

## **Generation Sustainability Strategy Through Gamification Learning: A Study of the Influence of Habits of Mind and Mathematics Interest on Decision-Making Ability**

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**Abstract:** *This research was motivated by students' lack of interest and response to learning mathematics. Based on findings in the field, it was found that students still considered mathematics a scourge and the most boring subject. This study aims to determine the influence of habits of mind and mathematics interest on students' decision making through gamification learning. This is a correlational research ex post facto quantitative approach using double linear regression. The data were obtained through questionnaires and tests. The research was conducted at SMKN 1 Geger, Madiun, East Java, with research subjects consisting of students of class XI Islamic Banking 1 and class XI Automation of Office Management 1. The results showed that habits of mind and mathematics interest significantly positively affected students' decision making in mathematics through gamification learning.*

**Key Words:** Decision Making; Gamification; Habits of Mind; Mathematics Interest

### **Introduction**

21-st century learning emphasizes critical thinking, collaboration, communication, and creativity (4C) (Vacide Erdoğan, 2019; Panggabean et al., 2021). These are several competencies and skills that students must master in learning in the 21<sup>st</sup> century (Le et al., 2022). These competencies and skills can be learned through students learning mathematics (Yilmaz, 2020). Based on findings in the field, it was found that students still considered mathematics a scourge and the most boring subject, in line with the findings of Nyakudya (2020) and Wibawa et al. (2022). Supported by the PISA and the TMMS study results, Indonesia is still ranked very low for its mathematics results (OECD, 2019). This affects students' habits of mind and mathematics interest, which will affect student decision making.

Habits of mind are the tendency to think and behave intelligently to enable productive actions when dealing with problems (Altan et al., 2019; Pratiwi et al., 2020). Costa Kallick

defines habits of mind as a person's thinking habits when dealing with complex problems (Astatin et al., 2020; Donmez et al., 2020). Marzano categorizes habits of mind into 3 categories: self regulation, critical thinking and creative thinking (Alpusari et al., 2020; Hidayati & Idris, 2020). On the other hand, Costa and Kallick categorize the habits of mind into 16 categories: persisting, managing impulsivity, listening with understanding and empathy, thinking flexibility, metacognition, striving for accuracy, questioning and problem posing, applying past knowledge to new situations, thinking and communicating with clarity and precision, gathering data through all sense, creating, imagining and innovating, responding with wonderment and awe, taking responsible risk, finding humor, thinking independently, remaining open to continuous learning (Rikizaputra & Firda, 2020; Arifah et al., 2021; Mujib & Firmansyah, 2022). Habits of mind are defined as students' thinking habits in solving a previously unknown problem. Habits of mind are related to students' mathematics interest, where habits of mind will affect the level of students' mathematics interest (Wong and Wong, 2019).

Mathematics interest is the willingness and awareness to study (Bringula et al., 2021). Mathematics interest can predict students' mathematics learning outcomes and make students not afraid of mathematics (Suren and Ali Kandemir, 2020). Mathematics interest is a willingness and awareness to learn mathematics with feelings of pleasure, full attention, and high concentration. Mathematics interest is one of the factors that has been proven to impact students' learning outcomes in mathematics significantly (Ili et al., 2021). There are 4 categories of mathematics interest: feelings of pleasure in learning mathematics, interest in learning mathematics, attention in learning mathematics, and involvement in learning mathematics (Rahmatullah et al., 2021; Herdiyanti and Herman, 2021).

Decision making refers to the cognitive process by which students analyze information, consider alternatives, and choose appropriate actions to solve problems (Fandos-Herrera et al., 2021; Santri et al., 2022). Decision-making is a critical determinant of student success in mathematics learning, as it influences the ability to apply concepts and strategies to new problems (Firman et al., 2020). For example, mathematics decision-making skills can be assessed by evaluating how students perform in problem-solving tasks and tests within a specific (Godwin et al., 2021). It can be concluded that decision-making abilities is closely linked to achieving meaningful learning outcomes in mathematics, as it supports cognitive engagement and application during learning activities. Using gamification learning can improve students' decision making (Dikmen, 2021).

