the post-test, which is classified as low. In addition, the low student learning outcomes are also influenced by several factors, including the short time to deliver the material. So that the material presented is not optimal (Ismail & Mohammad, 2017; Iwamoto et al., 2017).

The research results (Omar, 2017) asked for students' feedback about using Kahoot. They looked at several ranking categories shown by Kahoot based on the speed and accuracy of students in answering quizzes. In this category, a student stated that Kahoot was very fun but actually could not judge a person's performance or not by answering the quiz quickly and accurately (Setiawan & Soeharto, 2020). Following the student's statements in this study, they were ordered by the most significant score, not by the number of questions answered correctly.

Based on the observations made by researchers during the research process, Kahoot has generally affected the dynamics, and the learning atmosphere becomes more enjoyable. The learning process using Kahoot can attract attention and force students to focus on what is in front of the class. So that the classroom atmosphere becomes easier to control (C. S. Lin & Wu, 2016; M. H. Lin et al., 2017; Y. W. Lin et al., 2017; Muhammad & Tetep, 2018)

Results-Based this research is theoretical and practical. The first theoretical implication of this research is that students' learning motivation influences student learning outcomes. Students with high motivation tend to have greater curiosity and are more active in learning activities in class than students with high learning motivation. It is expected that teachers can foster learning motivation in students in various ways according to their abilities and which are attractive to students. Second, there is an interaction between learning media and learning motivation in

influencing student learning outcomes. Kahoot media is proven to make the learning atmosphere more fun during learning activities. Students are more active in participating in the learning process. Third, although there is no significant difference in learning outcomes between Kahoot learning media and PowerPoint learning media, teachers are expected to always provide innovations and solutions in the learning process, especially in mathematics learning, to improve student learning outcomes. Meanwhile, the practical implications of this research are that it can be used as input for teachers and prospective teachers. Improving myself in terms of teaching that has been done and student learning outcomes that have been achieved by paying more attention to appropriate learning media and student motivation to improve student learning outcomes in mathematics.

This study has shortcomings and limitations. For further research, researchers should conduct research that is more focused on indicators of student learning motivation that do not exist in this study, such as the ability of students to give their opinions / defend their opinions, the frequency of students paying attention to the teacher when delivering material in the process. Learning and learning can develop this research by looking at other factors that affect student learning outcomes to maximize research results.

## **CONCLUSIONS**

Based on research on differences in student learning outcomes by considering factors of learning motivation and learning media, it can be concluded that there are significant differences in student learning outcomes between students with high learning motivation and students with low learning motivation. Then it is known that other factors affect student concentration; namely, an interaction between learning media and learning motivation influences student learning outcomes. There is no significant difference in learning outcomes between Kahoot learning media and PowerPoint learning media.

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## **AUTHOR CONTRIBUTIONS STATEMENT**

Based on his contribution to this research, MP as the lead researcher, prepared the research as a whole, constructed research instruments, and wrote the articles. RAS contributed as an analytical instrument and wrote down the findings during the study. NW contributed as a documentary during research and editor in writing articles.

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