Gamification was first introduced by Nick Pelling, who said that TED and gamification are the games that can attract a particular group or individual (Omar et al., 2022). Gamification learning is a learning approach that positively influences behavior and cognitive processes by increasing motivation and attracting student interest (Dichev & Dicheva, 2017; Vrtič et al., 2021; Taufik et al., 2022) so that in the end, it brings new experiences such as playing games (Huotari & Hamari, 2017; Legaki et al., 2020). Over the past few years, gamification learning has influenced many things and continues to grow in learning (Koivisto & Hamari, 2019; Legaki et al., 2020). *Kahoot* is a web-based application that can be used in gamification learning. *Kahoot* was designed by implementing game principles and motivation

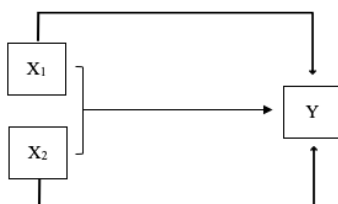
(Wang & Tahir, 2020; Wirania et al., 2022). *Kahoot* can be used to review knowledge through formative assessment for example, through pre-tests, practice questions, material reinforcement, remedial, enrichment, and others in learning (Salam et al., 2022). Gamification is a learning activity with a game approach, whereas gamification learning is more exciting and can attract students' interest.

Habits of mind are related to students' mathematics interest, where habits of mind will affect the level of students' mathematics interest (Wong and Wong, 2019). Gamification learning is a learning approach that positively influences behavior and cognitive processes by increasing motivation and attracting student interest (Dichev & Dicheva, 2017; Virtič et al., 2021; Taufik et al., 2022). Karamert and Kuyumcu Vardar (2021) found statistical differences in gamification. From the research above, no specific research examines the effect of habits of mind and mathematics interest simultaneously on students' decision making through gamification learning.

Based on the urgency of the problem above, this study aims to determine the relationship between habits of mind and mathematics interest through gamification learning.

## Method

This research is an ex post facto correlational study with a quantitative approach.



**Figure 1.** Ex Post Facto Design

Information:

$X_1$  : Habits of Mind

$X_2$  : Mathematics Interest

Y : Decision Making

The research was conducted at SMK Negeri 1 Geger, Madiun, East Java, in the even semester of the 2022/2023 academic year. Samples were obtained using the cluster random sampling technique. A sample of 68 students was obtained from class XI PBS 1 and XI OTKP 1. Data collection used questionnaires and tests. The data analysis technique for the questionnaire uses validation and reliability, while the test uses validation, reliability, difficulty index, and discriminatory power. The validity categories for questionnaires and tests are categorized based on Table 1.

**Table 1.** Questionnaire Validity Category

Interval	Category
80%-100%	Fantastic
60%-79%	High
40%-59%	High Enough
20%-39%	Low
0%-19%	Very Low

The habits of mind questionnaire instrument consist of 42 statements and the mathematics interest questionnaire consists of 35 statements with a likert scale measurement with 5 possible answers, namely strongly disagree (STS), disagree (TS), sometimes (KD), agree (S), totally agree (SS). Each questionnaire contains positive and negative statements. Score for each statement can be seen in Table 2.

**Table 2.** Responses Score with Likert Scale

Respons	Statement	
	Positive	Negative
Strongly Disagree	1	5
Disagree	2	4
Sometimes	3	3
Agree	4	2
Totally Agree	5	1

The description of the research data contains validity and reliability for the independent variables, namely habits of mind and mathematics interests. The dependent variable is student decision making, containing validity, reliability, difficulty index, and discriminatory power. The results of validity and reliability of independent variables can be seen in Table 3.

**Table 3.** Validity and Reliability of Independent Variables

Var	$\sum$ Questionnaires Before	$\sum$ Questioners After	$r_{11}$
X <sub>1</sub>	42	34	0,891
X <sub>2</sub>	35	28	0,873

For the results of the validity of the decision making test, namely 5 questions were overall declared valid. The reliability results were  $r_{11} > 0,613$ . Questions 2, 3, and 5 have good criteria, and 1 and 4 have perfect criteria. Question number 2 has easy criteria, and questions 1, 3, 4, and 5 have medium criteria. This study used all test questions of decision making in data collection.

The description of the research variables contains the mean, minimum, maximum, standard deviation with the variables Habits of Mind (X<sub>1</sub>), Mathematics Interest (X<sub>2</sub>) and Decision Making (Y). The results of the description of research on Table 4.

**Table 4.** Description of Research Variable

Var	N	Min	Max	Mean	SD
X <sub>1</sub>	68	79	138	104,66	14,1
X <sub>2</sub>	68	51	106	82,19	12,23
Y	68	0	100	62,65	29,1

Table 2 shows that all variables have the same amount of data, namely 68, with the habits of mind variable having minimum value of 79, a maximum of 138, a mean of 104.66, and a standard deviation of 14.1. The mathematics interest variable has a minimum value of 51, a maximum of 106, a mean of 82.19, and a standard deviation of 12.23. The decision making

variable has a minimum value of 0, a maximum of 100, a mean of 62.65, and a standard deviation of 29.1.

There are 3 hypothesis in this study: Habits of Mind ( $X_1$ ) on Decision Making (Y), Mathematics Interest ( $X_2$ ) on Decision Making (Y), and Habits of Mind ( $X_1$ ) and Mathematics Interest ( $X_2$ ) on Decision Making (Y). For the results two tests: the prerequisite and the hypothesis test. Prerequisite tests in this study include normality tests, linearity tests, and multicollinearity tests. Hypothesis testing is done by simple regression followed by multiple linear tests.

## Result and Discussion

### Descriptive Data

#### 1) Normality Tests

The normality test is used to find out whether the research data comes from a normally distributed population (Tsagris and Pandis, 2021). This study used the lilliefors test with  $\alpha = 0,05$ . The results of the normality test on Table 5.

**Table 5.** Normality Test Results

Var	L <sub>Obs</sub>	DK	Decision	Results
X <sub>1</sub>	0,100	0,107	H <sub>0</sub> accepted	Normal
X <sub>2</sub>	0,041	0,107	H <sub>0</sub> accepted	Normal
Y	0,105	0,107	H <sub>0</sub> accepted	Normal

#### 2) Linearity Tests

The linearity test is used to find out whether the simple regression equation is linear or not (Widana and Muliani, 2020). The linearity test in this study uses a significant level  $\alpha = 0,05$ . The results of the linearity test can be seen in Table 6.

**Table 6.** Linearity Test Results

Var	F <sub>Obs</sub>	DK	Decision	Results
X <sub>1</sub> Y	1,783	3,138	H <sub>0</sub> accepted	Linear
X <sub>2</sub> Y	1,997	3,138	H <sub>0</sub> accepted	Linear

#### 3) Multicollinearity tests

The multicollinearity test is used to determine the relationship between independent variables in the regression model (Widana and Muliani, 2020). The results of the multicollinearity test can be seen on Table 7.

**Table 7.** Multicollinearity Test Results

Var	r <sub>xy</sub>	Criteria	Results
X <sub>1</sub> Y	0,233	0,8	Independent variables are mutually independent
X <sub>2</sub> Y	0,228	0,8	Independent variables are mutually independent

## A. Hypothesis Results

### 1) Habits of Mind ( $X_1$ ) on Decision Making (Y)

The test results using simple linear regression is  $\hat{Y} = 13.514 + 0.492X_1$ . The coefficient of determination obtained a correlation between habits of mind ( $X_1$ ) and decision making (Y) at 83.7%.

### 2) Mathematics Interest ( $X_2$ ) on Decision Making (Y)

The test result using simple linear regression is  $\hat{Y} = 19.272 + 0.556X_2$ . The coefficient of determination obtained a correlation between mathematics interest ( $X_2$ ) and decision making (Y) at 85.3%.

### 3) Habits of Mind ( $X_1$ ) and Mathematics Interest ( $X_2$ ) on Decision Making (Y)

The test results using multiple linear regression is  $\hat{Y} = 28.937 + 0.309X_1 + 0.326X_2$ . The coefficient of determination obtained a correlation between habits of mind ( $X_1$ ) and learning outcomes (Y) at 45.4%, while the correlation between mathematics interest ( $X_2$ ) and decision making (Y) at 54.6%.

## B. Discussion

### 1) Habits of Mind ( $X_1$ ) on Decision Making (Y)

Based on the analysis results, it is evident that habits of mind significantly affect students' decision making in mathematics through gamification learning. The coefficient of determination  $r_{x_1y} = 0.387$  means that it has an influence of 83.7% with 16.3% being influenced by other factors. Habits of mind have sufficient influence on student decision making (Hidayati and Idris, 2020). In line with the research of Khotimah et al. (2021) that habits of mind have a significant positive effect on students' decision making. There is a positive influence and interaction between habits of mind on students' decision making (Sari et al., 2018; Sukmawati and Sabillah, 2021). Based on studies above, it can be seen that the habits of mind on decision making increase by using gamification learning. The higher the students' habits of mind, the higher their decision making ability, and vice versa.

### 2) Mathematics Interest ( $X_2$ ) on Decision Making (Y)

Based on the analysis results, it is evident that mathematics interests students' decision making through gamification learning. The coefficient of determination  $r_{x_1y} = 0.853$  means that it has an influence of 85.3% with 14.7% being influenced by other factors. Mathematics interest has a significant positive relationship with a contribution to students' decision making (Karlina et al., 2021). In line with research (Simorangkir and Sidabutar, 2022) mathematics interest has a positive significance on decision making. There is a significant influence between mathematics interest on students' decision making (Triarisanti and Purnawarman, 2019; Rahmawati et al., 2021). Based on studies above, it can be seen that mathematics interest in decision making increases by using gamification learning. The higher the student's interest in mathematics, the higher their ability in decision making, and vice versa.

### 3) Habits of Mind ( $X_1$ ) and Mathematics Interest ( $X_2$ ) on Decision Making (Y)

Based on the results of the analysis, it is evident that habits of mind and mathematics interests significantly affect students' decision making in mathematics through gamification learning. The coefficient of determination  $r_{x12y} = 0.454$  which means it influences 45.4% with 54.4% being influenced by other factors. Habits of mind have significant positive relationships on students' decision making (Khotimah et al., 2021; Sukmawati and Sabillah, 2021). Mathematics interests have a significant relationship on students' decision making (Wong and Wong, 2019; Triarisanti and Purnawarman, 2019; Rahmawati et al., 2021). Based on the research above, it can be concluded that habits of mind and mathematics interest simultaneously affect student decision making. In this study, gamification learning greatly influences student decision making. With gamification learning, student decision making ability increase. On the other hand, the higher the students' habits of mind and mathematics interest, the higher their decision making ability, vice versa.

## Conclusion

This study concludes that habits of mind and mathematics interest significantly positively affect students' decision making through gamification learning. The findings of this study indicate that the higher the habits of mind influenced the best decision making. Furthermore, the higher the mathematics interest influenced the best decision making. In this study, we found that it is essential for teachers to understand students' habits of mind and mathematics interest because they have a reasonably high correlation with students' decision making, so teachers can develop learning according to students' conditions. Further research is needed to focus more on learning development to determine its influence on habits of mind and mathematics interests or learning development to determine students' decision making.

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